

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2017-2018

DURATION: 3 Hours

FULL MARKS: 150

CSE 4205: Digital Logic Design

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

1. a) Show that the dual of the exclusive-OR is equal to its complement. 5
- b) Find the value of x for the following equations: 10
 - i. $x = 9$'s complement of $(453)_{10}$
 - ii. $(110101.101)_2 = (x)_4$
 - iii. $x = \text{BCD of } 8620$
 - iv. $x = \text{Excess-3 code of } 37$
- c) Define following terms (Draw diagram if necessary): 10
 - i. Demultiplexer
 - ii. Encoder
 - iii. Pulse and Edge Trigger
 - iv. Race Condition
2. a) Suppose, input to a combinational circuit is a 4 bit binary number. Design a circuit with minimum gates for the following: 15
 - i. Output, $P = 1$, if the number is prime
 - ii. Output, $Q = 1$, if the number is divisible by 3
- b) Obtain the simplified Boolean expressions for output F and G in terms of the input variables in the circuit of Figure below and construct their truth table. 10

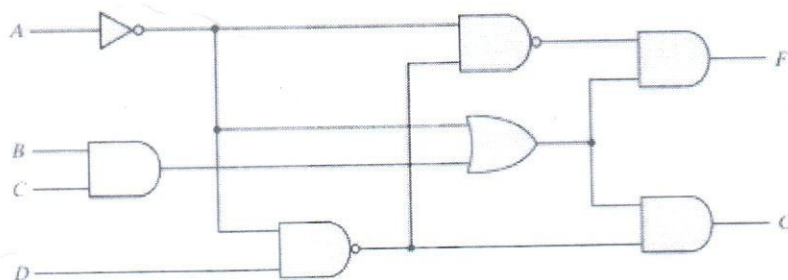


Figure 1: A combinational Circuit.

3. a) Design a combinational circuit that generates the 9's complement of a BCD digit. 10
- b) Show that the characteristic equation for the complement output of a JK flip-flop is $Q(t+1) = J'Q' + KQ$. 8
- c) Explain the differences among a truth table, a state table, a characteristic table, and an excitation table. Also, write the differences among a Boolean equation, a state equation, a characteristic equation, and a flip-flop input equation. 7

4. a) What is Master-Slave flip-flop? Explain with block diagram and logic diagram. 5
 b) Design the conversion of JK flip flop into D flip flop and T flip flop. 10
 c) Design a 5 bit parity generator and parity checker with their corresponding equations. 10
5. a) Design a BCD to Seven segment display circuit using decoder. 10
 b) A sequential circuit with two D flip-flops A and B , two inputs, x and y ; and one output z is specified by the following next-state and output equations. 15
- $$A(t + 1) = xy' + xB$$
- $$B(t + 1) = xA + xB'$$
- $$z = A$$
- i. Draw the logic diagram of the circuit.
 ii. List the state table for the sequential circuit.
 iii. Draw the corresponding state diagram.
6. a) Design a modulo-16 counter, using JK flip flop with the following sequence: 20
 7,6,5,4,3,2,1,0,8,9,10,11,12,13,14,15,7,6,5,...
 b) What is the maximum propagation delay from clock to output for the counter of the Question 6.(a)? Explain your answer assuming necessary variables. 5
7. a) What is the difference between serial and parallel transfer? What type of register is used in each case? 5
 b) Draw the logic diagram of a four-bit register with four D flip-flops and four 4×1 multiplexers with mode selection inputs S_1 and S_0 . The register operates according to the following function table (Table 1). 10

Table 1: Selection modes

s_1	s_0	Register Operation
0	0	No change
1	0	Complement the four outputs
0	1	Clear register to 0 (synchronous with the clock)
1	1	Load parallel data

- c) Write down the necessary equation accomplished by a 4 bit binary adder. Design that 4 bit magnitude comparator following those equations. 10
8. a) The content of a 4 bit shift register is initially 1101. The register is shifted six times to the right, with the serial input being 101101. What is the content of the register after each shift? 5
 b) Construct a binary counter that counts from 0 through binary 127. 10
 c) What is carry propagation delay of Binary Parallel Adder? How it can be reduced? Explain with necessary equation and figure. 10

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2017-2018

DURATION: 3 Hours

FULL MARKS: 200

Math 4241: Integral Calculus and Differential Equations

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Give figure(s) where necessary. Figures in the right margin indicate marks.

1. a) Write the fundamental theorem of Calculus. Find dy/dx of $y = \int_0^{\sin x} \frac{dt}{\sqrt{1-t^2}}$ i. by using 5+16.33
 Fundamental theorem, ii. by evaluating the integral and then differentiating the result.
- b) Find the total area between the region and the x -axis formed by the curve $y = 3x^2 - 3$, 12
 $-2 \leq x \leq 2$
2. a) Evaluate the followings: 3×5
 i. $\int_{-4}^4 |x - 2| dx$, ii. $\int_1^{e^{\pi/4}} \frac{4}{x(1+\ln^2 x)} dx$, iii. $\int_{-1}^{-1/2} x^{-2} \sin^2(1 + \frac{1}{x}) dx$
- b) Find the area of the regions enclosed by the lines and the curves as follows: 9+9.33
 i. $y = 7 - x^2$ and $y = x^2 + 4$
 ii. $x - y^2 = 0$ and $x + 2y^2 = 3$
3. a) The solid lies between the planes perpendicular to the x -axis at $x = -1$ and $x = 1$. The 18.33
 cross-sections perpendicular to the x -axis are circular disks whose diameter run from the parabola $y = x^2$ to the parabola $y = 2 - x^2$. Find the volume of the solid.
- b) Find the volume of the solid generated by revolving the regions bounded by the given 15
 curve and the lines $y = 2\sqrt{x}$, $y = 2$, $x = 0$ about x -axis.
4. a) Define length of curve. Find the length of the curve $y = (x/2)^{2/3}$ from $x = 0$ to $x = 2$. 5.33+7
- b) Find the surface area generated by revolving the curve $x = (\frac{1}{3})y^{3/2} - y^{1/2}$, $1 \leq y \leq 3$, 10
 about y - axis.
- c) Find the lateral surface area of the cone generated by revolving the line segment $y = 7+4$
 $x/2$, $0 \leq x \leq 4$, about y -axis. Check your answer with the following formula:
 Lateral surface area = $(1/2) \times$ base circumference \times slant height.
- a) Using Trapezoidal and Simpson's rules with $n = 4$ and 8 , find the approximate value of 10+5.33
 $\int_0^3 \sqrt{x+1} dx$. Finally compare your results with true value and comments on it.
- b) Define proper and improper integrals with examples. Evaluate the following integrals 4+2×7
 and then state whether they are convergent or not :
 i. $\int_{-\infty}^{\infty} \frac{1}{e^x + e^{-x}} dx$, ii. $\int_0^{\ln 2} x^{-2} e^{-1/x} dx$

6. a) Define ordinary and partial differential equations with examples. Form an ordinary differential equation corresponding to the family of curves $y = k(x - k)^2$, where k is an arbitrary constant. Finally, identify it. 4+10+3
- b) Define is exact differential equation and write its necessary condition. Test whether the following differential equations are exact or not. 4.33+4×3
- i. $(2y \sin x \cos x + y^2 \sin x)dx + (\sin^2 x + 2y \cos x)dy = 0$, ii. $(y^2 + 2xy)dx - x^2 dy = 0$
- iii. $(4x + 3y^2)dx + 2xy dy = 0$, iv. $\left(\frac{x}{y^2} + x\right) dx + \left(\frac{x^2}{y^3} + y\right) dy = 0$
7. a) Determine the constant A such that the given equation is an exact differential equation (DE) and then solve it. 5.33+12
- $$\left(\frac{Ay}{x^3} + \frac{y}{x^2}\right) dx + \left(\frac{1}{x^2} - \frac{1}{x}\right) dy = 0$$
- b) Solve the following DEs: 2×8
- i. $4xy dx + (x^2 + 1)dy = 0$, ii. $(x^2 + 3y^2)dx - 2xydy = 0$
8. a) What is first order linear differential equation? Explain with examples, when Bernoulli's DE becomes a first order linear DE. 4.33+2
- b) Solve the following initial value problems: 3×9
- i. $x \frac{dy}{dx} - 2y = 2x^4$, $y(2)=8$, ii. $\frac{dy}{dx} - y = \sin 2x$, $y(0)=0$ iii. $\frac{dy}{dx} + y = xy^3$, $y(0)=1$

186

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF TECHNICAL AND VOCATIONAL EDUCATION (TVE)

Semester Final Examination

Course No: HUM 4621

Course Title: Technology, Environment and Society

Summer Semester (2017-2018)

Time : 3 hours

Full Marks : 150

There are 8 (Eight) questions. Answer any 6 (Six).

Figures in the right margin indicate marks of the questions.

1. a) What do you understand by Environment? Explain the role of technology for environmental protection with necessary example(s). 10
 b) Define ecosystem. Describe the components of an ecosystem. 05
 c) Briefly describe the Energy Flow and the Carrying Capacity of an ecosystem. 10
2. a) How do you define the term 'Biodiversity'? What are the necessary elements of a rich biodiversity in an ecosystem? Explain with example. 10
 b) Write a short note on "Ecosystem Services". 05
 c) What do you understand by the term Sustainability and Sustainable Development? What measures do you take to achieve Sustainable Development? 10
3. a) Why does the curve of temperature fluctuate in various layers of atmosphere? Explain with appropriate drawings. 10
 b) List out the consequences of Global Warming on Earth. What are the actions can be taken to reduce the adverse impact of Global Warming? 10
 c) Write a short note on 'Environmental Justice'. 05
4. a) Differentiate between Traditional Refrigerants and CFCs. How is CFC impacting on Ozone layer depletion? 10
 b) State the causes and formation of Acid Precipitation. 10
 c) Define climate and Climate Change with respective examples. 05
5. a) Describe Hydrological/Water cycle with necessary illustration. 10
 b) Define Water Quality. How can Biochemical Oxygen Demand (BOD) help us to measure Water Quality? 10
 c) Define point water pollution and non-point water pollution with appropriate examples. 05
6. a) Define the term Municipal Solid Waste. What do you understand by the 3"R" of solid waste management system? Write the benefits of recycling. 5x3
 b) What are the main types of Renewable energy sources? Write the Pros and Cons of Renewable Energy. 10
7. a) Write down major environmental concerns of Bangladesh. How can sea level rise be a threat for life and livelihood? 10
 b) Write short notes of the following: 5x3
 i) Kyoto Protocol, ii) Carbon Footprint, iii) Carbon Trading
8. a) What is the difference between Act and Ordinance in the country legislation? 05
 b) Give a list of Ecologically Critical Areas under the Bangladesh Environmental Conservation Rules, 1997. 10
 c) Write short notes of the following: i) Urban Heat Island, ii) Biodiversity Conservation 5x2

~~189~~ 187

Programme: M.Sc.TE (2-Yr), 2nd Sem.

Date: 30 October, 2018, Tuesday

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF TECHNICAL & VOCATIONAL EDUCATION (TVE)

Semester Final Examination

Course No: TVE 6213

Course Title: Educational Psychology

Summer Semester (2017-2018)

Time: 3 hours

Full Marks: 150

There are 8 (eight) questions. Answer any 6 (six).
Figures in the right margin indicate marks of the questions.

1. (a) Define Educational psychology. Explain the relationship between education and psychology. 10
(b) State the objectives of educational psychology in light of technical education. 5
(c) Discuss the importance of psychology in education. 10
2. (a) What do you mean by mental hygiene? What are its aims? Trace its relation to education. 15
(b) Discuss briefly different criteria of personality adjustment. 10
3. (a) Define development. State the characteristics of development. 10
(b) Distinguish between growth and development. 10
(c) State the guide lines for parents and teachers for all round development of students. 5
4. (a) Define Physical development. 5
(b) State the characteristics of Physical development. 10
(c) "Factors affecting for Physical growth and development of students".- explain. 10
5. (a) What is mental health? Describe its importance for education. 10
(b) Explain the concept of mental health of the students. What can schools do to promote sound mental health among students? 15
6. (a) "Personality is a very complex term". Discuss in brief the meaning and characteristics of personality in the context of this statement. 15
(b) Explain briefly the important elements of personality. 10
7. (a) Explain the term adjustment. What are the characteristics of a well-adjusted individual? 10
(b) What is maladjustment? What are the various causes of maladjustment of learners in a school? State the role of the teachers in removing maladjustment. 15
8. (a) "Motivation is the heart of the learning process." Explain. 10
(b) What is transfer of learning? Explain briefly different types of transfer of learning in light of technical education. 15

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)**

Department of Computer Science and Engineering (CSE)

FINAL SEMESTER EXAMINATION

SUMMER SEMESTER, 2017-2018

DURATION: 3 Hours

FULL MARKS: 100

CSE 4271: Computer Programming

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **8 (eight)** questions. Answer any **6 (six)** of them including Question no. **8**.

Figures in the right margin indicate marks.

-
1. a) What is a string? Write code to take a string as input and determine how many words are there. 1+6
- b) Explain encryption and decryption. Write a code which will take input characters (the number of input is not specified so handle the input method accordingly) from a file and store the encrypted (use any approach to encrypt the text) information in another file. 2+8
2. a) What is a comparison operator in C programming? Give example for all the comparison operators available. 1+6
- b) Create a student structure having id, name and cgpa as the attributes. Select proper data-types for the attributes. Create an array of size N for student structure, take input for all attributes of N instances of student structure. Finally sort them in descending order according to their cgpa attribute and print the information in that order. That means, student who got highest cgpa, his information should appear at the beginning and then the next. 10
3. a) What do you understand by calling a function by value and calling a function by reference? Briefly explain with example. 7
- b) Below is a sample code for checking leap year. Figure out all the mistakes in the code and provide appropriate solutions for it. Only write your corrected statement on the script, you do not have to write entire code. 2×5
- ```
int main(){
 int *year;

 print("Enter a year: ");
 scanf("%d", &year);

 if(year%4 == 0){
 if(year%100 == 0){
 /*year is divisible by 400, hence the year is a leap year*/
 if (year%400 = 0)
 printf("%d is a leap year.", year);
 else
 printf("%d is not a leap year.", year);
 }
 else if
 printf("%d is a leap year.", year);
 }
 else
 printf("%d is not a leap year.", year);
 return 0;
}
```
4. a) What is return type of a function? Write a function that will take a string as input argument and determine the length of the string without taking help of any library functions. 1+6
- b) Write a program which can determine whether a string is a palindrome or not 10

- 5. a) What is a loop? Write down the structure with example for three different kinds of loop in C programming. 1+9
- b) Write down the output for the following code: 7

```
#include<stdio.h>
void print1(int *x){
 printf("%d\n", *x);
 (*x)++;
 printf("%d\n", *x);
}

int print2(int x){
 int y=++x;
 x=++x;
 printf("%d\n", x);
 return y;
}

int main(void) {
 int number=1, y;
 y=number++;
 printf("%d\n", y);
 print1(&number);
 y=print2(number);
 printf("%d\n", y);
 print1(&y);
 return 0;
}
```

- 6. a) What is comment in C programming? Show two different ways of making a comment. 1+2
- b) Using pointer, write a program which will swap two values through a function. 7
- c) Write a program which will take n integers as input and sort them in descending order. 7

- 7. a) Write a program which will take an integer n as input and print from 1 up to n in the following way: 7

```
1
2 3
4 5 6
7 8 9 10
11 12
```

The output above is given for n = 12

- b) The semester final in IUT is almost at an end and so the IUTians are eagerly planning a tour but they are in a dilemma whether to go. The constraints are money and how well did they perform in the exam. If someone has performed **very good** in the exam no matter how much money s/he has, s/he will visit **Cox's Bazar** even by borrowing money from her/his friends. But if someone has performed **good** and has at least **5000** BDT s/he will visit **Cox's Bazar**. Otherwise, if someone who performed **good** but has **less than 5000**, will visit places in **Dhaka**. Finally, if someone performed **bad**, then no matter how much money s/he has, s/he will **Stay Home** and prepare her/himself to ace the next semester. You have to write a program which will take an integer and a string as input and based on the scenario described above print whether the student will visit Cox's Bazar / Dhaka / Stay Home. 7
- c) Write a program which will take three integers as input, and print the maximum and minimum value among those three values. 3

**[Mandatory]**

- 8. a) What is format specifiers? Discuss about different types of format specifiers for different types of Data Type. 5
- b) Write a program to check whether a number is an Armstrong number or not. 10



L90

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2017-2018

DURATION: 3 Hours

FULL MARKS: 150

**CSE 4273: System Analysis and Design**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

1. a) ABC Travel Agency is a company based in Dhaka. They specialize in organising day trips to various destinations in Bangladesh. Customers of ABC Travel Agency include institutions such as schools, nursing homes etc. They hire buses with drivers for trips. The manager of ABC is responsible for allocation of buses and drivers. Trip records are created when trips are arranged. If a customer (for whom a trip is being arranged) is 'new' then the customer's details are recorded. Otherwise, the customer's record is updated. Customers will typically request that a day trip be organised for them on a specific date. The number of buses allocated to a trip depends on the number of seats required. In response to this request ABC will check to see if the required buses can be made available on that date. If the buses are available ABC will allocate one or more drivers and create a trip record for the customer. Customers are allowed to cancel a trip before a deposit is paid. The deposit should be paid within 7 days of the booking for the trip being taken. If a trip is cancelled after that, the deposit is kept by ABC Travel Agency. If a trip is cancelled the trip record will record this. ABC will request full payment for a trip in the week before it takes place. A cancelled trip is deleted from the system 6 months after cancellation. Other trip records are deleted 12 months after the corresponding trips were completed. 3+6
- Based on the given information, Draw the following for ABC Travel Agency.
- i. Context Diagram
  - ii. Diagram 0
- b) Write short notes on the following 12
- i. Cash-flow analysis
  - ii. Payback period
  - iii. Scrum
- c) What do you mean by 'fit and adaptation' in HCI elements of human, task and computer and how can it increase the performance of the system and well-being of the users. 4
2. a) What is prototype? Explain different types of prototypes with appropriate examples. 8
- b) Musixscore.com is an online service providing sheet music to customers. On the "browse music" Web page, customers select a genre of music from a drop-down list. The Web page uses Ajax to obtain a list of performers, musicians, or groups that match the genre, which is formatted as a dropdown list. When a selection is made from the performer's drop-down list, the Web page uses Ajax to display a third drop-down list displaying all the CDs or other works of the performer. When a CD is selected, the Web page uses Ajax to obtain all the songs on the CD in a fourth drop-down list. The viewer may make multiple selections. 3x5

When the Add to Shopping Cart image is clicked, the songs are added to the shopping cart. The viewer may change any of the drop-down lists to select additional sheet music, and the process is repeated.

Based on the above, answer the following questions

- i. Draw the Use Case diagram of the website.
  - ii. Draw the activity diagram of the website with clear indications of swim-lanes.
  - iii. Draw a sequence diagram of the website.
- c) What is Probing in questionnaires? 2
3. a) What are the alternative choices of software for a system analyst with their advantages and disadvantages. 6
- b) Discuss the values and principles of Agile Development process. 4+3
- c) What is Software Quality Assurance (SQA)? Briefly discuss the different steps in six sigma with examples. What are Structured Walkthroughs in SQA? 2+6+4
4. a) What is RAD? What are the phases of RAD? 7
- b) Discuss the Human limitations and disabilities considered when designing an HCI interface 9
- c) Explain the causes of the following DFD mistakes and how to solve them 6
- i. Black holes
  - ii. Spontaneous generation or miracle.
  - iii. Entity mismatch.
- d) Describe the uses of swimlanes on activity diagram. 3
5. a) Draw an ER diagram to model the application with the following assumptions: 10
- We have a set of teams, each team has a unique identifier(ID), name, main stadium, and to which city this team belongs.
  - Each team has many players, and each player belongs to one team. Each player has a number (unique identifier), name, Date of Birth, start year, and shirt number that he uses.
  - Teams play matches, in each match there is a host team and a guest team. The match takes place in the stadium of the host team.
  - For each match we need to keep track of the following:
    - The date on which the game is played
    - The final result of the match
    - The players participated in the match. For each player, how many goals he scored, whether or not he got yellow card, and whether or not he got red card.
    - During the match, one player may substitute another player. We want to record this substitution and the time at which it took place.
  - Each match has exactly three referees. For each referee we have a unique identifier (ID), name, Date of Birth, years of experience. One referee is the main referee and the other two are assistant referee.

Design an ER diagram to meet the above requirements. State any assumptions you have that affects your design. Make sure cardinalities and primary keys are clear.

- b) Differentiate between Aggregation and composition relationships. Give proper examples. How is a many-to-many association between two classes broken up? 8
- c) What are the advantages of Prototyping with SDLC? 7

- 6. a) Describe the four categories into which Unified Modeling Language (UML) classes falls. Give examples for each. 8
- b) Interglobal Paper Company has asked for your help in comparing its present computer system with a new one its board of directors would like to see implemented. Proposed system and present system costs are as follows: 10

Table 1: Cost comparison between present and proposed systems

| Item            | Proposed System Costs | Present System Costs |
|-----------------|-----------------------|----------------------|
| <b>Year 1</b>   |                       |                      |
| Equipment Lease | \$20,000              | \$11,500             |
| Salaries        | 30,000                | 50,000               |
| Overhead        | 4,000                 | 3,000                |
| Development     | 30,000                | --                   |
| <b>Year 2</b>   |                       |                      |
| Equipment Lease | \$20,000              | \$10,500             |
| Salaries        | 33,000                | 55,000               |
| Overhead        | 4,400                 | 3,300                |
| Development     | 12,000                | --                   |
| <b>Year 3</b>   |                       |                      |
| Equipment Lease | \$20,000              | \$10,500             |
| Salaries        | 36,000                | 60,000               |
| Overhead        | 4,900                 | 3,600                |
| Development     | --                    | --                   |
| <b>Year 4</b>   |                       |                      |
| Equipment Lease | \$20,000              | \$10,500             |
| Salaries        | 39,000                | 66,000               |
| Overhead        | 5,500                 | 4,000                |
| Development     | --                    | --                   |

Using break-even analysis, determine the year in which Interglobal Paper will break even. Graph the costs and show the break-even point.

- c) What are the different ways of arranging questions in an interview? 7
- 7. a) What is CRC? What are the different parts of CRC? Discuss "Object think" in CRC. 6
- b) Design a Class diagram for a system for a movie-shop, in order to handle ordering of movies and browsing of the catalogue of the store, and user subscriptions with rechargeable cards. Only subscribers are allowed hiring movies with their own card. Credit is updated on the card during rent operations. Both users and subscribers can buy a movie and their data are saved in the related order. When a movie is not available it is ordered. 8
- c) Compare RAD to the SDLC. 6
- d) What are user stories? Differentiate between nominal and interval scale of measurements. 5

8. a) Discuss any four user interfaces in terms of HCI. Give their advantages. 8
- b) A company has decided to purchase 'off the shelf' (OTS) software to handle the financial aspects of its business. Describe some general criteria that should be used to decide which OTS software applications are suitable for the company. 6
- c) Draw the PERT diagram for the following activities and determine the critical path. Also draw the corresponding Gantt chart, assume you are in week 6 and you may have valid parallel activities in your diagram. 11

Table 2: A list of activities

| Activity | Predecessor | Duration (In weeks) |
|----------|-------------|---------------------|
| A        | None        | 2                   |
| B        | A           | 4                   |
| C        | B           | 3                   |
| D        | B           | 4                   |
| E        | C           | 1                   |
| F        | D           | 2                   |
| G        | E           | 2                   |
| H        | F           | 4                   |
| I        | G, H        | 2                   |

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**  
**Department of Computer Science and Engineering (CSE)**

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2017-2018

Duration: 3 Hours

Full Marks: 150

**Hum 4247: Accounting**

Programmable calculators are not allowed. Do not write anything on the question paper.

There are 8 (eight) questions. Answer any 6 (six) of them.

Figures in the right margin indicate marks. All questions carry equal marks

1. a) Explain the term 'Debit and Credit'. 25  
 b) Briefly explain different steps in the recording process.  
 c) Which accounts generally are involved in closing entries? Why are these accounts closed

2. 25  
 X Advertising Agency  
 Trial Balance  
 December 31st 2017

|                           | Unadjusted |          | Adjusted |          |        |
|---------------------------|------------|----------|----------|----------|--------|
|                           | Dr.        | Cr.      | Dr.      | Cr.      |        |
| Accounts Receivable       | 20,000     |          | 21,500   |          |        |
| Arts Supplies             | 8,600      |          | 5,000    |          |        |
| Prepaid Insurance         | 3,350      |          | 2,500    |          |        |
| Printing Equipment        | 50,000     |          | 50,000   |          |        |
| Accumulated depreciation  |            | 28,000   |          |          | 33,000 |
| Accounts Payable          |            | 5,000    |          |          | 5,000  |
| Interest Payable          |            | 0        |          |          | 150    |
| Unearned Advertising Fees |            | 7,200    |          |          | 5,600  |
| Salaries Payable          |            | 0        |          |          | 1,300  |
| Share Capital             |            | 10,500   |          |          | 10,500 |
| Dividend                  | 12,000     |          | 12,000   |          |        |
| Advertising Revenue       |            | 58,600   |          |          | 61,700 |
| Salaries Expense          | 10,000     |          | 11,300   |          |        |
| Insurance Expense         |            |          | 850      |          |        |
| Interest Expense          | 350        |          | 500      |          |        |
| Depreciation Expense      |            |          | 5,000    |          |        |
| Arts Supplies Expense     |            |          | 3,600    |          |        |
|                           | 1,04,300   | 1,04,300 | 1,12,250 | 1,12,250 |        |

Answer the followings:

- a) Journalize the adjusting entries for December 31<sup>st</sup> 2017.  
 b) Pass necessary closing entries for December 31<sup>st</sup> 2017.  
 c) Prepare post-closing trial balance for December 31<sup>st</sup> 2017.
3. The following cost and revenue data relate to AB Company Bangladesh Ltd., selling price is Tk. 50, variable cost Tk. 30 and fixed cost Tk. 2,00,000. 25

Answer the followings:

- a) Calculate the annual break-even point in taka sales and in unit sales for the company.  
 b) If 15,000 units are sold in a year, what would be the company's net income or loss?  
 c) The company is considering paying the sales manager an incentive commission of Tk.2 per unit. If this change is made, what will be the new break-even point in take sales and in unit sales?  
 d) Refer to the original data. If company planned to earn after tax profit of Tk. 4,000, how many units the company need to sell? [Tax rate is 40%.]  
 e) Refer to the original data. If the company planned to earn after tax profit of Tk. 2,500, and sold 12,000 units, what will be the new price for each unit? [Tax rate is 40%.]  
 f) Refer to the original data. Compute the margin of safety in both Tk and percentage form if the company sold 15,000 units.  
 g) Compute the degree of operating leverage at 20,000 unit sales.

4. AB Company is ready to begin its second quarter, in which peak sales occur. The company has 25  
 required a Tk. 50,000, 3 months loan from its bank to help meet cash requirements during the quarter.  
 Since the company has experienced difficulty in paying off its loans in the past, the loan officer at the  
 bank has asked the company to prepare a cash budget for the quarter. In response to this request, the  
 following data have been assembled:

- On April 1, the beginning of the 2<sup>nd</sup> quarter, the company will have a cash balance of Tk. 45,000.
- Budgeted merchandise purchases and budgeted expenses for the third quarter are given below:

|                                | April<br>Tk. | May<br>Tk. | June<br>Tk. |
|--------------------------------|--------------|------------|-------------|
| Purchase<br>2,00,000           | 2,50,000     | 3,50,000   |             |
| Salaries<br>45,000             | 35,000       | 40,000     |             |
| Operating expenses<br>1,00,000 | 1,20,000     | 1,25,000   |             |
| Office Rent<br>10,000          | 10,000       | 10,000     |             |

Purchases are paid in full during the month following purchase. Accounts payable for the  
 merchandises on March 31, which will be paid during April, total Tk. 2,00,000.

- Office furniture costing Tk. 30,000 will be purchased for cash during June.
- Actual sales for the last two months and budgeted sales for the third quarter as follows:

|                   | Tk.      |
|-------------------|----------|
| February (actual) | 3,50,000 |
| March (actual)    | 4,00,000 |
| April (budgeted)  | 5,00,000 |
| May (budgeted)    | 6,00,000 |
| June (budgeted)   | 4,00,000 |

Past experience shows that 20% of a month's sales are collected in the month of sales, 75% in  
 the month following sales, and 4% in the second month following sales. The remainder is  
 uncollectable.

- In preparing the cash budget, assume that Tk. 50,000 loan will be made in April and repaid in  
 June. Interest on the loan will total Tk. 1,500.

Answer the followings:

- Prepare a cash budget by month and in total, for the second quarter.
- If the company needs a minimum cash balance of Tk. 25,000 to start each month, can the loan be  
 repaid as planned? Explain.

5. XY Company Ltd. has had great difficulty in controlling overhead costs. At a recent conversation, the 25  
 president heard about a control device for overhead costs known as flexible budget, and he has hired  
 you to implement this budgeting program in the company. After some effort, you develop the  
 following cost formulas for the company's machining department. These costs are based on a normal  
 operating range of 2,000 to 6,000 machine- hours per month:

During March 2017, the first month after your presentation of the above data, the machining  
 department worked 5,000 machine-hours and produced 9,000 units of product. The actual costs of this  
 product were:

|                |           |
|----------------|-----------|
| Utilities      | Tk. 5,000 |
| Direct labor   | 4,500     |
| Machine set up | 3,200     |
| Indirect labor | 18,000    |
| Depreciation   | 60,000    |

There were no variances in the fixed costs. The department has originally been budgeted to work  
 6,000 machine-hours during March, 2017. The budgeted costs of this product were:

| Cost                 | Cost formula          |
|----------------------|-----------------------|
| <b>Variable cost</b> |                       |
| Utilities            | 0.90 per machine hour |
| Direct Labor         | 0.80 per machine hour |
| Machine setup        | 0.50 per machine hour |
| Indirect labor       | 0.50 per machine hour |
| <b>Fixed cost</b>    |                       |
| Depreciation         | 60,000 per month      |
| Indirect labor       | 15,000 per month      |

Answer the followings:

- a) Prepare flexible budget for 2,000; 4,000 and 6,000 machine hours.
- b) Prepare an overhead performance report for the machining department for the month of March.
- c) Explain the causes of any unusual variances

6. AB Company Ltd. merchandising organization operating in the Dhaka. The following data are for the Company 25

AB Company Ltd.  
Unadjusted trial Balance  
For the year ended 31 December 2017

| Account                                   | Debit           | Credit          |
|-------------------------------------------|-----------------|-----------------|
| Share capital                             |                 | 60,000          |
| Retained earnings                         |                 | 21,500          |
| Dividends                                 | 31,780          |                 |
| Sales                                     |                 | 6,68,960        |
| Sales return and allowances               | 14,610          |                 |
| Discount received                         |                 | 1,070           |
| Purchases                                 | 3,49,570        |                 |
| Purchases returns and allowances          |                 | 12,000          |
| Freight inwards                           | 4,120           |                 |
| Sales salaries expenses                   | 89,320          |                 |
| Freight outwards                          | 2,000           |                 |
| Discount allowed                          | 1,800           |                 |
| Interest expense                          | 2,130           |                 |
| Loss on sale of store equipment           | 12,900          |                 |
| Cash at bank                              | 20,000          |                 |
| Accounts receivable                       | 1,26,400        |                 |
| Inventory (1 January)                     | 59,000          |                 |
| Prepaid insurance                         | 12,400          |                 |
| Office Furniture                          | 1,08,060        |                 |
| Accumulated depreciation-office furniture |                 | 25,660          |
| Accounts payable                          |                 | 19,900          |
| Loan payable                              |                 | 25,000          |
| <b>Total</b>                              | <b>8,34,090</b> | <b>8,34,090</b> |

Use the following information to make the year-end adjustments.

- (1) Corporate income tax rate is 30% for the period. The ending inventory determined by physical count was Tk. 55,000. (2) Prepaid insurance expired for the year Tk. 5,400. (3) Depreciation on the office furniture Tk. 5,000. (4) Accrued interest on the loan payable Tk. 1,500. (5) Sales salaries expenses accrued Tk. 5,000

Prepare a multiple-step income statement, a statement of changes in equity and a statement of financial position for the year ended December 2017.

7. a) What are the limitations of CVP analysis? 25
- b) What do you mean by budget? Briefly explain different types of budget.
- c) Why flexible budget is more efficient tools of control than static budget?

8. a) What do you mean by financial statements? Who are the users of the statements? 25
- b) Briefly explain the limitations of a trial balance.
- c) What are the contents of a post-closing trial balance? Explain briefly.

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)  
ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

**SEMESTER FINAL EXAMINATION**

**SUMMER SEMESTER, 2017-2018**

**DURATION: 3 Hours**

**FULL MARKS: 150**

**Hum 4249: Business Psychology and Communications**


**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

- 
1. Effective persuasion involves four distinct and essential steps. Discuss the four essential steps of effective persuasion. 25
  
  2. a) A carefully chosen story can help the leader of an organization translate an abstract concept into a meaningful mandate for employees. The key is to know which narrative strategies are right for what circumstances. 12  
 Critically examine the power of a narrative in communication.
  
  - b) Discuss the effectiveness of telling a tale for leading people into the future. 13
  
  3. MaxPro is a leading manufacturer of office equipment, including printers, photocopiers, and fax machines. The company has a centralized structure, with the bulk of its marketing and sales operations located at corporate headquarters. Mary Flood, the executive vice president of sales and marketing, knows she must restructure her operations to become more customer focused. Specifically, she needs to form major-account teams at the regional level instead of at the corporate level. All national accounts and targeted marketing would be based in one of five regions (Northeast, Southeast, Midwest, Southwest, and West), each run by a different vice president. In Flood's plan, account executives for MaxPro's major customers (clients with revenues over \$50 million) would relocate near the headquarters of those companies and would report directly to their respective regional VP. Each region would have its own marketing team and distribution channels, leaving corporate marketing responsible just for brand development. Flood needs to persuade George Nolan, MaxPro's CEO, to approve these changes. 25  
 Consider this fictional scenario: Sales and Marketing VP Mary Flood knows her company must become more customer focused. She recommends decentralizing her operations into regional account teams but needs her CEO's support. How she'd argue her case, if her CEO's decision-making style is 'followers' and/or 'controllers'?
  
  4. If you want to know why so many organizations sink into chaos, look no further than their leaders' mouths. Leadership, at any level, certainly isn't easy but unclear, vague, roller-coaster pronouncements make many top managers' jobs infinitely more difficult than they need to be. 25  
 What are the five recommendations from professor Dr. Hamm for crystal-clear communication of managers? Discuss.



5. a) We often tell our customers, peers, and suppliers how to assess and manage risk. Engineering risks include technical risk, schedule risk, and cost risk. Many technical books about risk assessment and management have been published. However, risk management involves risk communication, which involves listening in order to identify various risks correctly. Distinguish the characteristics of a poor listener and effective listener. 12
- b) An effective risk and cost communication begins with listening to the people's voices about perceived risk and cost. 13  
What causes listening to fail? Explain.
6. In a start-up company, the basic decision to be an entrepreneur was already made. Now the Entrepreneur will turn to the question about the new business idea. 25  
Critically examine generation of a new business idea.
7. The "Business Opportunity Analysis" provides a structured, repeatable method for assessing current sales opportunities. This sales aid helps to qualify opportunities faster and more effectively by analyzing them from the most critical customer, business, and competitive perspectives. Use of this aid will help to invest time, energy, and resources on the opportunities you are most likely to win. 25  
Discuss business opportunity analysis.
8. a) After getting a good understanding of the customer's business environment and performing an opportunity analysis the next step is to meet with the customer to discuss the entrepreneur's value proposition. The "Value Proposition" is balancing out the advantages and disadvantages of a market offering and communicates the unique business value through focus on own strengths and the conjunction between unique business value with the compelling event. 13  
Discuss value proposition as key concept for building new business.
- b) A business model is a model by which a company uses its resources to offer its customers better value than its competitors and make money doing it. The "Business Model" is an addition to an old discuss of the sequence of strategies and actions which was a development over the times. 12  
Discuss the concept of a business model.
- 

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)  
ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2017-2018

DURATION: 3 Hours

FULL MARKS: 150

**CSE 4403: Algorithms**

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

1. a) What is an algorithm? How does a software use different algorithms together to achieve a particular high level goal? 2+3  
 b) Prove that the expected running time of quicksort using randomized-partition is  $O(n \log n)$ . 10  
 c) The *maximum sub-array* problem and *Longest Increasing Subsequence (LIS)* problem have some similarities and yet they are different. Provide an analysis of the two problems and outline how they are similar and how they are dissimilar. You may draw diagrams if needed. 10
2. a) Although merge sort runs in  $\theta(n \log n)$  worst-case time and insertion sort runs in  $\theta(n^2)$  worst-case time, the constant factors in insertion sort can make it faster in practice for small problem sizes on many machines. Thus, it makes sense to coarsen the leaves of the recursion by using insertion sort within merge sort when subproblems become sufficiently small. Consider a modification to merge sort in which  $n/k$  sublists of length  $k$  are sorted using insertion sort and then merged using the standard merging mechanism. 8  
 i. Show that insertion sort can sort the  $n/k$  sublists, each of length  $k$  in  $\theta(nk)$  worst-case time.  
 ii. Show how to merge the sublists in  $\theta(n \log(n/k))$  worst-case time.  
 b) Define the optimal substructure of Longest Common Subsequence (LCS) problem. 7  
 c) Compute the LCS for the following two strings: 10  
     **ABABCD A and CDABAB.**
3. a) What do you understand by 'optimal substructure'? Why is it a necessary property for a problem to hold if it is to be solved by dynamic programming? 7  
 b) How can you find a cycle in a graph by the two set operations **Union**( $u, v$ ) and **Find-Set** ( $x$ )? 8  
 c) Compute the *prefix function* ( $\pi$ ) for a KMP matcher for the following pattern: 10  
     **P=abacbcabac**
4. a) Prove that Breadth-First Search (BFS) provides the shortest path from the source to all other vertices. 7  
 b) The algorithms for finding the Minimum Spanning Tree (MST) in a graph are greedy algorithms. What is the theoretical foundation for MST algorithms to be greedy? 8  
 c) Prove that the height of a B-tree is  $h \leq \log_2 \left( \frac{n+1}{2} \right)$  10

5. a) Many of the practical algorithms are derived from common-sense. Mention two algorithms that are common sense (do not quote sorting algorithms) and how the algorithms are mapped to common sense. 8
- b) Analyze the complexity of Kruskal's MST algorithm. 7
- c) Insert the following keys into a B-tree (Assume  $t=2$ ): 10

G M P X A C D E J K N O R S T U V Y Z

6. a) Activity selection problem can be solved by using a greedy algorithm. What is the greedy choice it makes in every iteration? How can you prove that the greedy activity selection algorithm will provide the optimal set of selected activities? 10
- b) A dynamic programming algorithm that matches two time series X and Y has the following cost function: 15

$$c[i, j] = \begin{cases} 0 & \text{if } i = 0 / j = 0 \\ d[i, j] + \min(c[i-1, j], c[i, j-1], c[i-1, j-1]) & \text{otherwise} \end{cases}$$

Where  $d[i, j] = |X[i] - Y[j]|$

Calculate the minimum matching cost and find the minimal matching path (warp path) between the two time series as given below:

$$X = [1, 2, 3, 7, 2, 4, 5] \quad Y = [1, 1, 6, 2, 3, 3, 4, 5]$$

7. a) Show the solution for the following recurrence: 9
- $$T(n) = 2T(\sqrt{n}) + \log n$$
- b) Analyze the complexity of Build-Max-Heap() algorithm. 10
- c) Briefly describe the  $O$ ,  $\theta$  and  $\Omega$  notations. 6
8. a) How do you analyze the correctness of an algorithm? 5
- b) Use Floyd Warshall algorithm to calculate the all pair shortest path using the following adjacency matrix for 4 vertices: 10

$$\begin{pmatrix} 0 & 3 & 8 & \infty \\ \infty & 0 & 3 & 1 \\ \infty & 4 & 0 & 2 \\ 2 & \infty & -5 & 0 \end{pmatrix}$$

- c) Use graham scan algorithm to find the convex hull of the following points: 10
- (1, 3), (1, 2), (-1, -1), (4, 4), (0, 1), (8, 8), (2, 7), (4, 3), (3, 4).

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)  
ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

**SEMESTER FINAL EXAMINATION**

**SUMMER SEMESTER, 2017-2018**

**DURATION: 3 Hours**

**FULL MARKS: 100**

**CSE 4407: System Analysis and Design**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

1. a) ABC Travel Agency is a company based in Dhaka. They specialize in organizing day trips to various destinations in Bangladesh. Customers of ABC Travel Agency include institutions such as schools, nursing homes etc., They hire buses with drivers for trips. The manager of ABC is responsible for allocation of buses and drivers. Trip records are created when trips are arranged. If a customer (for whom a trip is being arranged) is 'new' then the customer's details are recorded. Otherwise, the customer's record is updated. Customers will typically request that a day trip be organized for them on a specific date. The number of buses allocated to a trip depends on the number of seats required. In response to this request ABC will check to see if the required buses can be made available on that date. If the buses are available ABC will allocate one or more drivers and create a trip record for the customer. Customers are allowed to cancel a trip before a deposit is paid. The deposit should be paid within 7 days of the booking for the trip being taken. If a trip is cancelled after that, the deposit is kept by ABC Travel Agency. If a trip is cancelled the trip record will record this. ABC will request full payment for a trip in the week before it takes place. A cancelled trip is deleted from the system 6 months after cancellation. Other trip records are deleted 12 months after the corresponding trips were completed. 8
- Based on the given information, Draw the following for ABC Travel Agency.
- i. Context Diagram
- ii. Diagram 0
- b) Write short notes on the following 6
- i. Cash-flow analysis
- ii. Payback period
- iii. Scrum
- c) What do you mean by 'fit and adaptation' in HCI elements of human, task and computer and how can it increase the performance of the system and well-being of the users. 2.66
2. a) What is prototype? Explain different types of prototypes with appropriate examples. 5
- b) Musixscore.com is an online service providing sheet music to customers. On the "browse music" Web page, customers select a genre of music from a drop-down list. The Web page uses Ajax to obtain a list of performers, musicians, or groups that match the genre, which is formatted as a dropdown list. When a selection is made from the performer's drop-down list, the Web page uses Ajax to display a third drop-down list displaying all the CDs or other works of the performer. When a CD is selected, the Web page uses Ajax to obtain all the songs on the CD in a fourth drop-down list. The viewer may make multiple selections. 10

When the Add to Shopping Cart image is clicked, the songs are added to the shopping cart. The viewer may change any of the drop-down lists to select additional sheet music, and the process is repeated.

Based on the above, answer the following questions

- i. Draw the Use Case diagram of the website.
  - ii. Draw the activity diagram of the website with clear indications of swim-lanes.
  - iii. Draw a sequence diagram of the website.
- c) What is Probing in questionnaires? 1.66
3. a) What are the alternative choices of software for a system analyst with their advantages and disadvantages. 4
- b) Discuss the values and principles of Agile Development process. 6
- c) What is Software Quality Assurance (SQA)? Briefly discuss the different steps in six sigma with examples. What are Structured Walkthroughs in SQA? 6.66
4. a) What is RAD? What are the phases of RAD? 4
- b) Discuss the Human limitations and disabilities considered when designing an HCI interface 7
- c) Explain the causes of the following DFD mistakes 4
- i. Black holes
  - ii. Spontaneous generation or miracle.
  - iii. Entity mismatch.
- d) Describe the uses of swimlanes on activity diagram. 1.66
5. a) Draw an ER diagram to model the application with the following assumptions: 7
- We have a set of teams, each team has a unique identifier (ID), name, main stadium, and to which city this team belongs.
  - Each team has many players, and each player belongs to one team. Each player has a number (unique identifier), name, Date of Birth, start year, and shirt number that he uses.
  - Teams play matches, in each match there is a host team and a guest team. The match takes place in the stadium of the host team.
  - For each match we need to keep track of the following:
    - The date on which the game is played
    - The final result of the match
    - The players participated in the match. For each player, how many goals he scored, whether or not he got yellow card, and whether or not he got red card.
    - During the match, one player may substitute another player. We want to record this substitution and the time at which it took place.
  - Each match has exactly three referees. For each referee we have a unique identifier (ID), name, Date of Birth, years of experience. One referee is the main referee and the other two are assistant referees.
- Design an ER diagram to meet the above requirements. State any assumption you have that affects your design. Make sure cardinalities and primary keys are clear.
- b) Differentiate between Aggregation and composition relationships. Give proper examples. 6  
How is a many-to-many association between two classes broken up?
- c) What are the advantages of Prototyping with SDLC? 3.66

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

**SEMESTER FINAL EXAMINATION**

**SUMMER SEMESTER, 2017-2018**

**DURATION: 3 Hours**

**FULL MARKS: 150**

**Math 4441: Probability and Statistics**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

1. a) Suppose that four balls are selected one at a time, without replacement, from a box containing  $r$  red balls and  $b$  blue balls ( $r \geq 2, b \geq 2$ ). Determine the probability of obtaining the sequence of outcomes red, blue, red, blue. 8
  - b) Suppose that a box contains 10 balls. At the start, 3 are white and 7 are blue. Whenever a ball is selected from the box, a layer of blue paint is applied to it, so blue balls stay blue, and white balls become blue; afterward, the ball is returned to the box, so that 10 balls always in the box.
    - i. Find the probability that a blue ball is chosen at the beginning of round 3. 8
    - ii. Suppose at the start of round 3 (i.e., before any painting in round 3 is performed), a blue ball is selected. Find the probability that the blue ball was originally blue (it was blue at the beginning and was not colored at round 1 or 2). 9
2. a) A business trip is equally likely to take 2, 3, or 4 days. After a  $d$ -day trip, the change in the traveler's weight, measured as an integer number of pounds, is uniformly distributed between  $-d$  and  $d$  pounds. For one such trip, denote the number of days  $D$  and the change in weight by  $W$ . Find the joint PMF  $P_{DW}(d, w)$ . 12
  - b) First a point  $Y$  is selected at random from the interval  $(0, 1)$ . Then another point  $X$  is selected at random from the interval  $(Y, 1)$ . Find the probability density function of  $X$ . 13
3. a) A prisoner is trapped in a cell containing three doors. The first door leads to a tunnel that returns him to his cell after two days of travel. The second door leads to a tunnel that returns him to his cell after three days of travel. The third door leads immediately to freedom.
  - i. Assume that the prisoner will always select doors 1, 2, and 3 with probabilities 0.5, 0.3, and 0.2, respectively. Find the expected number of days until the prisoner reaches freedom. 7
  - ii. Assume that the prisoner is always equally likely to choose among those doors that he has not used previously. Find the expected number of days until he reaches freedom. 8  
 Note: If the prisoner initially tries door 1, then when he returns to the cell, he will now select only from doors 2 and 3.
- b) A game is often played in carnivals and gambling houses is called chuck-a-luck, where a player bets on any number 1 through 6. Then three fair dice are tossed. If one, two, or all three land the same number as the player's, then he or she receives one, two, or three times the original stake plus his or her original bet, respectively. Otherwise, the player loses his or her stake. Let  $X$  bet the net gain of the player per unit stake. First find the probability mass function of  $X$ ; then determine the expected amount that the player will lose per unit of stake. 10

4. a) The amount of time that a customer spends waiting at an airport check-in counter is a random variable with mean 8.2 minutes and standard deviation 1.5 minutes. Suppose that a random sample of  $n = 49$  customers is observed. Find the approximate probability that the average time waiting in line for these customers is:

- i. Less than 10 minutes.
- ii. Between 5 and 10 minutes.

6

- b) Let  $X_1, X_2, \dots, X_n$  be a sample from a population with density function given by

$$f(x) = \begin{cases} \theta x e^{-\theta x}, & x \geq 0 \\ 0, & \text{otherwise.} \end{cases}$$

8

11

Determine the maximum likelihood estimator (MLE) of the parameter  $\theta$ .

5. a) A college admissions officer wanted to know the average Scholastic Aptitude Test (SAT) score of this year's class of entering students. Instead of checking all student folders, she decided to use a randomly chosen sample. It is known that students' scores are normally distributed with a mean  $\mu$  and standard deviation  $\sigma$ . If the value of  $\sigma$  is 70, how large a random sample is needed if the admissions officer wants to obtain a 95% confidence interval estimate that is of length 4 or less?

10

- b) An important issue for a retailer is to decide when to reorder stock from a supplier. A common policy used to make the decision is of a type called  $d, D$ : The retailer orders at the end of a period if the on-hand stock is less than  $d$ , and orders enough to bring the stock up to  $D$ . The appropriate values of  $d$  and  $D$  depend on different cost parameters, such as inventory holding costs and the profit per item sold, as well as the distribution of the demand during a period. Consequently, it is important for the retailer to collect data relating to the parameters of the demand distribution. Suppose that the following data give the numbers of a certain type of item sold in each of 30 weeks.

15

14, 8, 12, 9, 5, 22, 15, 12, 16, 7, 10, 9, 15, 15, 12,

9, 11, 16, 8, 7, 15, 13, 9, 5, 18, 14, 10, 13, 7, 11

Assume that the numbers of items order in each week are independent random variables from a common distribution. Use the data to obtain a 95 percent confidence interval for the mean number ordered in a week, if  $d = 10$  and  $D = 20$ .

6. a) A bakery was taken to court for selling loaves of bread that were under-weight. These loaves were advertised as weighing 24 ounces. In its defense, the bakery claimed that the advertised weight was meant to imply not that each loaf weighted exactly 24 ounces, but rather that average value over all loaves was 24 ounces. The prosecution in a rebuttal produced evidence that a randomly chosen sample of 20 loaves had an average weight of 22.8 ounces with a sample standard deviation of 1.4 ounces. In her ruling, the judge stated that advertising a weight of 24 ounces would be acceptable if the mean weight were at least 23 ounces.

- i. State the null and alternative hypothesis to be tested for the claim.

5

- ii. For the 5 percent level of significance, what should be the judge's rule?

8

- b) Suppose that if a signal of intensity  $\mu$  is emitted from a particular star, then the value received at an observatory on earth is a normal random variable with mean  $\mu$  and standard deviation 4. In other words, the value of the signal emitted is altered by random noise, which is normally distributed with mean 0 and standard deviation 4. It is suspected that the intensity of the signal is equal to 10. Test whether this hypothesis is plausible if the same signal is independently received 20 times and the average of the 20 values received is 11.6. Assume a 5 percent level of significance.

12

Find the probability that the null hypothesis (that the signal intensity is equal to 10) will not be rejected when the actual signal level is 9.2.

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)  
ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

**SEMESTER FINAL EXAMINATION**

**SUMMER SEMESTER, 2017-2018**

**DURATION: 3 Hours**

**FULL MARKS: 150**

**CSE 4635: Web Architecture**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (eight)** questions. Answer any **6 (six)** of them. **Question no. 1 is mandatory.**

Figures in the right margin indicate marks.

**[Question no. 1 is mandatory]**

1. Suppose you have to implement an online computer shop. The information about different kinds of computers are stored in a database. To represent an entity in this database, you have to use object representation of the database table (for example the `Customer` class is the representation of `Customer` table of the database) where one instance represents one row.  
To keep track of each customer's choices, you can implement a `ShoppingCart`. The shopping cart is something that should exist during a session only. Each session will have its own instance (meaning that all customers will have their own shopping carts). The user is presented with a list of computers available to buy through a web page. For this scenario, answer the followings:
  - a) What are the web technologies suitable to implement this application? Justify your choice. 5
  - b) Which web architecture is best suited for this application and why? 5
  - c) How do you manage the component architecture specifically for business logics to get the benefits of web architectural design pattern? 5
  - d) Design and draw a detail web architectural model, showing relationships between different parts of the application with your chosen architecture, patterns and technologies. 10
  
2.
  - a) What is the advantage of using HEAD method while making an HTTP request? Explain with example. 8
  - b) Suppose you want to design your personal 'PhoneBookXML' language. Define your XML tags for describing your contact information and your friends' contacts using these tags. Think about what properties should be defined as attributes and what properties are best described as elements. Make sure your documents are well-formed. 12
  - c) Draw an architecture to generate dynamic web page. 5
  
3.
  - a) Why do you need to perform session tracking? Explain with an example. 10
  - b) Write an authentication filter to check the password given by a user in filter class, if given password is 'admin', it will forward the request to the `WelcomeAdmin` servlet otherwise it will display an error message. 10
  - c) Give an example code to demonstrate HTTP requests forwarding mechanism using Servlet's `RequestDispatcher`. 5
  
4.
  - a) Sometimes, some pre-processing needs to be done after the user has submitted a form. The result of this pre-processing decides where the control flow should go next. Such pre-processing code is frequently referred to as a "controller". JSP can be used to implement this controller. Give an example code of the controller using JSP technology. Your controller should invoke/redirect to one Servlet and two JSP pages. 9
  - b) What are the differences between Request attributes, Session attributes, and ServletContext attributes? 6
  - c) Briefly explain the JSP standard tag libraries according to their functionalities. 10
  
5.
  - a) What are the differences between Java Bean and Entity Bean? 5



- b) The Model 1 architecture has one thing going for it: simplicity. If your project is small, simple, and self-contained, it is the quickest way to get up and running. Explain the disadvantages of Model 1 architecture for developing a web project. 10
- c) Write a JavaScript function to get the values of First and Last name of the following form. 6

```
<form id="form1" onsubmit="getFormvalue()">
First name: <input type="text" name="fname" value="X">

Last name: <input type="text" name="lname" value="Lname">

<input type="submit" value="Submit">
</form>
```

- d) Write the advantages of using JSON over XML. 4
6. a) "RMI is used as standard API for many distributed objects in EJB" – Explain the statement. 5
- b) Suppose you have to implement an RMI application for the police department. Consider a scenario that a motorcyclist has crossed the speed limit and a policeman has stopped the rider. Officer wants to fine him and before that, he wants to check whether the driver was issued for warrants. Through his smart device, the officer places a request to the central computer to check warrant history. From the RMI coding perspective, the client submits the request and the server executes the result, returns the result to the client. Write a Java RMI application for the scenario. 20

7. a) Consider the Façade architectural pattern given in Figure 1. 2+3

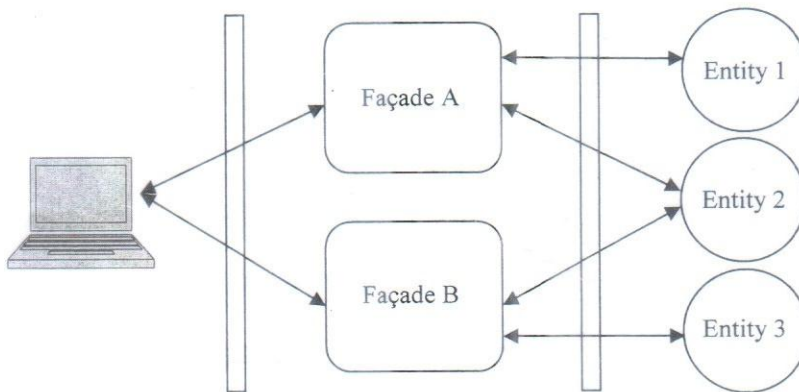


Figure 1: Façade pattern

Map this pattern with an online banking application scenario as a distributed web application and illustrate how you would implement this pattern. [Hint: Writing code segments are enough]

- b) Why does EJB need two interfaces, home interface and remote interface? Explain with example. 10
- c) Demonstrate with code how to invoke a Stateless Session Bean from Servlet and display any output through a JSP page. 10
8. a) What is DAO pattern? With a real-life example describe how you could use DAO pattern and Entity Beans. 12
- b) What is the relationship between entity manager and persistence context? Give an example use of the annotation named `@PersistenceContext`. 5
- c) What are entities in EJB 3.0? Consider the following schema of a database table for course information: 8

```
Student .(student_id, student_name, department, phone_number)
```

- i. Where, `student_id` is the primary key and need to be generated automatically. Write an Entity class for this table in EJB 3.0.

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

**SEMESTER FINAL EXAMINATION**

**SUMMER SEMESTER, 2017-2018**

**DURATION: 3 Hours**

**FULL MARKS: 150**

**CSE 4615: Wireless Networks**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are 8 **(eight)** questions. Answer any 6 **(six)** of them.

Figures in the right margin indicate marks.

1. a) Define the *Access Networks* with a hierarchical classification. 7  
 b) Describe the importance of RTS/CTS (Request to Send / Clear to Send) frames in any multi hop wireless networks. 7  
 c) Clarify the neighborhood of a link in a multi-hop wireless ad-hoc network with the aid of a diagram. 6  
 d) 5

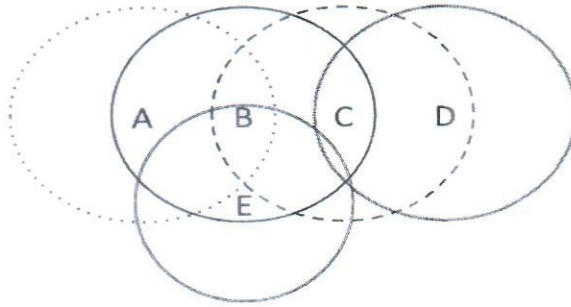


Figure 1: network topology for question 1(d)

Consider the topology of a wireless network illustrated in Fig 1. In the given scenario, the station *A*, *B*, *C*, and *D* all have equi-sized transmission ranges, while station *E* has a smaller transmission range. Assume that, two nodes' transmissions will interfere if and only if they transmit at the same time and their transmission areas overlap. Further, assume that losses only occur due to collisions. Consider the *RTS/CTS* as an enabled mechanism in this scenario.

For the given scenario, if station *A* sends data to station *B* and station *C* sends data to station *D* (as fast as they can), and no collision detection mechanism is used, what is the throughput of their transfer as a proportion of their send rate?

2. a) An *Independent Basic Service Set (IBSS)* consists of three stations (*A*, *B*, *C*) those follow *IEEE 802.11 Distributed Coordination Function (DCF)* as *Medium Access Control Protocol*. 12

Draw a time line diagram showing *one successful re-transmission* of MSDU (MAC Service Data Unit) from station *A* to station *C*. The diagram should include the back-off process of all the contenders which includes the back-off slots, DIFS period and the SIFS period. Note that, the x-axis of the diagram shows time and y-axis shows one horizontal line for each containing stations.

- b) How is the *QoS (Quality of Service)* assured in *IEEE 802.11e EDCF (Enhanced Distributed Channel Access)*? 13

3. a) How does a *Radio Frequency Identification (RFID)* system work? 6  
 b) A 30 MHz spectrum is allocated to a wireless system which uses two 25 KHz simplex channels to provide full duplex voice and control channels. Compute the number of channels available per cell if the system uses 7-cell reuse. If 1 MHz of the allocated spectrum is dedicated to control channels, determine an equitable distribution of control channels and voice channels in each cell of that system. 7  
 c) How can the cellular capacity of a GSM network be improved? 6  
 d) Clarify the responsibilities of following components of GSM network. 6  
 i. Mobile services Switching Center (MSC)  
 ii. Base Station Controller (BSC)
4. a) IEEE 802.11 WLANs perform channel contention in time domain which possesses greater channel wastage. 6+9  
 i. Address the specific reasons behind such inefficiency caused by time domain channel contention.  
 ii. Discuss a promising channel contention mechanism which effectively overcomes these limitations introducing back-off operation using extra frequency bands (EFB).  
 b) "Post back-off can reduce the delivery delay in lightly loaded systems" justify this statement. 5  
 c) Define the *time alignment* problem. 5

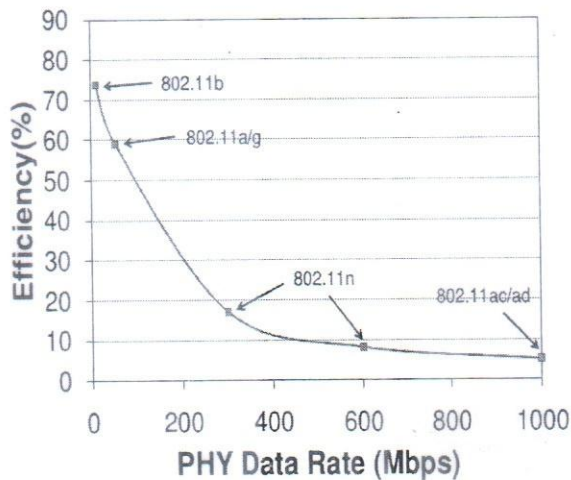


Figure 2: graph for question 5.a

5. a) The IEEE 802.11 MAC efficiency degrades rapidly as the PHY data rate increases. The graph illustrated in Fig. 2 shows such a phenomenon of IEEE 802.11 MAC for a sample network. Clarify the reason behind such phenomenon. 7  
 b) Discuss the contribution of *Low-Energy Adaptive Clustering Hierarchy (LEACH)* protocol in enhancing the network lifetime of WSNs. 10  
 c) What is *frequency re-use distance*? Clarify the relationship between *cellular capacity* and *frequency re-use distance* in mobile telephony system with proper arguments. 8
6. a) Mention few effective approaches to extend the network life-time of *Wireless Sensor Networks (WSNs)*. 7  
 b) What is the fundamental idea of *Sensor-MAC (S-MAC)* protocol in enhancing network life-time of WSNs? 9

- c) Contention-based asynchronous duty cycle MAC protocols transmit long preamble during low power listening (LPL) period. However, such long preamble transmission may occupy the medium for much longer than actual data transmission. Discuss the significant contribution of *Receiver-Initiated MAC (RI-MAC) protocol* in resolving such limitation in asynchronous duty cycled WSN. 9
7. a) Mention few characteristics and complexities of *Mobile Ad-hoc Networks (MANET)*. 5  
b) How is the *Expected Transmission Count (ETX)*, a path metric for multi hop wireless networks calculated? 7  
c) Mention the motivation of *Expected Transmission Time (ETT)* routing metric. 6  
d) Discuss the concept of *Wastage Aware Routing Metric* in *Energy-Harvesting Wireless Sensor Networks (EH-WSNs)*. 7
8. a) How does the *congestion control* mechanism differ from *flow control* mechanism? 5  
b) *Long Term Evolution (LTE)* standard has introduced a number of new technologies when compared to the previous cellular system. Describe those in brief. 7  
c) Mention the significance of *Warning Bit* and *Choke Packets* in *Congestion Control*. 6  
d) 'Traditional TCP schemes may suffer from severe performance degradation in a wireless environment'. Justify the statement. 7

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**  
**Department of Computer Science and Engineering (CSE)**

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2017-2018

DURATION: 3 Hours

FULL MARKS: 150

**CSE 4617: Artificial Intelligence**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

1. a) Suppose we must solve planning problems for cleaning a house. Various rooms can be dusted (making the room dust-free) or swept (making the room have a clean floor), but the robot can only sweep or dust a room if it is in that room. Sweeping causes a room to become dusty (i.e., not dust-free). The robot can only dust a room if the dustcloth is clean; but dusting rooms that are extra-dusty, like the garage, cause the dustcloth to become dirty. The robot can move directly from any room to any other room.

Assume there are only two rooms, the garage – which, if it is dusty, it is extra-dusty – and the living room – which is not extra-dusty.

Assume the following features:

- Lr dusty is true when the living room is dusty.
  - Gar dusty is true when the garage is dusty.
  - Lr dirty floor is true when the living room floor is dirty.
  - Gar dirty floor is true when the garage floor is dirty.
  - Dustcloth clean is true when the dust cloth is clean.
  - Rob loc is the location of the robot.
- Suppose the robot can do one of the following actions at any time:
    - move: move to the other room,
    - dust lr: dust the living room (if the robot is in the living room and the living room is dusty),
    - dust gar: dust the garage (if the robot is in the garage and the garage is dusty),
    - sweep lr: sweep the living room floor (if the robot is in the living room), or
    - sweep gar: sweep the garage floor (if the robot is in the garage).

Answer the following questions:

- i. Give the STRIPS representation for dust gar. 3
  - ii. Suppose that the initial state is that the robot is in garage, both rooms are dusty but have clean floors and the goal is to have both rooms not dusty. Draw the first two level (with two actions, so the root has children and grandchildren) of a forward planner showing the actions (but you don't have to show the states) 6
  - iii. Draw the CSP for a planning horizon of 2. Describe each constraint (you don't need to give the table, but need to explicitly say what values are (in)consistent.) 9
- b) Given the knowledge base (KB) containing the clauses: 3+4

$a \leftarrow b \wedge c.$   
 $b \leftarrow d.$   
 $b \leftarrow e.$   
 $c.$   
 $d \leftarrow h.$   
 $e.$   
 $f \leftarrow g \wedge b.$

Figure 1: Knowledge Base

Answer the following questions:

- i. Show the bottom up proof for this KB.
- ii. 'a' is a logical consequence of KB. Explain what this means. Give a top-down derivation for the query: ?a.

2. a) How would the implementation of a BFS and DFS differ if you were to extend the generic search algorithm to implement both. 4

b) Suppose you have a Bayesian network that has the following conditional probabilities after applying the chain rule and compensating for conditional independence [i.e. discarding information about other variables given parents] :  $P(A)$ ,  $P(B | A)$ ,  $P(C | B)$ ,  $P(D | A, C)$ ,  $P(E | B)$ ,  $P(F | E)$

i. Draw the belief network that has these conditional probabilities. 5

ii. Suppose you want to compute  $P(D)$ . What variables can be pruned? 2

iii. In the belief network, each variable is Boolean (that is, has domain {true, false}). 8

$A = \text{true}$  is written as  $a$  and  $A = \text{false}$  is written as  $\neg a$ , and similarly for the other variables. You have the following conditional probabilities:

$P(a) = 0.8$	$P(d   a \wedge c) = 0.5$	$P(e   \neg b) = 0.4$
$P(b a) = 0.8$	$P(d   a \wedge \neg c) = 0.6$	$P(f   e) = 0.3$
$P(b \neg a) = 0.8$	$P(d   \neg a \wedge c) = 0.7$	$P(f   \neg e) = 0.8$
$P(c   b) = 0.9$	$P(d   \neg a \wedge \neg c) = 0.2$	
$P(c   \neg b) = 0.3$	$P(e   b) = 0.9$	

Table 1: Conditional probabilities

iv. Now, imagine you want to compute  $P(d)$  and are going to eliminate  $A$  first. What is the resulting factor after eliminating  $A$ ? You need to show the variables that this is a factor on and you must show the first three elements of the factor numerically, but don't simplify them (e.g., you should write them as  $0.1 * 0.2 + 0.3 * 0.4 + 0.5$ ). 6

Show the remaining factors that are created in computing  $P(d)$ . For each variable eliminated you need to show what variable was eliminated, show which factors were removed to create the factor, and show the new factor (including which variables the new factor depends on). You do not need to give the numerical values of the factors created, just what variables they depend on.

3. a) In a nuclear research submarine, a sensor measures the temperature of the reactor core. An alarm is triggered ( $A = \text{true}$ ) if the sensor reading is abnormally high ( $S = \text{true}$ ), indicating an overheating of the core ( $C = \text{true}$ ). The alarm and/or the sensor can be defective ( $A_{ok} = \text{false}$ ,  $S_{ok} = \text{false}$ ) which can cause them to malfunction. The alarm system can be modelled by the following belief network (all variables are Boolean): 6+6

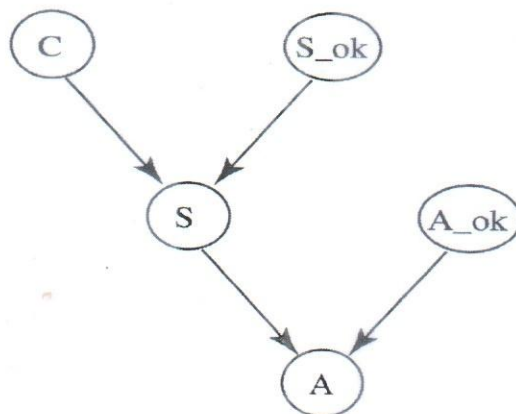


Figure 2: Corresponding belief network

Answer the following questions:

- i. Suppose we add a second, identical sensor to the system and trigger the alarm when either of the sensors reads a high temperature. The two sensors break and fail independently. Give the extended belief network. (Draw the graph and specify any new conditional probabilities).
- ii. When an alarm is observed, a decision is made whether to shut down the reactor. Shutting down the reactor has a cost  $c_s$  associated with it (independent of whether the core was overheating), while not shutting down an overheated core incurs a cost  $c_m$  much higher than  $c_s$ . Draw the decision network modelling this decision problem for the original system (i.e., only one sensor). Specify any new tables that need to be defined (you should use the parameters  $c_s$  and  $c_m$  where appropriate in the tables). You can assume that the utility is the negative of cost.

b) Consider the following search problem:

4+9

- the set of states  $S = \{s_0, s_1, s_2, s_3, s_4, s_5\}$
- successors of  $s_0$  are  $\{s_0, s_1, s_2\}$
- successors of  $s_1$  are  $\{s_1, s_2, s_3\}$
- successors of  $s_2$  are  $\{s_2, s_3\}$
- successors of  $s_3$  are  $\{s_0, s_3, s_4\}$
- successors of  $s_4$  are  $\{s_4, s_5\}$
- successors of  $s_5$  are  $\{s_2, s_3, s_5\}$
- objective function  $f$  is as follows:  $f(s_0) = 0$ ,  $f(s_1) = 3$ ,  $f(s_2) = 2$ ,  $f(s_3) = 4$ ,  $f(s_4) = 1$ , and  $f(s_5) = 5$

Answer the following questions:

- i. Which (if any) states are local maxima and global maxima?
- ii. Trace hill climbing search starting in state  $s_0$  (indicate which state is considered at each iteration, and which solution is returned when the search terminates). Does it return the optimal solution?

4. a) You have been hired by the organizers of the Tour de France to enforce anti-doping measures for all cyclists and teams. We have been instructed to suspend any team that has a member with a doping violation. A cyclist is considered to have a violation if he has tested positive for EPO or tested positive for synthetic testosterone. We consider a test result to be positive if both the first sample and second sample return positive. A cyclist will also receive a violation if they miss a test.

15

Write a short set of axioms to define the problem as described in the preceding paragraph.

You can add any information in the KB that lets you test the predicates. You should only use the following predicates, where  $[x]$  tells you how many parameters the predicate requires:

- `suspendTeam[1]`
- `hasMember[2]`
- `hasViolation[1]`
- `testPositive[2]`
- `firstPositive[2]`
- `secondPositive[2]`
- `missedTest[1]`

b) Prove that Bottom-up proof procedure is sound. What is a minimal model?

8+2

5. a) Consider the case where the arc consistency algorithm terminates and some domains have multiple values. Is there guaranteed to be a solution? Defend your answer with an example.

6

b) Suppose that in a decision network, the decision variable Run has parents Look and See. Suppose that we are using variable elimination to find the optimal policy. Suppose that after eliminating all of the other variables, we have the factor

6+6

Look	See	Run	Utility
True	True	Yes	23
True	True	No	8
True	False	Yes	37
True	False	No	56
False	True	Yes	28
False	True	No	12
False	False	Yes	18
False	False	No	22

Table 2: Utility for various combinations of Look, See and Run

- i. What is the resulting factor after eliminating the decision variable Run?
  - ii. What is the optimal decision function for Run?
- c) Consider a scheduling problem, where there are eight variables A, B, C, D, E, F, G, H each with domain {1, 2, 3, 4}. Suppose the constraints are:  $A > G$ ,  $A \leq H$ ,  $|F - B| = 1$ ,  $G < H$ ,  $|G - C| = 1$ ,  $H - C$  is even,  $H \neq D$ ,  $D > G$ ,  $D \neq C$ ,  $E \neq C$ ,  $E < D - 1$ ,  $E \neq H - 2$ ,  $G \neq F$ ,  $H \neq F$ ,  $C \neq F$ ,  $D \neq F$ ,  $|E - F|$  is odd.
- Draw the Arc-consistency network for this scenario.

7

6. a) Consider the grid world in the following figure:

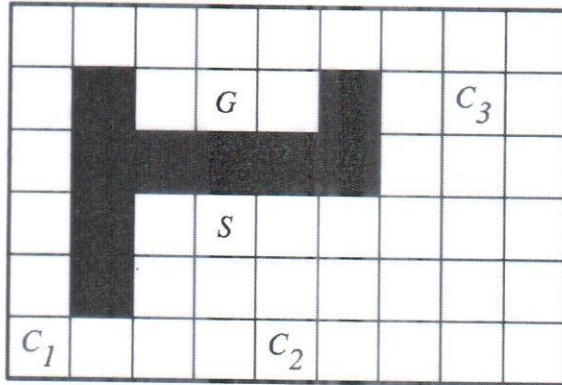


Figure 3: Grid World

Assume that a robot can be in any of the white squares, and can do one step up, down, left, or right at each time. It cannot step into one of the black squares or outside of the boundary. The cost of a path is the number of steps in the path. At the squares marked with  $C_i$  are coffee shops where, if the robot goes to the square, it will be given coffee. Suppose the robot starts at the square marked as S, without coffee, and must end up at the square marked G carrying coffee. Represent the grid world as a state-space search problem.

- i. What is a state for this problem?
  - ii. How many states are there?
  - iii. What is the start state?
  - iv. Draw the first two levels of the search space. [Root is considered level-1]
  - v. Define two non-trivial admissible heuristics functions for this problem. Your first heuristic,  $h_1$ , should not take into account the locations of the coffee shops or the blocked squares. The second heuristic,  $h_2$ , should take into account the locations of the coffee shops, but not locations of the blocked squares.
- Hint: a useful concept is the Manhattan distance between two points  $(x_1, y_1)$  and  $(x_2, y_2)$  which is  $|x_1 - x_2| + |y_1 - y_2|$ .
- b) Give an overview of the simulated annealing search algorithm. With the help of the  $h(n) - h(n)$  graph show how the probability of selecting a non-improving node changes. The graph should have separate curves for various temperature values.

2  
2  
2  
5  
4

10



7. a) Both A\* and Branch and Bound (B&B) find the optimal solution. When would you use A\* over B&B and when will you use B&B over A\*? Give one example of each. 8
- b) Consider the following Bayesian Network: 5

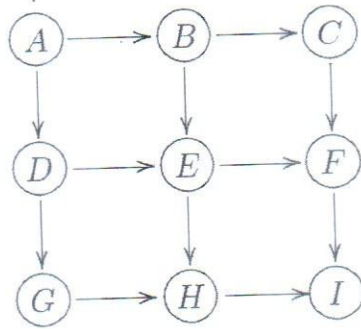


Figure 4: Bayesian Network

- Which nodes could you prune before running variable elimination to compute  $P(A | D = t, E = t, F = t)$ ? Explain why you can prune these nodes and no others. 12
- c) Consider the following formula for  $P(Q)$ :

$$P(Q) = \sum_{K,L,M,N,O} f_0(K) \times f_1(L) \times f_2(K, L, M) \times f_3(M, N) \times f_4(K, O) \times f_5(L, N, O, Q)$$

- i. Simplify this formula by summing out variable O, just as you would do in a single step of variable elimination. Explicitly state all the substeps you need to perform to sum out O. For each substep, state which operation you perform on which factors, and which variables the factor resulting from the operation is dened over. Give the simplified formula for  $P(Q)$  after summing out O.
  - ii. Now sum out K from the simplified formula that you acquired from the previous question. Do the same steps you did for summing out O.
8. a) Bill has noticed that his morning newspaper delivery has been sporadic. There are several relevant variables relating to whether or not the paper is delivered. Delivery is dependent on the paper having been successfully printed the previous night. Possible explanations for a paper not having been printed are a malfunction at the printing press, or the end of civilization as we know it. 15
- The prior probability of a printer malfunction is 0.05. Bill has been noticing some ominous signs of the apocalypse and so expects the end of civilization with a relatively high probability of 0.001. If the end of civilization is here, then the paper not be printed for sure. If there is a printing malfunction and no end of civilization, there is a probability of 0.05 that the paper will be printed (this is non-zero because the malfunction might be fixed in time). If there is no malfunction and no end of civilization, there is a probability of 0.99 that the paper will be printed. If the paper is not printed it will not be delivered. If it is printed, there is a probability of 0.9 that it will be delivered. The fact that this probability is not 1 suggests that there are other possible causes for the paper not being delivered that we should eventually add to our belief network (e.g. the paperboy being sick).
- Draw the belief network and build the the truth tables according to the probabilities above.
- b) How to you evaluate Stochastic Local Search. Using 4-Queens problem as an example show how local search might not work and might need random walk or random restarts. 5+5

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)  
ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2017-2018

DURATION: 3 Hours

FULL MARKS: 150

**CSE 4619: Peripherals and Interfacing**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

- 
- |       |                                                                                                                                                                                                                                                       |    |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1. a) | 'Microprocessor is generalized and microcontroller is specific' – Explain how.                                                                                                                                                                        | 10 |
| b)    | Explain about the handshake signals of 8155 Programmable Peripheral Interface (PPI).                                                                                                                                                                  | 10 |
| c)    | Write a short note on 8251 USART interfaces.                                                                                                                                                                                                          | 5  |
| 2. a) | What is the naming convention of ATMEL microcontroller? Define and distinguish between Tiny, Mega and XMEGA AVR's (Advanced Virtual RISC).                                                                                                            | 10 |
| b)    | Draw and explain the timing diagram of 8255 PPI mode 2 signaling.                                                                                                                                                                                     | 10 |
| c)    | In order to display multiple characters, how can you interface multiple 7-segment display using a single 8255 PPI? Just draw the interfacing diagram.                                                                                                 | 5  |
| 3. a) | "Computer revolutions helps for developing modern embedded Systems" – How?                                                                                                                                                                            | 10 |
| b)    | Suppose, a control register of 8155 PPI has an address of 1Eh. If following instructions are executed in an 8085 microprocessor system, then derive the all the port functionalities (i.e., including pins) of the 8155 PPI.<br>MVI A, CDh<br>OUT 1Eh | 10 |
| c)    | Differentiate between a Computer System and Embedded System.                                                                                                                                                                                          | 5  |
| 4. a) | Explain the role of an Interrupt Controller using a particular PIC example.                                                                                                                                                                           | 10 |
| b)    | Differentiate between 8155 and 8255 Programmable Peripheral Interface.                                                                                                                                                                                | 10 |
| c)    | Write the taxonomy of models of transfer in Peripherals and Interfacing along with their features.                                                                                                                                                    | 5  |
| 5. a) | Draw a block diagram for a DMA controller. How does a DMA controller help to ensure faster processing by the microprocessor? Explain.                                                                                                                 | 10 |
| b)    | Write the pros and cons of the <i>Serial</i> and <i>Parallel</i> interface transmissions.                                                                                                                                                             | 10 |
| c)    | List out the register names of 8237 DMA Controller.                                                                                                                                                                                                   | 5  |
| 6. a) | Write short notes on following frames of CAN bus:<br>i. Remote frame<br>ii. Error frame                                                                                                                                                               | 10 |
| b)    | What is the maximum length of a CAN bus? How can you justify that the maximum length of CAN bus is appropriate?                                                                                                                                       | 10 |
| c)    | Draw the block diagram of a basic CAN controller.                                                                                                                                                                                                     | 5  |

7. a) What do you mean by Wired-AND principle? How does it help for I<sup>2</sup>C bus? 10  
b) Why does in I<sup>2</sup>C bus the Start-End condition and Data-Transition signaling are opposite to each other? Explain. 10  
c) Draw the data formats of I<sup>2</sup>C protocol when the Master IC reads and writes to/from Slave IC. 5
8. a) Write a short note on the Fiber-channel and Infini-band interface. 10  
b) Write a comparative study on USB, Firewire and Bluetooth interfacing techniques. 10  
c) Suppose, in a serial system total 20 frames (each having a size of 5 bytes) need to be transmitted. In case of *asynchronous transmission* 1 byte overhead occurs either for *start* or *stop* byte. In contrast, for *synchronous transmission* 1 byte of synchronization overhead occurs after each 4 frame transmissions. Now, mathematically show the performance efficiency comparison between *Synchronous Transmission* and *Asynchronous Transmission*. 5

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2017-2018

DURATION: 3 Hours

FULL MARKS: 150

**CSE 4631: Digital Signal Processing**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

- 
1. a) Describe the two main uses of Digital Filters. Why do we usually look at step response of the filters instead of impulse response, even though they contain identical information? 4+4
  - b) The impulse response a low-pass filter having cut-off frequency 0.3 is  $h_1 = [1, 2, 3, 2, 1]$ . Calculate the filter kernel of the following filters: 12
    - i. A High-pass filter that allows only the frequencies above 0.2
    - ii. A Band-pass filter that allows the frequencies in the range 0.2 to 0.3 and stops others.
    - iii. A Band-reject filter that stops the frequencies in the range 0.2 to 0.3 and allows others.
  - c) Why Hamming window is used in spectral analysis? 5
  2. a) Calculate and draw the filter kernel of a 7-point moving average filter (MAF). Calculate the frequency response of the MAF for the following frequency values. What conclusion can you draw from the frequency response? 3+7  
 $F = [0, 0.1, 0.2, 0.3, 0.4, 0.5]$
  - b) A financial expert receives daily reports on the value of a particular stock. Each day he calculates the average value of the stock over the last 30 days. If this averaging were describe as a system: 10
    - i. What are the input and output signals?
    - ii. Is this system linear?
    - iii. What is the impulse response of the system?
    - iv. What would be the impulse response if the average was taken over  $M$  days?
  - c) Why is it impossible to design an ideal low pass filter for computers? 5
  3. a) Why FFT works faster than DFT? 7
  - b) Suppose you are asked to design a Windowed-Sinc filter using the Blackman window. The transition bandwidth and cut-off frequency of the filter is set to 0.4 and 0.04, respectively. If the first five points of the Blackman window is  $(0, 0.05, 0.25, 0.63, 0.95)$ , calculate the first four points ( $i = 0, 1, 2, 3$ ) of the filter kernel. 12
  - c) What is the relationship between *computation time* and *sharpness* for Windowed-Sinc filter? 6
  4. a) What are the Discrete Fourier Transform (DFT) basis functions? Calculate, sketch and label the basis functions for an 8 point DFT. 3+10
  - b) You are told that the following signals are the frequency domain of a 32 point real DFT. Give two reasons why this is not possible. 6  
Real part:  $\{1, 2, 3, 4, 5, 6, 7, 8, 7, 6, 5, 4, 3, 2, 1, 0\}$   
Imaginary part:  $\{8, 7, 6, 5, 4, 3, 2, 1, 0, 1, 2, 3, 4, 5, 6, 7\}$
  - c) Convert the following real and imaginary parts into polar form (Magnitude and Phase). 6
    - i.  $Re = 1, Im = 1$
    - ii.  $Re = -1, Im = -1$
    - iii.  $Re = -1, Im = 1$

5. a) Name the three common application domains of the DFT. 6  
 b) Figure 1 shows the corresponding phase change of a signal resulting from time domain shifting. Inspect this carefully and answer the following questions: 13
- i. Why is there no change of phase in zero frequency?
  - ii. How much is the phase change at the highest frequency for one sample shift in time domain? Why is it so?
  - iii. Observe that for all the other frequencies between 0 and 0.5, the phase change is linear. Why is it so?

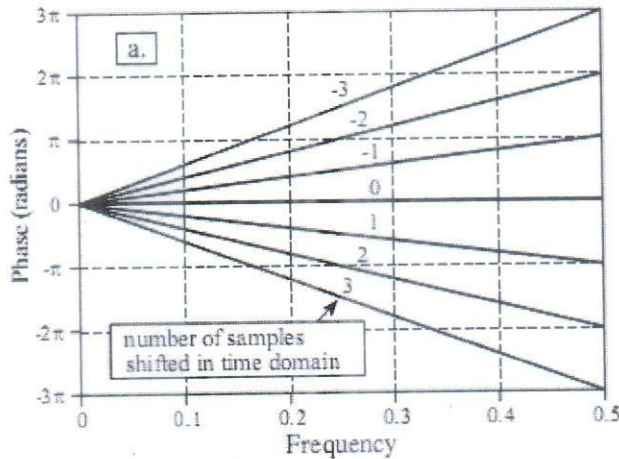


Figure 1: Phase change with respect to time domain shifting

- c) If  $x(n)$  has the frequency domain:  $X_{real}(f)$  and  $X_{imag}(f)$ , and  $y(n)$  has the frequency domain:  $Y_{real}(f)$  and  $Y_{imag}(f)$ , calculate the frequency domain of the following signals: 6
- i.  $x(n) + y(n)$
  - ii.  $3.14x(n) + \frac{y(n)}{3.14}$
6. a) Why complex conjugate is important? 6  
 b) What is circular convolution? How can you avoid it? Explain with appropriate figures. 4+5  
 c) How fast is the FFT compared to the DFT? The real and imaginary parts of a signal after performing real DFT is given below: 4+6
- $$ReX = [1 \ 2 \ 3 \ 4 \ 5]; ImX = [0 \ 4 \ 3 \ 2 \ 0]$$
- What would be the Real and Imaginary part if complex DFT was performed instead of real DFT?
7. a) Using interlaced decomposition determine the final 16 one-point signals that will be formed in the time domain from the following 16-point signal. Your answer should show each step of the decomposition process. 10
- $$x(n) = \{5, 2, 8, 10, 3, 11, 18, 0, 6, 15, 19, 20, 17, 1, 13, 25\}$$
- b) Define: Passband, Stopband, Transition band, Roll-off 8  
 c) What are the important time domain and frequency domain parameters to be considered while designing a filter? Briefly describe them. 7
8. a) Calculate the convolution of the following signals (your answer will be in the form of an equation): 15
- i.  $h(n) = \delta(n-2), x(n) = \delta(n-1) + \delta(n+4)$
  - ii.  $h(n) = \delta(n-1) + \delta(n+1), x(n) = \delta(n-a) + \delta(n+b)$
  - iii.  $h(n) = \delta(n), x(n) = \exp(-n)$
  - iv.  $h(n) = \exp(-n), x(n) = \delta(n-2)$
  - v.  $h(n) = \delta(n) - \delta(n-1), x(n) = \exp(-n)$
- b) Explain with appropriate figures - "How FFT synthesis works." 10

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)  
ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

**SEMESTER FINAL EXAMINATION**

**SUMMER SEMESTER, 2017-2018**

**DURATION: 3 Hours**

**FULL MARKS: 150**

**CSE 4635: Web Architecture**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (eight)** questions. Answer any **6 (six)** of them. **Question no. 1 is mandatory.**

Figures in the right margin indicate marks.

**[Question no. 1 is mandatory]**

1. Suppose you have to implement an online computer shop. The information about different kinds of computers are stored in a database. To represent an entity in this database, you have to use object representation of the database table (for example the Customer class is the representation of Customer table of the database) where one instance represents one row.  
To keep track of each customer's choices, you can implement a ShoppingCart. The shopping cart is something that should exist during a session only. Each session will have its own instance (meaning that all customers will have their own shopping carts). The user is presented with a list of computers available to buy through a web page. For this scenario, answer the followings:
  - a) What are the web technologies suitable to implement this application? Justify your choice. 5
  - b) Which web architecture is best suited for this application and why? 5
  - c) How do you manage the component architecture specifically for business logics to get the benefits of web architectural design pattern? 5
  - d) Design and draw a detail web architectural model, showing relationships between different parts of the application with your chosen architecture, patterns and technologies. 10
2.
  - a) What is the advantage of using HEAD method while making an HTTP request? Explain with example. 8
  - b) Suppose you want to design your personal 'PhoneBookML' language. Define your XML tags for describing your contact information and your friends' contacts using these tags. Think about what properties should be defined as attributes and what properties are best described as elements. Make sure your documents are well-formed. 12
  - c) Draw an architecture to generate dynamic web page. 5
3.
  - a) Why do you need to perform session tracking? Explain with an example. 10
  - b) Write an authentication filter to check the password given by a user in filter class, if given password is 'admin', it will forward the request to the WelcomeAdmin servlet otherwise it will display an error message. 10
  - c) Give an example code to demonstrate HTTP requests forwarding mechanism using Servlet's RequestDispatcher. 5
4.
  - a) Sometimes, some pre-processing needs to be done after the user has submitted a form. The result of this pre-processing decides where the control flow should go next. Such pre-processing code is frequently referred to as a "controller". JSP can be used to implement this controller. Give an example code of the controller using JSP technology. Your controller should invoke/redirect to one Servlet and two JSP pages. 9
  - b) What are the differences between Request attributes, Session attributes, and ServletContext attributes? 6
  - c) Briefly explain the JSP standard tag libraries according to their functionalities. 10
5.
  - a) What are the differences between Java Bean and Entity Bean? 5

- b) The Model 1 architecture has one thing going for it: simplicity. If your project is small, simple, and self-contained, it is the quickest way to get up and running. Explain the disadvantages of Model 1 architecture for developing a web project. 10
- c) Write a JavaScript function to get the values of First and Last name of the following form. 6

```
<form id="form1" onsubmit="getFormvalue()">
First name: <input type="text" name="fname" value="X">

Last name: <input type="text" name="lname" value="Lname">

<input type="submit" value="Submit">
</form>
```

- d) Write the advantages of using JSON over XML. 4
- 6. a) "RMI is used as standard API for many distributed objects in EJB" – Explain the statement. 5
- b) Suppose you have to implement an RMI application for the police department. Consider a scenario that a motorcyclist has crossed the speed limit and a policeman has stopped the rider. Officer wants to fine him and before that, he wants to check wheather the driver was issued for warrants. Through his smart device, the officer places a request to the central computer to check warrant history. From the RMI coding perspective, the client submits the request and the server executes the result, returns the result to the client. Write a Java RMI application for the scenario. 20

- 7. a) Consider the Façade architectural pattern given in Figure 1. 2+3

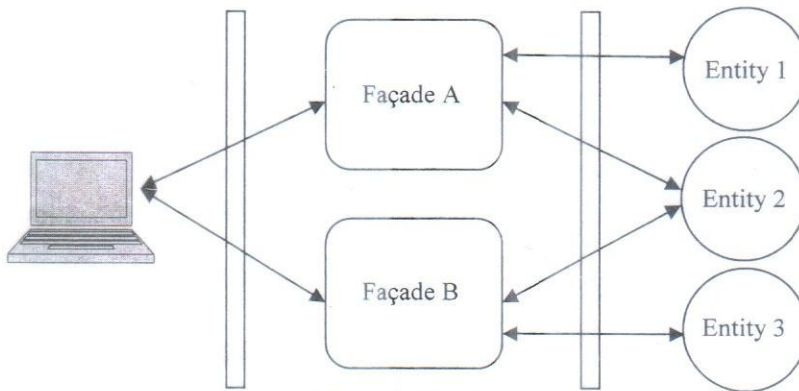


Figure 1: Façade pattern

Map this pattern with an online banking application scenario as a distributed web application and illustrate how you would implement this pattern. [Hint: Writing code segments are enough]

- b) Why does EJB need two interfaces, home interface and remote interface? Explain with example. 10
- c) Demonstrate with code how to invoke a Stateless Session Bean from Servlet and display any output through a JSP page. 10
- 8. a) What is DAO pattern? With a real-life example describe how you could use DAO pattern and Entity Beans. 12
- b) What is the relationship between entity manager and persistence context? Give an example use of the annotation named `@PersistenceContext`. 5
- c) What are entities in EJB 3.0? Consider the following schema of a database table for course information: 8

```
Student (student_id, student_name, department, phone_number)
```

- i. Where, `student_id` is the primary key and need to be generated automatically. Write an Entity class for this table in EJB 3.0.

Li 238

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)  
ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

**SEMESTER FINAL EXAMINATION**

**WINTER SEMESTER, 2017-2018**

**DURATION: 3 Hours**

**FULL MARKS: 150**

**CSE 4673: Operating System and System Programming**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

1. a) With the help of figures, show how the length of the next CPU burst is predicted. Include necessary formulas. 10
- b) Sketch the Gantt chart and find the average Waiting Time (WT) for the following data using preemptive Shortest Job First (SJF) CPU scheduling algorithm. 7+4

Process	Arrival Time	Burst Time
P1	3	4
P2	4	7
P3	5	1
P4	2	1
P5	1	8
P6	0	12

- c) Define context switching and swapping. "Context switching time and swapping time should be as minimal as possible"- Justify this sentence. 4
2. a) Consider the following snapshot of a system and it's 5 resources: 5+8

Process	Allocation					Max					Available				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
P1	0	1	0	2	1	6	3	0	4	2	5	3	2	4	5
P2	2	0	1	1	4	6	2	1	5	3					
P3	5	0	2	1	3	9	0	2	1	7					
P4	0	1	1	2	3	2	2	2	3	8					

Answer the following questions using the banker's algorithm:

- i. Is the system in a safe state? If yes then what is the safe sequence?
- ii. If a request from process **P2** arrives for **(2, 0, 2, 1, 0)**, can the request be granted immediately? If granted then what will be the safe sequence?
- b) What is multiprogramming and multitasking? Explain why these two features maximize the CPU performance. 12
3. a) What is dispatch latency? With figures show how dispatch latency works. 13
- b) With figures show how Storage Area Networks work. 12
4. a) Explain Starvation and Aging. 6
- b) Draw a resource allocation graph that has a cycle but no deadlocks. Draw another graph 12



where there is a deadlock. Explain why the first graph has a deadlock but not the second graph.

- c) Show how parameter passing through a table works. 7
5. a) With figures, show how the CPU switches from one process to another. 14  
 b) Show how process creation in UNIX works. 11
6. a) A disk system has 100 cylinders, numbered 0 to 99. Assume that the read / write head is at cylinder 50. The queue of pending requests, in order, is 4x4  
 20, 12, 62, 29, 67, 33, 81, 52, 35, 85, 8

Illustrate how the read/write head moves for the following algorithms:

- i. SSTF
- ii. C-SCAN
- iii. C-LOOK
- iv. SCAN

- b) Write short notes on: 9  
 Hard Disk, Solid State Drive and Magnetic Tape.
7. a) Explain how the user moves from user mode to kernel mode. 12  
 b) With figures show how multilevel feedback queue works. 13
8. a) If Time Quantum (TQ) is extremely large, at that point Round Robin (RR) works like First Come First Serve (FCFS)- justify this with an example. 10  
 b) Explain how Linux scheduling works. "Turnaround Time Varies with The Time Quantum" - 5+10  
 justify this statement.

Li 240

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

**SEMESTER FINAL EXAMINATION**

**SUMMER SEMESTER, 2017-2018**

**DURATION: 3 Hours**

**FULL MARKS: 150**

**CSE 4675: Mobile Application Development**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

- 
1. a) Android is structured in the form of a software stack comprising applications, an operating system, run-time environment, middleware, services, and libraries. Draw properly the Android software stack by providing different component names in each of the layers. 8
  - b) List down the information obtained by *Location provider* Object. Briefly mention the parameters and return values of the following useful methods provided by *LocationManager* class. 10
    - i. `addProximityAlert()`
    - ii. `getAllProviders()`
    - iii. `getLastKnownLocation()`
  - c) Preparing your android application for release is a multi-step process which involves five basic tasks. Briefly discuss those points. 7
  2. a) What is In-App Billing? Write the three main problems of releasing your android application through a personal website. 6
  - b) Discuss the following User Interface Design issues and mention why we should follow these rules. 12
    - i. Data entry
    - ii. The placement of controls
    - iii. Contrast
    - iv. Text size
    - v. Team up real users
  - c) In addition to request permissions, the *AndroidManifest.xml* file can list features the app uses. What are the benefits of listing features? Write down the code for adding camera and location feature in *AndroidManifest.xml*. 7
  3. a) How does Content Providers and WebView utilize built-in security features that significantly reduce the frequency and impact of application security issues? 8
  - b) Briefly discuss four basic features provided by the Android sensor framework. Write short notes on the following sensors: 10
    - i. Accelerometer
    - ii. Light
    - iii. Temperature
    - iv. Hall Sensor
  - c) Describe some of the features of MotionEvent object when `onTouch()` method is called. Write down the main difference between `getAction()` and `getActionMasked()` method. 7

4. a) Dragging and dropping views is not particularly difficult to implement with the help of *OnDragListener* since API 11. Unfortunately, to support gingerbread managing drag and drop becomes much more manual as you have to implement it using the *onTouch* handlers. Now write down the code for implementing the drag event for a particular view which can run in gingerbread version. Later on, implement the related methods for Swipe Gesture detection. 12
- b) What is Nine-Patch file? Write down the differences between Property Animation and Tween Animation. 7
- c) What is Mobile condition? How does the mobile user is fundamentally different from the stationary user? 6
5. a) Think about an app for refugees that will help them understand the languages and cultures of new locations so that they can connect with the locals and start becoming a part of the community in a better way. Now mention five important features that you could offer in your app. Besides, write down five application development challenges and possible solutions for completing your app. 10
- b) What is App icon badge notification? Write down the code for adding a dialog like Figure 1 with a title and list of colors. 10

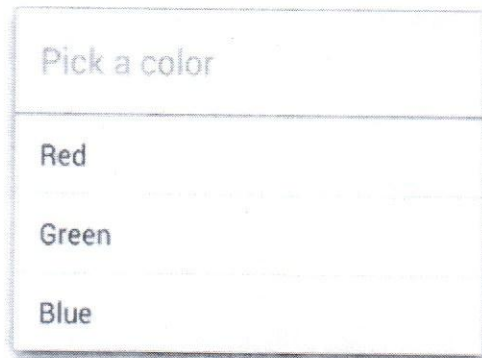


Figure 1: Figure for Question no. 5 (b)

- c) How can you capture images or videos without directly using the Camera object (or requiring the permission)? 5
6. a) Consider you have to develop a mobile application in *iOS* platform for finding small paid work in your local area. It is for the users who are in need of some quick cash and willing to do small works like repairing a computer, cleaning the garden, monitoring baby or other similar tasks. Some of the features of this application are: 13
- Password protection
  - Efficient location detection and map view
  - Quick history checking and rating info of a customer
  - Convenient payment options and tracking
  - Communicating through text messages
- Design an efficient user interface for such an application following standard rules and regulations of UI design. Finally, design a meaningful App icon that attracts attention in the App Store.
- b) A notification in its most basic and compact form (also known as collapsed form) which displays an icon, a title, and a small amount of content text. By default, the notification's text content is truncated to fit one line. Could you develop the code to enable an expandable notification along with its basic contents? Later on, mention the possible ways of removing a notification. 12

7. a) Briefly describe two sample applications which will illustrate the benefits of offloading. You have an HP iPAQ PDA with a 400-MHz Intel XScale processor and the following values:  $P_c \approx 0.9$  W,  $P_i \approx 0.3$  W, and  $P_{tr} \approx 1.3$  W. In the cloud side, you have a seven-core server, with a clock speed of 3.2 GHz. Due to additional memory and more aggressive pipelining, the speedup will be ten times faster. Suppose the computation of a sample application requires 10000 instructions. Now if you want to exchange 500 Bytes of data then find out the minimum bandwidth required for offloading to save energy. 12
- b) Draw the workflow for an android developer starting from the environment setup to publishing the app. 7
- c) Briefly discuss *SQLiteOpenHelper* with appropriate code, especially its two callback methods. 6
8. a) Write down any five dangerous permission group names along with their group members which are introduced after Android Marshmallow or 6.0. With the help of a diagram explain *android:gravity* and *android:layout\_gravity* function. 9
- b) Write Short notes on followings: 9
- Bearing
  - Notification importance
  - Screen pixel density (dpi) qualifier values
- c) The XML code given in Figure 2 represents an activity layout. Based on the given code try to design the appropriate user interface that will appear on the Android screen. 7

```

<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
 android:layout_width="match_parent"
 android:layout_height="match_parent"
 android:orientation="vertical">
 <Button
 android:layout_width="match_parent"
 android:layout_height="wrap_content"
 android:padding="30dp"
 android:layout_marginTop="50dp"
 android:text="First Button" />
 <LinearLayout
 android:layout_width="match_parent"
 android:layout_height="wrap_content"
 android:orientation="horizontal"
 android:layout_gravity="center"
 android:layout_marginTop="50dp">
 <Button
 android:id="@+id/gobutton"
 android:layout_width="wrap_content"
 android:layout_height="wrap_content"
 android:layout_weight="1"
 android:text="GO" />
 <Button
 android:id="@+id/exitbutton"
 android:layout_width="wrap_content"
 android:layout_height="match_parent"
 android:layout_weight="3"
 android:text="EXIT" />
 </LinearLayout>
</LinearLayout>

```

Figure 2: Code for Question no. 8 (c)

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

**SEMESTER FINAL EXAMINATION**

**SUMMER SEMESTER, 2017-2018**

**DURATION: 3 Hours**

**FULL MARKS: 150**

**CSE 4801: Compiler Design**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

- 
- |       |                                                                                                                                                                                                                                                                                                                                              |    |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1. a) | Draw the block diagram of a language processing system. Briefly discuss each of its components.                                                                                                                                                                                                                                              | 10 |
| b)    | Write a <i>Lex</i> program which can recognize presence of an even number of alphabetic strings followed by an odd number of integer numbers in a text file. Text file name will be supplied as an argument to the program. The <i>Lex</i> program will report start and end position of such sequence(s) present in the provided text file. | 10 |
| c)    | Discuss the functions of a symbol table manager.                                                                                                                                                                                                                                                                                             | 5  |
| 2. a) | Discuss the reasons for separating the analysis phase of compiling into lexical and parsing during an ideal compiler construction.                                                                                                                                                                                                           | 10 |
| b)    | Write a program using <i>Lex</i> and <i>Yacc</i> which can convert a prefix expression into postfix expression.                                                                                                                                                                                                                              | 10 |
| c)    | Which applications are known as cousins of a compiler?                                                                                                                                                                                                                                                                                       | 5  |
| 3. a) | List various compiler construction tools along with brief description.                                                                                                                                                                                                                                                                       | 10 |
| b)    | Compare LL parser and LR parser. What are the meaning of Ls and R here?                                                                                                                                                                                                                                                                      | 10 |
| c)    | Write regular expression for a float number supported in C++.                                                                                                                                                                                                                                                                                | 5  |
| 4. a) | Consider the following context-free grammar:                                                                                                                                                                                                                                                                                                 | 20 |
|       | $G \rightarrow L$                                                                                                                                                                                                                                                                                                                            |    |
|       | $L \rightarrow E ; L$                                                                                                                                                                                                                                                                                                                        |    |
|       | $L \rightarrow E$                                                                                                                                                                                                                                                                                                                            |    |
|       | $E \rightarrow E + T$                                                                                                                                                                                                                                                                                                                        |    |
|       | $E \rightarrow T$                                                                                                                                                                                                                                                                                                                            |    |
|       | $T \rightarrow \text{id}$                                                                                                                                                                                                                                                                                                                    |    |
|       | $T \rightarrow \text{id} ( )$                                                                                                                                                                                                                                                                                                                |    |
|       | $T \rightarrow \text{id} ( L )$                                                                                                                                                                                                                                                                                                              |    |
|       | The terminal symbols of this grammar are ; + ( ) id                                                                                                                                                                                                                                                                                          |    |
| i.    | Derive a leftmost derivation for the string $x + y ; z ( y ( ) )$ and show the corresponding parse tree.                                                                                                                                                                                                                                     |    |
| ii.   | Transform this grammar so that it can be used to construct a top-down predictive parser.                                                                                                                                                                                                                                                     |    |
| b)    | How syntax tree differs from parse tree? Classify attributes used in syntax tree.                                                                                                                                                                                                                                                            | 5  |

5. a) Consider the following context-free grammar and the parse table:

10

1.  $G \rightarrow L$
2.  $L \rightarrow L P$
3.  $L \rightarrow P$
4.  $P \rightarrow ( P )$
5.  $P \rightarrow ( )$

state	action			goto	
	(	)	\$	L	P
0	s3			1	2
1	s3		accpt		4
2	r3		r3		
3	s6	s7			5
4	r2		r2		
5		s8			
6	s6	s10			9
7	r5		r5		
8	r4		r4		
9		s11			
10		r5			
11		r4			

Show, in full detail, the steps that an LR(1) parser would follow to parse the string  $(( )) ( )$  using the above grammar. For each step, show the contents of the stack, what the next input is and the action that is taken.

b) Consider the context-free grammar:

10

$$S \rightarrow SS^* | SS+ | a$$

- i. Show that the string  $aa+a^*$  can be generated by this grammar.
- ii. Construct a parse tree for the string.

c) Briefly explain the concept of derivation.

5

6. a) Design a translation scheme for checking the *types* of the following statements:

10

- $$S \rightarrow \text{id} := E$$
- $$S \rightarrow \text{if } E \text{ then } S1$$
- $$S \rightarrow \text{do } S1 \text{ while } E$$
- $$S \rightarrow S1 ; S2$$

- b) Discuss various methods to implement three-address statements.
- c) Write short notes *viable prefix* and *handle pruning*.

10

5

7. a) Discuss on heap allocation strategy for activation records. Mention its advantages over other allocation methods.

10

b) Write the syntax-directed definition to generate intermediate code for the following statements:

15

- $$S \rightarrow \text{if } E \text{ then } S1$$
- $$S \rightarrow \text{if } E \text{ then } S1 \text{ else } S2$$
- $$S \rightarrow \text{do } S1 \text{ while } E$$
- $$S \rightarrow \text{while } E \text{ do } S1$$

8. a) What is an activation Record? List the contents of an activation record along with their description.

10

b) Write a *Lex* program which will take a file name as an argument and count the number of uppercase and lowercase letters, digits, words, white spaces, lines and other symbols presented in the file.

15

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**  
**Department of Computer Science and Engineering (CSE)**

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2017-2018

DURATION: 3 Hours

FULL MARKS: 150

**CSE 4803: Parallel and Distributed Processing****Programmable calculators are not allowed. Do not write anything on the question paper.**There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

1. a) What is mounting? How a foreign name space can be mounted in a distributed system? Explain with the example of NFS. 7
- b) Why is an identifier more suitable than an address as a name for an object in a distributed system? Explain DNS name space distribution with an example. 3+7
- c) What is location-independent naming? How does the Chord algorithm support it? 8
2. a) What is parallel computing? Briefly describe the parallel computer memory architectures. 8
- b) A benchmark program containing 234,000 instructions is executed on a processor having a cycle time of 0.15ns. The statistics of the program is given below: 9

Table 1: Statistics of a program

Instruction Type	Instruction Mix	Processor Cycles	Memory Cycles
Arithmetic	58 %	2	2
Branch	33 %	3	1
Load/Store	9 %	3	2

Each memory reference requires 3 CPU cycles to complete. Calculate MIPS rate and throughput for the program.

- c) The degree of concurrency increases as the decomposition becomes finer in granularity. Justify your answer with an example. 8
3. a) Suppose there are three processes *A*, *B*, and *C*. All clock runs at the same rate but initially *A*'s clock reads 10, *B*'s clock reads 0 and *C*'s clock reads 5. At time 10 by *A*'s clock, *A* sends a message to *B*, this message takes 4 units of time to reach *B*. *B* then waits one unit of time and then sends a message onto *C* which takes 2 units of time to reach *C*. Assuming that the system implements Lamport's timestamps draw a picture illustrating the timestamps for the messages and explain how the timestamps are obtained. 7
- b) What is the advantage of vector clocks over Lamport clocks? Consider three processes *p*<sub>1</sub>, *p*<sub>2</sub>, and *p*<sub>3</sub> with the following pattern of communication given in Figure 1. Label each event with a vector timestamp. 3+5

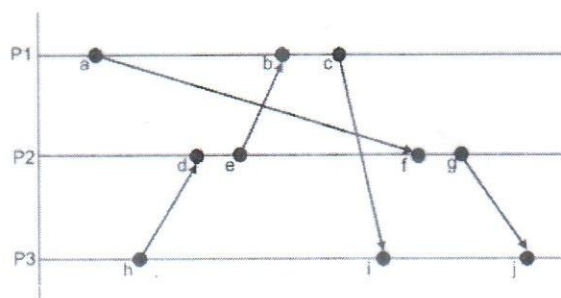


Figure 1: Four Processes P1, P2, P3 run events to send and receive messages.

- c) What is mutual exclusion? Describe in detail how a distributed algorithm will work in a network of four nodes to achieve mutual exclusion. Calculate the messages per entry/exit and delay before entry. 2+5+3
4. a) Define data centric consistency and client centric consistency. Calculate numerical deviation and order deviation for replica A and B given in Figure 2. 3+4

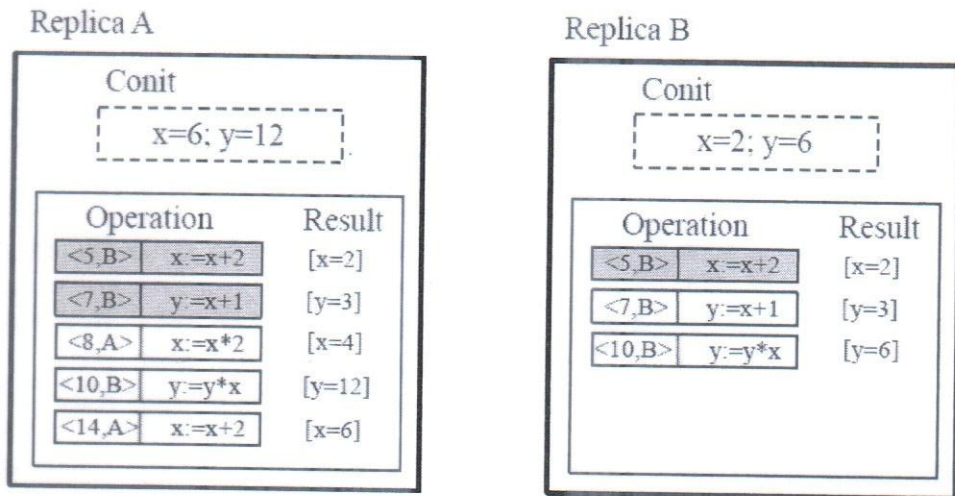


Figure 2: An example of keeping track of consistency deviations.

- b) Define sequential-consistency and causal consistency. Is the following data store, given in Figure 3, sequentially consistent? Explain your answer. 4+4

A	W(x)a	W(x)b	
B	R(x)a	R(x)b	
C		R(x)b	R(x)a

Figure 3: for Question no 4.(b)

- c) Consider a Web server that is placed in New York. Normally, this server can handle incoming requests quite easily, but it may happen that over a couple of days, a sudden burst of requests come in from an unexpected location far from the server. In that case, How the server will resolve it? Explain with example. 10
5. a) Consider the following sequence of instructions being processed on the pipelined 5-stage RISC processor: 6x3
- Load R4, #100(R2)

Add R5, R2, R3

Subtract R6, R4, R5

And R7, R2, R5
- i. Identify all the data dependencies in the above instruction sequence. For each dependency, indicate the two instructions and the register that causes the dependency.
  - ii. Assume that the pipeline does not use operand forwarding. Also, assume that the only sources of pipeline stalls are the data hazards. Draw a diagram that represents instruction flow through the pipeline during each clock cycle. How long does it take for the instruction sequence to complete?
  - iii. Now, assume that the pipeline uses operand forwarding. There are separate forwarding paths from the outputs of stage-3 and stage-4 to the input of stage-3. Draw a diagram that represents the flow of instructions through the pipeline during each clock cycle. Indicate operand forwarding by arrows.
- b) What is dynamic branch prediction? Draw the finite state machine for a 2-bit prediction scheme. 2+5



6. a) "Pipelining does not result in individual instructions being executed faster; rather, it is the throughput that increases" Explain this with necessary example. 8
- b) Define *The Owner Computes Rule*. Give an example of Mapping Technique for Minimum Idling 2+5
- c) Do you think a compiler can solve data hazard? If so how? Justify your answer with an example. 5
- d) Consider a web browser that returns an outdated cached page instead of a more recent one that had been updated at the server. In this a failure, and if so, what kind of failure? 5
7. a) Define *Cloud Computing*. Cloud computing can be viewed as a collection of services, which can be presented as a layered computing architecture. Briefly introduce the layered architecture of cloud computing. 10
- b) Describe the data center interconnect network architectures for clouds. 8
- c) Why PaaS and IaaS providers are often called the infrastructure providers or cloud providers? Explain. 7
8. a) What do the map and reduce phases do in the Map Reduce algorithm? Explain with proper example. 8
- b) Write down the main purpose of Google File System (GFS). With proper diagram outline the architecture of the GFS with brief description of each components. 2+6
- c) What is Lease and Mutation Order in GFS? Write the steps needed to append data in GFS. 3+6

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

**SEMESTER FINAL EXAMINATION**

**SUMMER SEMESTER, 2017-2018**

**DURATION: 3 Hours**

**FULL MARKS: 150**

**CSE 4805: Wireless Networks**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

1. a) Define the *Access Networks* with a hierarchical classification. 7
- b) Describe the importance of RTS/CTS (Request to Send / Clear to Send) frames in any multi hop wireless networks. 7
- c) Clarify the neighborhood of a link in a multi-hop wireless ad-hoc network with the aid of a diagram. 6
- d) Consider the topology of a wireless network illustrated in Figure 1. In the given scenario, the station *A*, *B*, *C*, and *D* all have equi-sized transmission ranges, while station *E* has a smaller transmission range. Assume that, two nodes' transmissions will interfere if and only if they transmit at the same time and their transmission areas overlap. Further, assume that losses only occur due to collisions. Consider the *RTS/CTS* as an enabled mechanism in this scenario. 5

For the given scenario, if station *A* sends data to station *B* and station *C* sends data to station *D* (as fast as they can), and no collision detection mechanism is used, what is the throughput of their transfer as a proportion of their send rate?

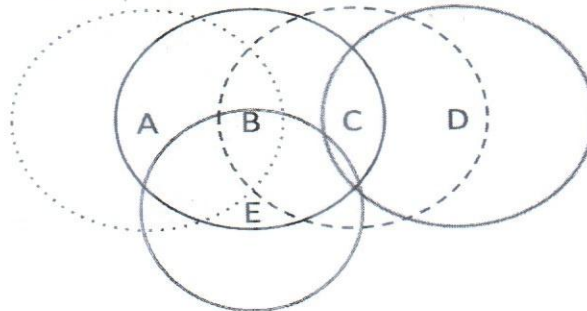


Figure 1: Network topology for Question 1.d

2. a) An *Independent Basic Service Set (IBSS)* consists of three stations (*A*, *B*, *C*) those follow *IEEE 802.11 Distributed Coordination Function (DCF)* as *Medium Access Control Protocol*. 12
- Draw a time line diagram showing *one successful re-transmission* of *MSDU* (MAC Service Data Unit) from station *A* to station *C*. The diagram should include the back-off process of all the contenders which includes the back-off slots, *DIFS* period and the *SIFS* period. Note that, the x-axis of the diagram shows time and y-axis shows one horizontal line for each containing stations.
- b) How is the *QoS (Quality of Service)* assured in *IEEE 802.11e EDCF* (Enhanced Distributed Channel Access)? 13
3. a) How does routing in *Delay Tolerant Network* work? 5
- b) Clarify the main idea of *CSMA/ECA (Carrier Sense Multiple Access with Enhanced Collision Avoidance)* protocol which creates a collision-free schedule in a fully decentralized manner 13

- c) The IEEE 802.11 MAC efficiency degrades rapidly as the PHY data rate increases. The graph illustrated in Figure 2 shows such a phenomenon of IEEE 802.11 MAC for a sample network. Clarify the reason behind such phenomenon.

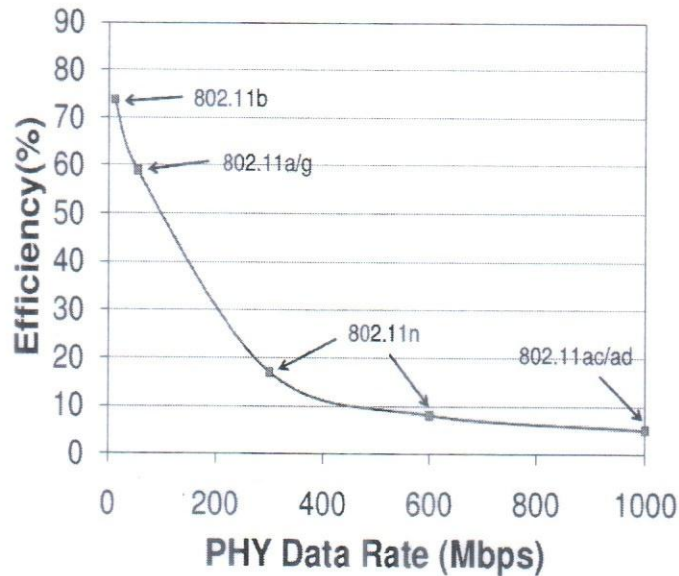


Figure 2: Graph for question 3.c

4. a) IEEE 802.11 WLANs perform channel contention in time domain which possesses greater channel wastage. 6
- Address the specific reasons behind such inefficiency caused by time domain channel contention. 6
  - Discuss a promising channel contention mechanism which effectively overcomes these limitations introducing back-off operation using extra frequency bands (EFB). 9
- b) "Post back-off can reduce the delivery delay in lightly loaded systems" - Justify this statement. 5
- c) How does node scanning procedure work in WLAN? 5
5. a) Mention few effective approaches to extend the network life-time of *Wireless Sensor Networks (WSNs)*. 7
- b) What is the fundamental idea of *Sensor-MAC (S-MAC)* protocol in enhancing network life-time of WSNs? 9
- c) Contention-based asynchronous duty cycle MAC protocols transmit long preamble during low power listening (LPL) period. However, such long preamble transmission may occupy the medium for much longer than actual data transmission. Discuss the significant contribution of *Receiver-Initiated MAC (RI-MAC) protocol* in resolving such limitation in asynchronous duty cycled WSN. 9
6. a) *Receiver Initiated Medium Access with Simple Polling (RIMA-SP)* uses a new control packet called *No-Transmission-Request (NTR)*, and an additional collision avoidance waiting period ( $w$ ). Clarify the importance of ( $NTR$ ) and ( $w$ ) in *RIMA-SP* with the aid of an appropriate example. 8
- b) Discuss the contribution of *Low-Energy Adaptive Clustering Hierarchy (LEACH)* protocol in enhancing the network lifetime of a WSN. 8
- c) Clarify the role of *CDMA* in minimizing interference between clusters formed by *LEACH*. 3
- d) Timing Synchronization Function (TSF) synchronizes all the stations within an *Independent Basic Service Set (IBSS)* to a common clock. Let an IBSS consists of 4 stations A, B, C, and D, and their present clock times are 14.00, 14.08, 13.55 and 14.05 respectively. Discuss the time synchronization procedure followed by these stations in the given scenario. 6

7.
  - a) Mention few characteristics and complexities of *Mobile Ad-hoc Networks (MANET)*. 5
  - b) How is the *Expected Transmission Count (ETX)*, a path metric for multi hop wireless networks calculated? 7
  - c) Mention the motivation of *Expected Transmission Time (ETT)* routing metric. 6
  - d) Discuss the concept of *Wastage Aware Routing Metric* in *Energy-Harvesting Wireless Sensor Networks (EH-WSNs)*. 7
  
8.
  - a) How does the *congestion control* mechanism differ from *flow control* mechanism? 5
  - b) *Long Term Evolution (LTE)* standard has introduced a number of new technologies when compared to the previous cellular system. Describe those in brief. 7
  - c) Mention the significance of *Warning Bit* and *Choke Packets* in *Congestion Control*. 6
  - d) "Traditional TCP schemes may suffer from severe performance degradation in a wireless environment" - Justify the statement. 7

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2017-2018

DURATION: 3 Hours

FULL MARKS: 150

**CSE 4807: IT Organization and Management**

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

1. It may surprise you that two snowboard enthusiasts who simply wanted a better way to sell their snowboards online have created an e-commerce platform that now has over \$275 million in sales and hosts more than 20 000 online retailers, including Pixar, Angry Birds, and the Foo Fighters. Tobias Lütke, CEO and founder, has created a business that allows companies of all sizes to set up their own online store, taking a task that used to take months and trimming it down to as little as half an hour. **Shopify** takes care of everything behind the scenes in return for a subscription fee and transaction fees. The business model that follows mainly deals with other businesses. Given the scenario, answer the following questions.
  - a) As the CEO of **Shopify**, what are the skillsets that Tobias Lütke requires? Justify your answer. 5
  - b) According to Henry Mintzberg, a prominent management researcher at McGill University, a manager has to perform certain roles in an organization. Considering **Shopify** as an organization which conducts business with other business organizations, what should be the roles of Tobias Lütke in orchestrating such a successful organization as **Shopify**? 12
  - c) Why are we calling an online platform like **Shopify** an organization? What type of organization is **Shopify**? Explain your answer. 4+4
  
2.
  - a) Describe what is meant by the term, 'Organizational design'. What is the difference between a mechanistic and an organic organization? 5+10
  - b) How do different organizations do business globally? 10
  
3.
  - a) With proper examples, describe the Strategic Management Process which includes detailed discussion on SWOT analysis and PESTEL analysis. 20
  - b) What do you understand by MBO? 5
  
4.
  - a) Levitt-Safety Limited is Canada's largest specialist supplier of safety equipment and services. 60 Like many Canadian companies, it looked to emerging foreign markets for growth opportunities. However, globalization and outsourcing are no longer a one-way street. Foreign competitors are eyeing the Canadian market, because barriers to entry such as the North American regulatory and approval bodies are easier to navigate in Canada. To be successful in the Canadian marketplace, foreign companies need to spend a lot of time and money to build up their brands. Or they could form an alliance with a company like Levitt-Safety to piggyback on a brand that is already established and well known after 36 years of business. 25

Increased competition has led to downward pressure on profit margins. To counter this, CEO Bruce Levitt created an intermediary company to import their product and resold it to

their distribution business. The company sales teams now have a much better understanding of inventory carrying costs, stock-outs, dead stock, and other often hidden costs. Levitt-Safety also has a separate manufacturing business, NL Technologies, run by Heidi Levitt, which has become a world leader in the manufacturing and design of mining technology. Levitt-Safety has created an effective organizational structure, with an intermediary and a separately managed company.

Levitt-Safety is looking at adding another brand that they can sell to others in the industry. Should Bruce Levitt set up another company or, instead, set up an alliance with a foreign company that would sell their product under the Levitt-Safety name? In any case, what should be the generic organizational model (Mechanistic or Organic)? Why? What contingency factors should Levitt-Safety be considering?

- |    |    |                                                                                                                                                                                                                                                                                                    |     |
|----|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 5. | a) | Discuss the strengths and weaknesses of the trait theory of leadership.                                                                                                                                                                                                                            | 5   |
|    | b) | What sources of power are available to leaders? Which ones are most effective?                                                                                                                                                                                                                     | 10  |
|    | c) | "All managers should be leaders, but not all leaders should be managers." Do you agree or disagree with this statement? Support your position.                                                                                                                                                     | 10  |
| 6. | a) | "Charismatic leadership is always appropriate in organizations." Do you agree or disagree? Support your position.                                                                                                                                                                                  | 5   |
|    | b) | How do the needs of employees affect motivation? Describe in details.                                                                                                                                                                                                                              | 10  |
|    | c) | What are the advantages of using pay-for performance programs to motivate employee performance? Are there any drawback exists? Explain.                                                                                                                                                            | 10  |
| 7. | a) | What role would money play in:                                                                                                                                                                                                                                                                     | 3×4 |
|    |    | i. The hierarchy of needs theory                                                                                                                                                                                                                                                                   |     |
|    |    | ii. Motivation-hygiene theory                                                                                                                                                                                                                                                                      |     |
|    |    | iii. Equity theory                                                                                                                                                                                                                                                                                 |     |
|    |    | iv. Expectancy theory                                                                                                                                                                                                                                                                              |     |
|    | b) | Describe several means that you might use to motivate:                                                                                                                                                                                                                                             |     |
|    |    | i. Minimum-wage employees working for a small company that makes tortillas or                                                                                                                                                                                                                      | 4   |
|    |    | ii. Professional and technical employees working for software design firm.                                                                                                                                                                                                                         | 4   |
|    |    | Which of your suggestions do you think is best? Support your position.                                                                                                                                                                                                                             | 5   |
| 8. | a) | All organizations do not have the same structure. Even organizations of comparable size do not necessarily have similar structures. What works for one organization may not work for another. Discuss the two generic models of organizational design and the contingency factors that favor each. | 20  |
|    | b) | "Organizations that fail to plan are planning to fail." - Do you agree or disagree with this statement? Explain your position.                                                                                                                                                                     | 5   |

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

**SEMESTER FINAL EXAMINATION**

**SUMMER SEMESTER, 2017-2018**

**DURATION: 3 Hours**

**FULL MARKS: 150**

**CSE 4831: Simulation, Modeling and Performance Evaluation**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (Eight)** questions. Answer any **6 (Six)** of them.

Figures in the right margin indicate marks.

1. Jobs arrive at a single-CPU computer facility with interarrival times that are IID exponential random variables with mean 1 minute. Each job specifies upon its arrival the maximum amount of processing time it requires, and the maximum times for successive jobs are IID exponential random variables with mean 1.1 minutes. However, if  $m$  is the specified maximum processing time for a particular job, the actual processing time is distributed uniformly between  $0.55m$  and  $1.05m$ . The CPU will never process a job for more than its specified maximum; a job whose required processing time exceeds its specified maximum leaves the facility without completing service. You are asked to develop a simulation program to study the computer facility until 1000 jobs have left the CPU assuming that jobs in the queue are processed in a FIFO manner.  
 The system is studied to compute the average and maximum delay in queue of jobs, the proportion of jobs that are delayed in queue more than 5 minutes.
  - a) What are the state variable(s) and output variable(s) for the simulation model? 7
  - b) Identify the set of events for the simulation model. Assume that the simulation terminates by a terminating event. 4
  - c) Write down the state equation(s) and output equation(s) for the simulation model. 10
  - d) Write down the state space for the simulation model. 4
  
2. For the scenario given in Question 1, answer the followings:
  - a) Draw a sample path of the system for a few breakdowns of machines showing the change of the state variable(s) over time. 5
  - b) Draw separate flow charts of the event routines (i.e., the event handler functions) for each of the events of the simulation model. 12
  - c) Draw the flow chart of the function that updates the necessary statistical variables according to the output equations of the simulation model. 8
  
3. An instructor knows from past experience that student exam scores have mean 77 and standard deviation 15. At present the instructor is teaching two separate classes – one of size 25 and the other of size 64.
  - a) Approximate the probability that the average test score in the class of size 25 lies between 72 and 82. 8
  - b) Repeat part (a) for a class of size 64. 6
  - c) Find out the approximate probability that the average test score in the class of size 25 is higher than that of the class size 64. 5

- d) Suppose the average scores in the two classes are 76 and 83. Which class, the one of size 25 or the one of size 64, do you think was more likely to have average 83? 6
4. a) Let  $X_1, X_2, \dots, X_n$  be a sample from the distribution whose density function is 10
- $$f(x) = \begin{cases} e^{-(x-\theta)}, & x \geq \theta \\ 0, & \text{otherwise.} \end{cases}$$
- Determine the maximum likelihood estimator of  $\theta$ .
- b) Consider the discrete uniform distribution 8
- $$P(x) = \frac{x}{b-a}, \quad x = a, a+1, \dots, b$$
- Find the joint maximum likelihood estimations (MLEs) of  $a$  and  $b$ , based on a random sample of size  $n$ .
- c) The number of traffic accident in a city in 10 randomly chosen days is as follows: 7  
4, 0, 6, 5, 2, 1, 2, 0, 4, 3  
If the number of accidents in a day follows a Poisson distribution, find the proportion of the days that had 2 or fewer accidents.
5. The following data represent the time to perform transaction in a bank, measured in minutes: 0.70, 1.28, 1.46, 2.36, 0.354, 0.750, 0.912, 4.44, 0.114, 3.08, 3.24, 1.10, 1.59, 1.47, 1.17, 1.27, 9.12, 11.5, 2.42, 1.77.  
Develop an input model for these data, which includes the followings:
- a) A summary statistic of the data for the functions: mean, coefficient of variation and skewness. Also, form the summary statistics comment on the possible distribution. 8
- b) A graphical estimate of the distribution by drawing one or more histograms. 6
- c) Estimation of the parameter(s) of the distribution. 5
- d) Use the Chi-square test to test the hypothesis that the random samples have the estimated distribution. 6
6. To estimate  $\theta$ , 20 independent values having mean  $\theta$  have been generated. If the successive values obtained are 102, 112, 131, 107, 114, 95, 133, 145, 139, 117, 93, 111, 124, 122, 136, 141, 119, 122, 151, and 143.
- a) Find a point estimate of  $\theta$ . 3
- b) Construct a 99% confidence interval for the estimated value. 12
- c) How many additional values do you think to be generated if we want to be 99 percent certain that our final estimate of  $\theta$  is correct to within  $\pm 0.5$ ? 10
7. a) Develop a random variate generator using the composition method for a random variable with the following distribution: 13
- $$f(x) = \begin{cases} \frac{1}{2}(x-2), & 2 \leq x \leq 3 \\ \frac{1}{2}\left(2 - \frac{x}{3}\right), & 3 \leq x \leq 6 \\ 0, & \text{otherwise.} \end{cases}$$
- b) Develop a random variate generator using the acceptance-rejection method for a 12



random variable with the following distribution:

$$f(x) = \begin{cases} 1+x, & -1 \leq x \leq 0 \\ 1-x, & 0 \leq x \leq 1 \\ 0, & \text{otherwise.} \end{cases}$$

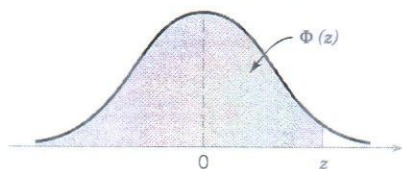
8. a) Use the inverse transform method (or any other method) to generate random variates with the following distribution function: 15

$$f(x) = \begin{cases} \frac{x}{2}, & 0 \leq x \leq 1 \\ \frac{3}{4}, & 1 < x \leq 2 \\ 0, & \text{otherwise} \end{cases}$$

- b) A machine is taken out of production if it fails, or after 5 hours, whichever comes first. By running similar machines until failure, it has been found that time to failure,  $X$ , has the uniform continuous distribution with parameters  $a = 0$  and  $b = 10$  hours. Thus, the time until the machine is taken out of production can be represented as  $Y = \min(X, 5)$ . Develop a step-by-step procedure for generating  $Y$ . 10

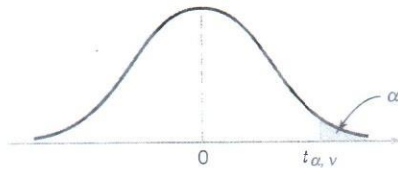
Appendix A: CDF of Standard Normal Distribution

$$\Phi(z) = P(Z \leq z) = \int_{-\infty}^z \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}u^2} du$$



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.500000	0.503989	0.507978	0.511967	0.515953	0.519939	0.523922	0.527903	0.531881	0.535856
0.1	0.539828	0.543795	0.547758	0.551717	0.555760	0.559618	0.563559	0.567495	0.571424	0.575345
0.2	0.579260	0.583166	0.587064	0.590954	0.594835	0.598706	0.602568	0.606420	0.610261	0.614092
0.3	0.617911	0.621719	0.625516	0.629300	0.633072	0.636831	0.640576	0.644309	0.648027	0.651732
0.4	0.655422	0.659097	0.662757	0.666402	0.670031	0.673645	0.677242	0.680822	0.684386	0.687933
0.5	0.691462	0.694974	0.698468	0.701944	0.705401	0.708840	0.712260	0.715661	0.719043	0.722405
0.6	0.725747	0.729069	0.732371	0.735653	0.738914	0.742154	0.745373	0.748571	0.751748	0.754903
0.7	0.758036	0.761148	0.764238	0.767305	0.770350	0.773373	0.776373	0.779350	0.782305	0.785236
0.8	0.788145	0.791030	0.793892	0.796731	0.799546	0.802338	0.805106	0.807850	0.810570	0.813267
0.9	0.815940	0.818589	0.821214	0.823815	0.826391	0.828944	0.831472	0.833977	0.836457	0.838913
1.0	0.841345	0.843752	0.846136	0.848495	0.850830	0.853141	0.855428	0.857690	0.859929	0.862143
1.1	0.864334	0.866500	0.868643	0.870762	0.872857	0.874928	0.876976	0.878999	0.881000	0.882977
1.2	0.884930	0.886860	0.888767	0.890651	0.892512	0.894350	0.896165	0.897958	0.899727	0.901475
1.3	0.903199	0.904902	0.906582	0.908241	0.909877	0.911492	0.913085	0.914657	0.916207	0.917736
1.4	0.919243	0.920730	0.922196	0.923641	0.925066	0.926471	0.927855	0.929219	0.930563	0.931888
1.5	0.933193	0.934478	0.935744	0.936992	0.938220	0.939429	0.940620	0.941792	0.942947	0.944083
1.6	0.945201	0.946301	0.947384	0.948449	0.949497	0.950529	0.951543	0.952540	0.953521	0.954486
1.7	0.955435	0.956367	0.957284	0.958185	0.959071	0.959941	0.960796	0.961636	0.962462	0.963273
1.8	0.964070	0.964852	0.965621	0.966375	0.967116	0.967843	0.968557	0.969258	0.969946	0.970621
1.9	0.971283	0.971933	0.972571	0.973197	0.973810	0.974412	0.975002	0.975581	0.976148	0.976705
2.0	0.977250	0.977784	0.978308	0.978822	0.979325	0.979818	0.980301	0.980774	0.981237	0.981691
2.1	0.982136	0.982571	0.982997	0.983414	0.983823	0.984222	0.984614	0.984997	0.985371	0.985738
2.2	0.986097	0.986447	0.986791	0.987126	0.987455	0.987776	0.988089	0.988396	0.988696	0.988989
2.3	0.989276	0.989556	0.989830	0.990097	0.990358	0.990613	0.990863	0.991106	0.991344	0.991576
2.4	0.991802	0.992024	0.992240	0.992451	0.992656	0.992857	0.993053	0.993244	0.993431	0.993613
2.5	0.993790	0.993963	0.994132	0.994297	0.994457	0.994614	0.994766	0.994915	0.995060	0.995201
2.6	0.995339	0.995473	0.995604	0.995731	0.995855	0.995975	0.996093	0.996207	0.996319	0.996427
2.7	0.996533	0.996636	0.996736	0.996833	0.996928	0.997020	0.997110	0.997197	0.997282	0.997365
2.8	0.997445	0.997523	0.997599	0.997673	0.997744	0.997814	0.997882	0.997948	0.998012	0.998074
2.9	0.998134	0.998193	0.998250	0.998305	0.998359	0.998411	0.998462	0.998511	0.998559	0.998605
3.0	0.998650	0.998694	0.998736	0.998777	0.998817	0.998856	0.998893	0.998930	0.998965	0.998999
3.1	0.999032	0.999065	0.999096	0.999126	0.999155	0.999184	0.999211	0.999238	0.999264	0.999289
3.2	0.999313	0.999336	0.999359	0.999381	0.999402	0.999423	0.999443	0.999462	0.999481	0.999499
3.3	0.999517	0.999533	0.999550	0.999566	0.999581	0.999596	0.999610	0.999624	0.999638	0.999650
3.4	0.999663	0.999675	0.999687	0.999698	0.999709	0.999720	0.999730	0.999740	0.999749	0.999758
3.5	0.999767	0.999776	0.999784	0.999792	0.999800	0.999807	0.999815	0.999821	0.999828	0.999835
3.6	0.999841	0.999847	0.999853	0.999858	0.999864	0.999869	0.999874	0.999879	0.999883	0.999888
3.7	0.999892	0.999896	0.999900	0.999904	0.999908	0.999912	0.999915	0.999918	0.999922	0.999925
3.8	0.999928	0.999931	0.999933	0.999936	0.999938	0.999941	0.999943	0.999946	0.999948	0.999950
3.9	0.999952	0.999954	0.999956	0.999958	0.999959	0.999961	0.999963	0.999964	0.999966	0.999967

## Appendix B: Percentage Points of the t-distribution

Percentage Points  $t_{\alpha, v}$  of the t-Distribution

$\alpha \backslash v$	.40	.25	.10	.05	.025	.01	.005	.0025	.001	.0005
1	.325	1.000	3.078	6.314	12.706	31.821	63.657	127.32	318.31	636.62
2	.289	.816	1.886	2.920	4.303	6.965	9.925	14.089	23.326	31.598
3	.277	.765	1.638	2.353	3.182	4.541	5.841	7.453	10.213	12.924
4	.271	.741	1.533	2.132	2.776	3.747	4.604	5.598	7.173	8.610
5	.267	.727	1.476	2.015	2.571	3.365	4.032	4.773	5.893	6.869
6	.265	.718	1.440	1.943	2.447	3.143	3.707	4.317	5.208	5.959
7	.263	.711	1.415	1.895	2.365	2.998	3.499	4.029	4.785	5.408
8	.262	.706	1.397	1.860	2.306	2.896	3.355	3.833	4.501	5.041
9	.261	.703	1.383	1.833	2.262	2.821	3.250	3.690	4.297	4.781
10	.260	.700	1.372	1.812	2.228	2.764	3.169	3.581	4.144	4.587
11	.260	.697	1.363	1.796	2.201	2.718	3.106	3.497	4.025	4.437
12	.259	.695	1.356	1.782	2.179	2.681	3.055	3.428	3.930	4.318
13	.259	.694	1.350	1.771	2.160	2.650	3.012	3.372	3.852	4.221
14	.258	.692	1.345	1.761	2.145	2.624	2.977	3.326	3.787	4.140
15	.258	.691	1.341	1.753	2.131	2.602	2.947	3.286	3.733	4.073
16	.258	.690	1.337	1.746	2.120	2.583	2.921	3.252	3.686	4.015
17	.257	.689	1.333	1.740	2.110	2.567	2.898	3.222	3.646	3.965
18	.257	.688	1.330	1.734	2.101	2.552	2.878	3.197	3.610	3.922
19	.257	.688	1.328	1.729	2.093	2.539	2.861	3.174	3.579	3.883
20	.257	.687	1.325	1.725	2.086	2.528	2.845	3.153	3.552	3.850
21	.257	.686	1.323	1.721	2.080	2.518	2.831	3.135	3.527	3.819
22	.256	.686	1.321	1.717	2.074	2.508	2.819	3.119	3.505	3.792
23	.256	.685	1.319	1.714	2.069	2.500	2.807	3.104	3.485	3.767
24	.256	.685	1.318	1.711	2.064	2.492	2.797	3.091	3.467	3.745
25	.256	.684	1.316	1.708	2.060	2.485	2.787	3.078	3.450	3.725
26	.256	.684	1.315	1.706	2.056	2.479	2.779	3.067	3.435	3.707
27	.256	.684	1.314	1.703	2.052	2.473	2.771	3.057	3.421	3.690
28	.256	.683	1.313	1.701	2.048	2.467	2.763	3.047	3.408	3.674
29	.256	.683	1.311	1.699	2.045	2.462	2.756	3.038	3.396	3.659
30	.256	.683	1.310	1.697	2.042	2.457	2.750	3.030	3.385	3.646
40	.255	.681	1.303	1.684	2.021	2.423	2.704	2.971	3.307	3.551
60	.254	.679	1.296	1.671	2.000	2.390	2.660	2.915	3.232	3.460
120	.254	.677	1.289	1.658	1.980	2.358	2.617	2.860	3.160	3.373
$\infty$	.253	.674	1.282	1.645	1.960	2.326	2.576	2.807	3.090	3.291

 $v$  = degrees of freedom.

## Appendix C: Chi-Square Distribution

TABLE A2 Values of  $\chi^2_{\alpha,n}$ 

$n$	$\alpha = .995$	$\alpha = .99$	$\alpha = .975$	$\alpha = .95$	$\alpha = .05$	$\alpha = .025$	$\alpha = .01$	$\alpha = .005$
1	.0000393	.000157	.000982	.00393	3.841	5.024	6.635	7.879
2	.0100	.0201	.0506	.103	5.991	7.378	9.210	10.597
3	.0717	.115	.216	.352	7.815	9.348	11.345	12.838
4	.207	.297	.484	.711	9.488	11.143	13.277	14.860
5	.412	.554	.831	1.145	11.070	12.832	13.086	16.750
6	.676	.872	1.237	1.635	12.592	14.449	16.812	18.548
7	.989	1.239	1.690	2.167	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	21.026	23.337	26.217	28.300
13	3.565	4.107	5.009	5.892	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.844	36.415	39.364	42.980	45.558
25	10.520	11.524	13.120	14.611	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	40.113	43.194	46.963	49.645
28	12.461	13.565	15.308	16.928	41.337	44.461	48.278	50.993
29	13.121	14.256	16.047	17.708	42.557	45.772	49.588	52.336
30	13.787	14.953	16.791	18.493	43.773	46.979	50.892	53.672

Other chi-square probabilities:

$$\chi^2_{9,9} = 4.2 \quad P[\chi^2_{16} < 14.3] = .425 \quad P[\chi^2_{11} < 17.1875] = .8976.$$

259

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2017-2018

DURATION: 3 Hours

FULL MARKS: 150

**CSE 4835: Pattern Recognition**

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

1. a) Define the following terms: 4
- i. Class Model
  - ii. Overfitting Problem
  - iii. Decision Rule
  - iv. Risk
- b) Consider a two-class problem with the following univariate Gaussian class-conditional densities:  $P(x | \omega_1) \equiv N(0,1)$  and  $P(x | \omega_2) \equiv N(1,1)$ .
- Assume  $P(\omega_1) = \frac{3}{4}$  and  $P(\omega_2) = \frac{1}{2}$ .
- i. Calculate the threshold boundary value  $x^*$  which gives the probability of minimum error. 7
  - ii. Is this classifier a linear machine? Justify your answer. 3
  - iii. Assume  $P(\omega_1) = P(\omega_2) = \frac{1}{2}$ . Find the minimum risk decision rule with loss functions 8+3  
as  $\lambda_{11} = \lambda_{22} = 0, \lambda_{12} = 1, \lambda_{21} = 1/2$ . Approximately show the effect on class regions.
2. a) Consider the three-category linear machine with discriminant functions :
- $$g_i(x) = w_i'x + w_{i0}, i = 1, 2, 3.$$
- i. For the special case where  $x$  is two-dimensional and the threshold weights  $w_{i0}$  are zero, sketch the weight vectors with their tails at the origin, the three lines joining their heads, and the decision boundaries. 7
  - ii. How does this sketch change when a constant vector  $c$  is added to each of the three weight vectors? 3
- b) Consider the following six data points: 15
- $$\omega_1 : (1, 5)^t, (2, 9)^t, (-5, -3)^t$$
- $$\omega_2 : (2, -3)^t, (-1, -4)^t, (0, 2)^t$$
- Are they linearly separable? Derive the decision boundary equation to separate them. Show your detailed calculation up to three iterations. Use batch update with Perceptron criterion function. Assume any values if necessary.
3. a) Let random variable  $x$  have an exponential density: 10

$$p(x | \theta) = \begin{cases} \theta e^{-\theta x} & x \geq 0 \\ 0 & \text{otherwise} \end{cases} \quad \text{and } \theta > 0.$$

Suppose that  $n$  samples  $x_1, x_2, \dots, x_n$  are drawn independently according to  $p(x|\theta)$ . Show that the maximum likelihood estimate of  $\theta$  is given by:

$$\hat{\theta} = -\frac{1}{\frac{1}{n} \sum_{k=1}^n x_k}$$

- b) Prove that the *minimum distance to class member* classifier is non-linear. 5
- c) For the following sixteen samples in a one-dimensional problem: 10
- $$D = \{0, 1, 3, 4.5, 5.5, 6.0, 6.5, 7.0, 7.2, 7.5, 8.0, 8.8, 9.2, 9.3, 11, 13\}$$
- Give the values of the  $k$ -nearest neighbor estimate  $p_n(x)$ , for  $n=16$  and  $k_n = \sqrt{n}$ , at  $x=1.2$ ,  $x=4.5$ ,  $x=6$ ,  $x=8$ , and  $x=10.3$ .
4. a) What is the objective of Principal Component Analysis (PCA)? How does PCA address the issue of curse of dimensionality? 5
- b) Multispectral data acquired from most remote sensors exhibit high interband correlations. Taking Landsat Multispectral Scanner (MSS) imagery as an example, band 1 (green) and band 2 (red) are highly correlated because of the relatively low reflectance of vegetation. Bands 3 and 4, the two infrared bands, are highly correlated because of the high reflectance of vegetation. Similarly, for the Thematic Mapper (TM) data, the first three visible bands (TM1, TM2, and TM3) are also highly correlated. Data processing with all of the spectral bands therefore involves a certain degree of redundancy. This increases the cost of data processing, especially when addressing change detection issues which involve images of more than one date. Devise a technique for detecting land-cover change with data reduction. 15
- c) Suppose the covariance matrix  $\mathbf{A}$  has trace value of 4, and two of its Eigen values are 1 and 0. Comment on the distribution pattern of the original samples in the 3D feature space from which that covariance matrix is computed. 5
5. a) Formulate the criterion function  $J$  of Linear Discriminant Analysis (LDA) for a two-class problem based on several factors which influence the design of that function. Extend your criterion function to support multiclass problem. 7+3
- b) The classification of upper-limb movements based on surface electromyography (EMG) signals is an important issue in the control of assistive devices and rehabilitation systems. Contemporary research try to increase the efficiency of these multifunction EMG prostheses by increasing the number of movements recognized, which can directly increase the number of control commands. However, this leads to a need for increased information to be extracted from the EMG signals. There are two major ways used to increase the information derived from EMG recognition systems: obtaining information from different muscle positions and utilizing the information present in features of the signal. However, whilst increasing the number of EMG channels, EMG features yields a high dimensional feature vector. Design a pattern classification system for detecting five different movements with high level of efficiency in terms of both cost and accuracy. 15
6. A long time ago there was a village amidst hundreds of lakes. Two types of fish lived in the region, but only one type in each lake. These types of fish both looked exactly the same, smelled exactly the same when cooked, and had the exact same delicious taste - except one was poisonous and would kill any villager who ate it. The only other difference between the fish was their effect on the pH (acidity) of the lake they occupy. The pH for lakes occupied by the non-poisonous type of fish was distributed according to a Gaussian with unknown mean ( $\mu$ ) and variance ( $\sigma^2$ ) and the pH for lakes occupied by the poisonous type was 25

distributed according to a different Gaussian with unknown mean ( $\mu$ ) and variance ( $\sigma^2$ ). (Poisonous fish tended to cause slightly more acidic conditions). Naturally, the villagers turned to you for help.

Design a complete solution based on the knowledge you have obtained from this course.

7. a) What equations are used for classification in a support vector machine (SVM) and how? 5  
 b) For a two-class classification problem, we use an SVM classifier and obtain the separating hyperplane as shown in Figure 1. We have marked four instances of the training data. Identify the point which will have the most impact on the shape of the boundary on its removal. Explain your choice. 7

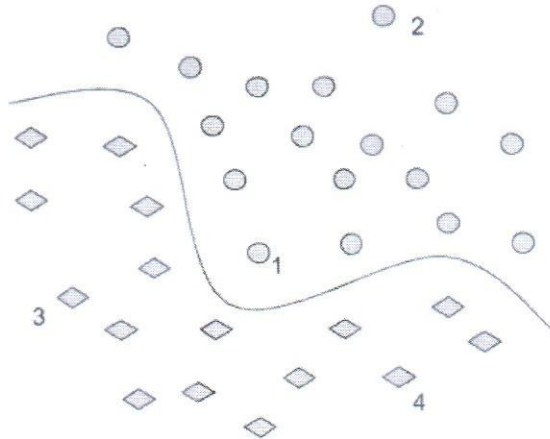


Figure 1. for 7(b)

- c) How does the kernel trick work in SVM? 5  
 d) Consider the following optimization problem: 8

$$\begin{aligned} \min f(x) &= x^2 + 1 \\ \text{subject to} \\ g(x) &= (x-2)(x-4) \leq 0 \end{aligned}$$

Find the extreme values using Lagrange Multipliers.

8. a) Draw a simple Neural Network to represent a generalized discriminant function 3  
 $g_i(x) = w_i'x + w_{i0}$ .  
 b) In a feed-forward neural network (NN), the weights  $w_{ij}$  of the edges to the hidden nodes are adjusted by the following term. 10

$$\begin{aligned} \frac{\partial E}{\partial w_{ij}} &= O_i \delta_j \\ \delta_j &= O_j(1 - O_j) \sum_{k \in K} \delta_k w_{jk} \end{aligned}$$

Taking into consideration the usual meaning of the notations used, how did the back-propagation algorithm devise this adjustment factor?

- c) Define TPR and FPR. Draw the ROC curve with five different thresholds on the following data scores given in Table 1. Show all required calculations. 2+10

Table 1. for 8(c)

Sample No.	True Class	Score
1	P	0.90
2	P	0.80
3	N	0.70
4	P	0.65
5	P	0.50
6	P	0.53
7	N	0.47
8	N	0.43
9	P	0.42
10	N	0.40
11	P	0.37
12	N	0.31
13	P	0.26
14	N	0.22
15	N	0.19
16	N	0.15
17	P	0.12
18	N	0.11
19	P	0.04
20	N	0.01



ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)  
ORGANISATION OF ISLAMIC COOPERATION (OIC)  
**Department of Computer Science and Engineering (CSE)**

SEMESTER FINAL EXAMINATION  
DURATION: 3 Hours

SUMMER SEMESTER, 2017-2018  
FULL MARKS: 150

**CSE 4873: IT Project Management**

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

- 
1. a) Describe what is meant by the term organizational design. What is the difference between a mechanistic and an organic organization? 5+10  
b) How do different organizations do business globally? 10
  2. a) With proper examples, describe the Strategic Management Process which includes detailed discussion on SWOT analysis and PESTEL analysis. 20  
b) What do you understand by MBO? 5
  3. a) Organizational Structure is how job tasks are formally divided, grouped, and coordinated within an organization. When managers develop or change the structure, they are engaged in organizational design. What are the elements of organizational design? Describe them elaborately. 25
  4. a) Discuss the strengths and weaknesses of the trait theory of leadership. 5  
b) What sources of power are available to leaders? Which ones are the most effective? 10  
c) "All managers should be leaders, but not all leaders should be managers." Do you agree or disagree with this statement? Support your position. 10
  5. a) "Charismatic leadership is always appropriate in organizations" - Do you agree or disagree? Support your position. 5  
b) How do the needs of employees affect motivation? Describe in details. 10  
c) What are the advantages of using pay-for-performance programs to motivate employee performance? Are there any drawback exists? Explain. 10
  6. a) What role would money play in: 3×4  
i. The hierarchy of needs theory  
ii. Motivation-hygiene theory  
iii. Equity theory  
iv. Expectancy theory  
b) Describe several means that you might use to motivate:  
i. Minimum-wage employees working for a small company that makes tortillas or 4  
ii. Professional and technical employees working for software design firm. 4  
Which of your suggestions do you think is best? Support your position. 5

7. a) All organizations do not have the same structures. Even organizations of comparable size do not necessarily have similar structure. What works for one organization may not work for another. Discuss the two generic models of organizational design and the contingency factors that favor each. 20
- b) "Organizations that fail to plan are planning to fail" - Do you agree or disagree with this statement? Explain your position. 5
8. a) What are the most important skillsets that managers require? Which skill is required at which level of management? 10
- b) According to Henry Mintzberg, a prominent management researcher at McGill University, a manager has to perform certain roles in an organization. Describe them briefly. 15

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)  
ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2017-2018

DURATION: 3 Hours

FULL MARKS: 150

**CSE 4885: Human-Computer Interaction**

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **8 (Eight)** questions. Answer any **6 (Six)** of them.

Figures in the right margin indicate marks.

- 
1. a) Briefly Explain how the oculomotor, monocular and binocular cues convey depth information with the help of appropriate examples. 10
  - b) Using an example describe the stages Donald Norman's model of Interaction 10
  - c) What is involved in the process of interaction design? 5
  2. a) Briefly explain the four basic activities of interaction design. How do interaction design and user centered design relate to each other 10
  - b) Briefly explain different types of reasoning. 8
  - c) Explain short-time memory and long-time memory. 7
  3. a) Write the importance of affinity diagram in the design process 5
  - b) A company that sells both spreadsheets and word processors has received complaints from users in the banking industry. The users often copy data from spreadsheets into letters offering special finance terms to individual customers. The default behavior of the word processor "paste" command is simply to insert the numeric value, whereas a special option (in the "paste special..." dialog) inserts a recalculating formula. The special option is used so regularly that users have requested an extra item on the pop-up (right click) menu. 20
    - i. How would you estimate the increase in operation speed that might result from this change?
    - ii. How would you confirm the actual speed increase after constructing prototype?
    - iii. The design team suggests an alternative – that the word processor should be enhanced with sufficient calculation functions that a spreadsheet is not needed at all. What factors should be taken into account in order to assess the effect this would have on user tasks?
  4. a) What is difference the between Usability goal and User experience goal? 5
  - b) Briefly explain the following terms: 10
    - i. Task analysis
    - ii. Metaphor
    - iii. Computer supported cooperative work
  - c) How does the usability engineering lifecycle model differ from interaction design lifecycle model in terms of iteration it supports? 10

5. a) What is the difference between scenario and persona? 5  
 b) State and explain any three non-computer method of developing prototypes. 10  
 c) Imagine you have been commissioned to design the user interface for a head-up display (e.g. Based on Google Project Glass) that can be used while riding a bicycle, as a reminder of appointments around Cambridge. In order to be safe while riding, the visual design of appointment reminders and instructions should be as simple as possible. Describe three specific ways this can be achieved, using formal elements of visual design 10
6. a) Define Ethnography. To structure the ethnographic presentation three dimensions should be considered. Briefly explain those dimensions. 8  
 b) A visiting HCI lecturer in IUT sees the sign "Caution Site Entrance" when approaching the Gates building. What does this illustrate about mental models of the designers and viewers of the sign? 7  
 c) What do you mean by evaluation of a design? Briefly explain usability testing, field testing, and analytical evaluation as the approaches of evaluation. 10
7. a) Write down the names of all 7 parts of the "Contextual Design" developed by Hugh Beyer and Karen Holtzblatt. 6  
 b) Brief discuss any two techniques for doing task Analysis 9  
 c) Consider a future application in which a (static) public billboard is augmented so that people passing in the street can see and modify an enhanced view, for example adding and editing caption text or speech bubbles over their personalized view of the billboard. This augmented functionality will be available either using hand-held mobile devices such as a touch-screen phone, or head-mounted displays such as *Microsoft HoloLens*. Whichever type of device is used, users should be able to control the application either using hand gestures or gaze control. Discuss the requirements for sensor configuration and computer vision processing, to achieve the necessary detection and registration of the augmented interaction in each of the four possible combinations of the display and control methods described above. 10
8. a) Describe the difference between: 10  
 i. Low fidelity and High fidelity prototypes  
 ii. "Affordance" and "Visibility" as used in usability principle  
 b) Suppose you have identified a market opportunity for home media players that would cater for older members of the population. Many older people have difficulty understanding the operating principles of devices such as MP3 players, "internet radios" for streaming audio, and personal video recorders and players. Describe the design and evaluation processes that could be used by a start-up company to improve the usability of such devices for this population. 15

## ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

## ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2017-2018

DURATION: 3 Hours

FULL MARKS: 150

**CSE 6269: Embedded Systems Design****Programmable calculators are not allowed. Do not write anything on the question paper.**There are **7 (seven)** questions. Answer any **6 (six)** of them including **Question 1 and Question 2.**

Figures in the right margin indicate marks.

**(Mandatory)**

1. a) Why is scheduling is very important for real-time systems? Discuss on Rate-Monotonic (RM) and Earliest Deadline First (EDF) scheduling policies. Which one is more prevalent in implementation and why? 13
- b) In IUT, a smart classroom has been designed that operates with a controlling smart card. With the touch of the controlling card, the computer, air conditioners, attendance system, smart boards are enabled. Briefly describe the architecture, sensor and actuator deployment for the smart class. 12

**(Mandatory)**

2. a) What is a feedback control loop? Describe the feedback control loop to stabilize a helicopter. 12
- b) Now a day many organizations are deploying surveillance IP cameras which send video streams to the server. However analyzing the high volume video streams are the most difficult tasks. If an intruder enters into the organization premises, finding his location becomes a manual work. If the IP cameras are augmented with local processing powers (i.e., become IoT devices) they can help locate the intruder or detect some events in its locality. Describe a feasible architecture for the intruder detection system with necessary diagrams. Describe the devices and algorithms needed, especially outline the local processing algorithm and data requirement for intruder detection and localization. 13
3. a) How are Quantization and Sampling related to sensors and actuators? Relate them with ADC and DAC. 12
- b) Suppose you have an ideal 8-bit digital accelerometer that produces the value  $f(x) = 128$  when the proper acceleration is  $0g$ , value  $f(x) = 1$  when the proper acceleration is  $3g$  to the right, and value  $f(x) = 255$  when the proper acceleration is  $3g$  to the left. Find the sensitivity  $a$  and bias  $b$ . What is the dynamic range (in decibels) of this accelerometer? Assume the accelerometer never yields  $f(x) = 0$ . 13
4. a) What are the minimum criteria for a processor to be a DSP processor? How can a DSP processor compute an FIR in half cycle? 5
- b) What is data hazard and control hazard in parallelism? How do embedded programmers handle parallelism? 10
- c) What is memory mapping? How does it help in micro-controller design? 10
5. a) Describe the technique to combine several GPIO to form a port. 7
- b) How can you achieve electrical isolation in two different subsystems? 8
- c) Describe the mechanism of serial interface. Elaborate the mechanism of I<sup>2</sup>C. 10

6. a) In a multitasking environment, a task assigned to the processor may not release the control voluntarily. How does operating system ensure that the processor will be preempted periodically? 5
- b) Describe observer pattern along with pseudo code? How is it related to the event handling mechanism of operating system? Describe the use of mutex in handling the concurrency issue in observer pattern. 15
- c) Some of the programming languages support threading; however some of the languages do not have thread support. How does a programming model can support threading if threading mechanism is not supported in its compiler? 5
7. a) What is system invariant? Describe the modeling of system invariant in the ease of program modeling. 7
- b) Define Linear Temporal Logic (LTL). Describe 4 (four) operators of LTL with examples. 10
- c) Describe the relations of modeling, Design and Analysis phases of embedded system development. 8

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)  
ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

**SEMESTER FINAL EXAMINATION**

**SUMMER SEMESTER, 2017-2018**

**DURATION: 3 Hours**

**FULL MARKS: 150**

**CSE 6279: Big Data Analysis and Management**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

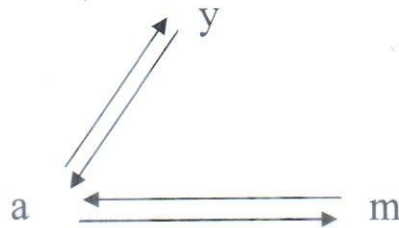
There are **8 (eight)** questions. You have to answer **6 (six)** questions.

Figures in the right margin indicate marks.

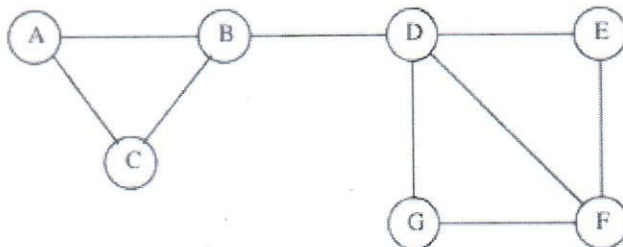
- 
1. a) What is Total Information Awareness? Briefly explain. 5  
 b) Explain the concept of Bonferroni's Principle using a suitable example. 10  
 c) There are many phenomena that relate two variables by a power law, that is, a linear relationship between the logarithms of the variables. Explain this concept using some imaginary data from a real-life application. 10
  
  2. a) What is velocity of data? Present two real-life scenarios where data at rest and continuous flow of data make significant difference. 5  
 b) Explain the execution overview of MapReduce using suitable diagram. 10  
 c) Define mutation and leasing in the context of The Google File System (GFS). Present a suitable flow diagram to briefly describe the order of leases and mutation. 10
  
  3. a) Reducer size for MapReduce can be selected with at least two objectives. Briefly explain them. 5  
 b) What is Jaccard Similarity? Mention a number of applications of this measure. Compute the Jaccard similarities of each pair of the following four sets:  
 $A=\{1, 2, 3, 4\}$ ,  $B=\{2, 3, 5, 7\}$ ,  $C=\{2, 4, 6\}$  and  $D=\{1, 4, 9\}$ . 5  
 c) What is Jaccard similarity for bags? "The maximum Jaccard similarity is 1/2, not 1" -justify with a suitable example. Compute the Jaccard bag similarity of each pair of the following three bags: 10  
 $X=\{1, 1, 1, 2\}$ ,  $Y=\{1, 1, 2, 2, 3\}$ , and  $Z=\{1, 2, 3, 4\}$   
 d) Explain why partitioning in graph is important to select a community in social network. What is Normalized Cuts? Explain with a suitable example. 5
  
  4. a) Define collaborative filtering. Mention two applications of collaborative filtering. 5  
 b) What is basic purpose of "Shingling of Documents"? Mention the basic principle of choosing the size of  $k$  for  $k$ -shingles. Also justify this principle using a suitable example. 10  
 c) Is there any connection between Minhashing and Jaccard similarity? Explain. 5  
 d) Suppose there is a Sensor Network placed outside of your lab, 10 sensors are deployed and each senses temperature and humidity with 5 sec. interval. Sensors report these readings to a central database server. The database server is running Oracle 11g Enterprise Edition. Also assume that there is no Big Data platform available. You want to deploy one application that will visualize the average, maximum and minimum temperature for each sensor for the last 30 minutes. So, the data visualization application will be refreshed after each 30 minutes. The obvious problem with this system is the data size will grow rapidly, whereas most of the data stored are stale and not utilized at all. But the stale data may be utilized for some other purposes later. 5

Your task is to propose a solution to address the above problem using modern relational data-base features. The solution should not impose any restriction on the application design. It should run without any involvement of the application programmer.

5. a) In early days human curated web directories to facilitate web searching (e.g yahoo DMOZ). What is the major flaw with this design principle? There are two major challenges for web search algorithm design. Mention them. 5
- b) Web is often represented as a directed graph. Explain how you should assign values of each node and direction of each edge for construction of such a graph. Use a suitable example to explain it. 5
- c) There are algorithms for community detection by partitioning all the individuals in a social network. This approach is efficient but suffers from a major drawback. Briefly state the problem. 5
- d) There are some metrics that describe social graphs. Briefly outline them with examples. 10
6. a) Write the formula for the calculation of rank of a node using the basic principle of PageRank. Assign the weight of each directed edge for the following web graph: 5



- b) Consider the graph for Question 6.(a) for the following questions: 20
- Arrange the rank equations and solve them. Also mention why the technique you used may not work for web graphs in today's world of Internet.
  - Present a feasible solution in step by step formulation. Finally show that they produce identical results.
7. a) Present a brief discussion on the Random Walk Interpretation for PageRank. What is the physical explanation of this analysis? 5
- b) Use a suitable web graph to explain the concept of "Spider Trap" and "Dead End" problems. Now correlate your explanation with Power Iteration Method. Finally propose how to overcome these problems. 10
- c) The utility matrix can be viewed as telling us about user or about items or both. This property is termed as "the duality of similarity". Explain two ways in which the symmetry is broken in practice. Also highlight the tradeoff to select user or item. 10
8. a) State the essential properties of a social network. What you understand by *locality of relationship* in social graph? Consider the following graph: 10



The entities are the nodes A through G. The relationship, which we might think of as "friends," is represented by the edges. For instance, B is friends with A, C, and D.

Is this graph really typical of a social network, in the sense that it exhibits locality of relationships? Justify your position using step by step analysis.

- b) Define betweenness. Explain the Girvan-Newman Algorithm using suitable social graph example. 10
- c) Briefly describe the long tail phenomenon. Also explain how long tail is connected to recommendation system. Use suitable example data to support your answer. 5



lib- 271

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**  
**Department of Computer Science and Engineering (CSE)**

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2017-2018

DURATION: 3 Hours

FULL MARKS: 150

**CSE 6491: Advanced Internet Computing****Programmable calculators are not allowed. Do not write anything on the question paper.**There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

1. You are asked to design a web application to manage students' attendance. Teachers can take or edit attendance for their respective subjects, can generate attendance report, view attendance sheet, archive attendance records and so on. Students can view their class attendance, get alert for less attendance. Answer the followings:
  - a) What are the Java web technologies suitable to implement the application? Justify your answer. 8
  - b) Draw and explain the J2EE architectural components for this project. 10
  - c) Justify that your chosen technology can make the internet communication faster. 7
2.
  - a) Why do you need to build dynamic web pages? How do you create a dynamic page using Java web technology? Demonstrate with an example. 10
  - b) Write the general structure of an URL. Why do we need the port number of a web server? What is the default port of a web server? 7
  - c) Write the differences between DOM parser and SAX parser. 8
3.
  - a) What do you mean by servlet dispatching? Write a servlet to generate a Login page that prompts the user to enter a user name and a password. If both are correct, the user will be redirected to a Welcome page. If not, the user will see the same Login page. [Hints: Use RequestDispatcher interface] 10
  - b) What is a WAR file? Draw the directory structure of a Java web application containing Servlets, static pages, libraries, images, and configurations files. 7
  - c) Consider the Servlet Filter architecture in Figure 1. Explain the architecture with a real life scenario. 8

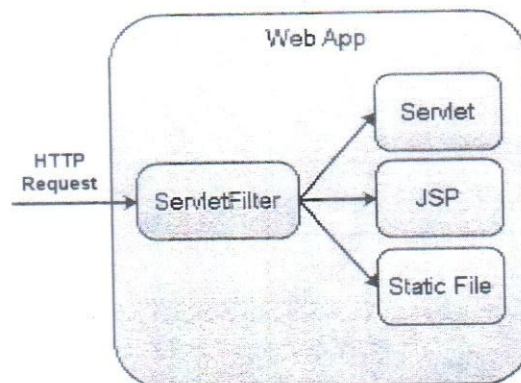


Figure 1: Servlet Filter of a web applicatio

4.
  - a) Describe the functionalities of an application server in terms of application-client container, web container, and EJB container. 9
  - b) Briefly explain Stateful session bean, Stateless session bean, and Entity bean with examples. 10
  - c) What is DAO layer? Explain with example. 6

5. a) Consider a Java bean called AccountBean in the com.internet.computing package shown in Figure 2. It has a private integer called balance. It also has a getter method called getBalance and a setter method named setBalance. 10

```

package com.internet.computing;
public class AccountBean {
 private int balance;

 public void setBalance(int amount) {
 memory = amount;
 }
 public int getBalance() {
 return amount;
 }
 public int doubleIt(int amount) {
 return 2 * amount;
 }
}

```

Figure 2: CalculatorBean class

Demonstrate the use of JSP standard actions by writing a JSP page to set or obtain the value of the instance variable balance.

- b) Describe how to prepare a server to receive a stream-based connection request from a single client. 10
- c) With example explain the differences between JSON objects and JavaScript objects. 5
6. a) Briefly explain with example how RMI implements Service Oriented Architecture. 10
- b) Write the functionalities of RMI layer model. 10
- c) What is the functionality of naming registry server? 5
7. a) Briefly describe different web application technologies. 10
- b) Consider the Façade architectural pattern given in Figure 3. 15

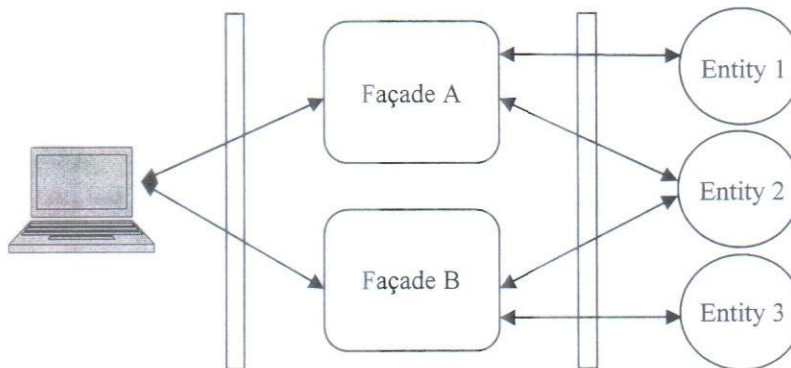


Figure 3: Façade pattern

Map this pattern with a real life example problem scenario for a distributed web application and illustrate how you would implement this pattern. [Hint: Writing code snapshots are enough]

8. a) Suppose you have to develop an online Medical Health Record (MHR). The system consists of Java application client through which a user can check his electronic health reports and manage the access credentials of those reports for the other users (e.g. Doctors, Caregiver, Nurse, Consultant etc.) to view, update or edit. Your business logics and information about MHR and access credentials kept in required session beans and separate entities. Draw a diagram to show the façade pattern indicating appropriate entities and session beans. Describe how you will implement the project with different web technologies. [Use code snippets if necessary] 15
- b) Why do you need EJB 3.0 Remote Interface and Local Interface? Explain your answer. 7
- c) What is the function of Persistence context? 3

4      273

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2017-2018

DURATION: 3 Hours

FULL MARKS: 150

**CSE 6291: Information Security**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

- 
1. Your company (TRUSTED PARTNER LTD.) is responsible of the security design of an online banking website (RELIABLE BANKING). The new system, known as (WATCHDOG), should allow every registered customer to check the status of their bank account and perform secure online bank transfers. Your company receives a set of requirements for the new design that can be summarized in five categories:
- Protection against denial of service attack (DoS) to the bank web server (RELIABLE BANKING). (i.e. Trudy cannot overload the web server by sending multiple fake web requests)
  - Strong authentication of the Bank's customers. (i.e. Trudy cannot impersonate Alice.)
  - Privacy and integrity of the communications between the RELIABLE BANKING and the customer. (i.e. Trudy cannot read or modify the content of the communications between the Bank's server and Alice).
  - Strong authentication of the Bank's website (i.e. Trudy cannot impersonate the Bank's website. Alice is sure to be talking to the Bank).
  - The bank can prove to the customer and to any other third party (e.g. tax authorities) that certain bank transfer has been performed in some given time. (i.e. Trudy cannot create a fake invoice. Strong accountability.)
- Describe how your new WATCHDOG will work. Write how you will provide each of the five features in a different section/paragraph. 25
2. a) What are the differences between message confidentiality and message integrity? Can you have confidentiality without integrity? Can you have integrity without confidentiality? Justify your answer. 7
- b) What is the first thing that a Mangler function does with the 32 bits input? Why this operation is needed? Suppose the DES mangler function mapped every 32-bit value to zero, regardless of the value of its input. What function would DES then compute? 8
- c) Draw a single Feistel Round. How the Feistel design helps DES to run the Encryption and Decryption algorithm in same direction? 10
3. a) What is a state array in AES? Why do we need the notion of a state array in AES? 8
- b) How many rounds are used in AES? How does the number of rounds change in AES when the key length is increased? What are the four steps that are executed in a single round of processing? 7
- c) Draw the block diagram of AES Encryption and Decryption process. 10
4. a) Briefly explain different block cipher modes of operation used in cryptography. 10
- b) PKI (Public Key Infrastructure) trust models can be organized in many different ways, such as Monopoly Model, Oligarchy Model, etc. 15
- i. Mention the different information that a digital certificate holds.

- ii. Is it possible to determine, by examining a certificate, what trust model is used within the PKI?
- iii. Revocation of public key certificates is an important part of PKI. But certificates also carry expiration dates, so there are two ways in which a certificate can be invalidated (revocation and expiration). What are the reasons for having two ways of invalidating certificates? Would it not be sufficient with revocation?
5. a) How does public key cryptography differ from private key cryptography? With the aid of a diagram show the authenticated Diffie-Hellman key exchange. Why Diffie-Hellman algorithm is considered as public key cryptography? 15
- b) Alice wants to use RSA to encrypt the message  $M=88$  and send it to Bob. Bob has chosen two prime numbers ( $p=17$  and  $q=11$ ) to calculate the public number needed for the RSA keys. Furthermore, Bob has selected the number  $e=7$  to use in his public key. 6
- i. What is the resulting public key published by Bob?
- ii. What is Bob's private key?
- c) Design a two-message authentication protocol, assuming that Alice and Bob know each other's public keys, which accomplishes both mutual authentication and establishment of a session key. 6
6. a) The IPSec specification defines two modes of applying IPSec protection to a packet. 15
- i. What are the two modes?
- ii. What is the difference between the two modes when it comes to providing protection?
- iii. Sketch what an IP packet looks like after IPSec protection in the two different modes. You only need to show payload and the different headers (not the individual header fields).
- b) IKE (Internet Key Exchange) is a protocol for doing mutual authentication and establishing a shared secret key to create an IPsec security association (SA). 10
- i. What is the purpose with the Diffie-Hellman exchange in IKE phase 1?
- ii. Why does IKE use cookies and nonces?
7. a) Compare the pros and cons of using KDC or CA to distribute keys? 10
- b) A secure hash function gives a condensed version of a message (it is a "lossy" compression function). 15
- i. What are the most important properties of a secure hash function?
- ii. What does it typically mean when cryptologists say that a hash algorithm is "insecure"?
- iii. Explain why HMAC is considered secure, and under what conditions it is considered secure?
- iv. Why are "salts" normally used with hash function when storing passwords in databases?
- v. Why do MD5 and SHA-1 require padding of messages that are already a multiple of 512 bits?
8. a) Kerberos is a protocol that is based around Needham-Schroeder protocol for many to many authentications. Now answer the following questions. (Use necessary diagrams to justify your answers) 15
- i. What is the main idea behind the use of a TGT (Ticket Granting Ticket)?
- ii. Why the network layer address is included in the ticket in Kerberos V4?
- iii. The information in a TGT (Ticket Granting Ticket) is encrypted so the client cannot access the information in the TGT. However, all information in the ticket is already known to the client. Why is it still necessary to encrypt it?
- b) Design a variant of Kerberos in which the workstation generates a TGT. The TGT will be encrypted with the user's master key rather than the KDC's master key. How does this compare with standard Kerberos in terms of efficiency, security, etc.? What happens in each scheme if the user changes her password during a login session? 10

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)  
ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

**SEMESTER FINAL EXAMINATION**

**SUMMER SEMESTER, 2017-2018**

**DURATION: 3 Hours**

**FULL MARKS:150**

**CSE 6297: Wireless Sensor Networks**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

1. a) What is the difference among unicast, multicast and broadcast transmission? Briefly explain the routing challenges and design issues in WSNs. 3+7
- b) Explain the differences between node lifetime and network lifetime. In what way they are connected? 5
- c) With a flowchart, explain how CSMA/CA works. Why IFS is used in CSMA/CA? 7+3
2. a) Differentiate between proactive and reactive routing protocols. Explain DSDV route selection with an example. 3+7
- b) Briefly explain the working principle of SPIN protocol with example. 8
- c) Why DSR is named as source routing? List the advantage and disadvantage of DSR. 2+5
3. a) Suppose A wants to send out 5M bytes of data to G based on AODV routing protocol. Show the principle of AODV and find out the AODV routing path (use format of A → B → ...) from the given Figure 1. 10

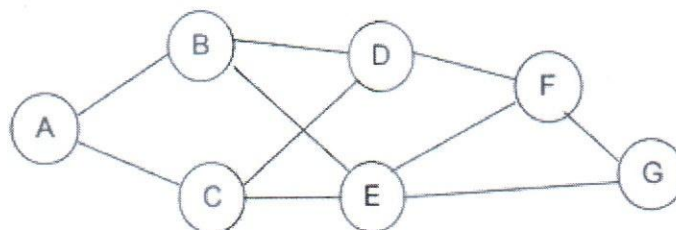


Figure 1: for Question no 3.(a)

- b) How does AODV handle link failure? Explain with proper figures. 8
- c) Why sequence numbers are used in AODV? Explain with example. 7
4. a) What are the advantages of data-centric routing protocols? How the optimal path is created between source and destination by directed diffusion protocol? 3+7
- b) What is the cluster head? Briefly explain the phases of LEACH protocol. 2+8
- c) How LEACH-C and EELEACH-C vary from LEACH? 5
5. a) What is geographic routing in sensor network? How queries are propagated from sink to all sensor nodes using Geographical Energy-aware Routing (GEAR)? 2+8
- b) Suppose we have a network as a Figure 2. The marked part is a network congestion area. If A wants to send packets to B, how does A detect such a congestion area? Suggest a reasonable, low-overhead solution. 8

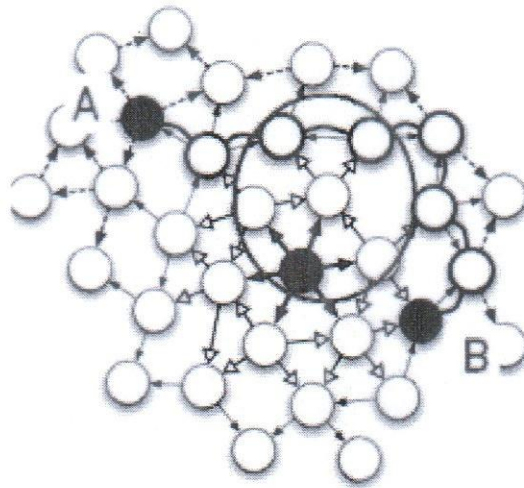


Figure 2: for Question no 5.(b)

- c) List the parameters of QoS routing. Suppose you want to develop a routing protocol for a video surveillance system. Explain the target of your routing protocol with an example. 2+5
6. a) A large vehicular network is used to send traffic updates to upstream vehicles, that is, vehicles whose route will cross areas affected by traffic jams or accidents. Since it is a vehicular network, there is a high level of mobility in the network. Which type of routing protocol from the following options given would you recommend for the traffic update messages and why? 10
- Link state routing
  - Distance vector routing
- b) Give an example of formation of a shortest path tree using Dijkstra algorithm. 8
- c) What is Three-node instability? How do you solve the problem? 7
7. a) Why does slotted ALOHA have fewer collisions than pure ALOHA? Briefly, explain with the proper figure. 10
- b) What is controlled access? Briefly explain one popular controlled access method. 8
- c) What is exposed node and hidden node problem? Explain with suitable example. 7
8. a) Prove that in the two-ray ground reflected model,  $\Delta = d'' - d' \approx 2h_t h_r / d$ . Show when this holds as a good approximation. 10
- b) In a two-ray ground reflected model, assume that  $\theta_\Delta$  must be kept below 6.261 radians for phase cancellation reasons. Assuming a receiver height of 2m, and given a requirement that  $\theta_i$  be less than  $5^\circ$ , what are the minimum allowable values for the T-R separation distance and the height of the transmitter antenna? The carrier frequency is 900 MHz. 8
- c) If  $P_t = 10W$ ,  $G_t = 0 \text{ dB}$ ,  $G_r = 0 \text{ dB}$ ,  $f_c = 900 \text{ MHz}$ , find  $P_r$  in Watts at a free space distance of 1 km. 7