163

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**
DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

SWE 4201: Object Oriented Concepts - I

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **4 (four)** questions. Answer any **3 (three)** of them **including Question no. 1 and 4**.
Figures in the right margin indicate marks.

[Mandatory]

1. a) Identify 10 objects from the paragraph below. For each of the objects, mention to which type the object belongs to. You may identify multiple objects of same type. Note that, the type of object may or may not be mentioned in the paragraph. 10

"The Battle of Uhud was a battle between the early Muslims and the Qurayshis of Makkah. The battle took place near Mount Uhud, to the north of Medina. The Qurayshi army was led by Abu Sufian, Khalid Ibn Walid, 'Amr Ibn al-'As. Interestingly, all three of them later converted to Islam and played significant role in Muslim army. The Battle of Uhud resulted in a lot of loss to Muslims, including death of Hamza (R). The grave of Hamza (R) and many other Martyrs of Uhud are near the mountain."

b) Give the object oriented terminology for each of the following features: 8

i. Pattern or blueprint for creating an object
ii. Characteristics that describe an object
iii. Actions that objects perform or operations which are performed to an object
iv. Hiding the internal details of an object from the user
v. Capability of creating a new class from an existing class
vi. A class from which another class inherits its attributes and behaviors
vii. A newly created class, derived from another which inherits all of the attributes and behaviors, but may have additional attributes and behaviors associated with it
viii. Multiple forms of the same method, where the exact same method name can be used in different classes, or the same method name can be used in the same class with different parameters

c) What are the uses of a constructor? Sometimes there is a need of initializing an object in different ways. How can we do that? Explain the order of execution of constructors in multilevel inheritance? 2+3 +2

2. a) Explain the followings with suitable example using an object oriented programming language. 10 + 6

i. Overloading vs Overriding
ii. Multilevel Inheritance

b) What is abstraction? Give two examples of abstraction. How do we implement abstraction in Java? 5

c) Differentiate between static and dynamic polymorphism. 4

3. a) Define the following terms: class variable, instance variable, argument variable and local variable. Also mention the scope/lifetime of each of them. 13

b) Briefly comment on the following statements from Java language point of view: 12

i. Irrespective of the presence of any constructor in a class, the compiler will provide a default constructor
ii. Methods and fields of an interface

iii. A class can extend a final class
iv. Abstract constructor
v. A child class that extends an abstract class needs to implement the abstract methods of its parent class
vi. In method overloading, we can create an overloaded method by changing the return type of the method.

[Mandatory]

4. a) Organize the following classes into inheritance hierarchies and where appropriate create new classes: `Building`, `StoryBook`, `FootballTournament`, `Bedroom`, `Kitchen`, `AcademicBuilding`, `Classroom`, `Helicopter`, `ThesisBook`, `AdministrativeBuilding`, `CricketTournament`, `SportsTournament`, `Rocket`. 15

b) Write down the output of the listing 1 and listing 2. Explain the steps of execution of the listings to get the output. 4+6

```
class A {
    int i;
    A() {
        i = 10;
    }
}
class B extends A {
    B() {
        i = 20;
    }
}
public class MainClass {
    public static void main(String[] args) {
        A a = new B();
        System.out.println(a.i);
    }
}
```

Listing 1: Code snippet (in Java) for Question 4.b.

```
class Printer {
    void print() {
        System.out.println("Printing normal papers.");
    }
}
class LaserPrinter extends Printer {}
class DotMatrixPrinter extends Printer {
    void print() {
        System.out.println("Printing for special purpose.");
    }
}
public class MainClass {
    public static void main(String[] args) {
        Printer p = new Printer();
        p.print();
        p = new LaserPrinter();
        p.print();
        p = new DotMatrixPrinter();
        p.print();
    }
}
```

Listing 2: Code snippet (in Java) for Question 4.b.

165

B.Sc. Engg. SWE 2nd Semester — 29 August 2019 (Morning)

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

MID SEMESTER EXAMINATION — **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

CSE 4205: Digital Logic Design

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) Convert the followings: 2.5x4
   - i. $(41.687)_{10} = (?)_2$
   - ii. $(DADA.B)_{16} = (?)_{10}$
   - iii. $(153.513)_{10} = (?)_8$
   - iv. $(198)_{12} = (?)_{10}$

   Hints: Calculate maximum upto 3 digits after the decimal point where necesssary. You have to show the procedures, only values produced by the calculator will not suffice.

   b) Describe odd parity and even parity with example. 5

   c) i. What is radix complement and diminished radix complement? 2+4+4

   ii. By r's complement perform: $(-9286)_{10} + (+801)_{10} = (?)_{10}$

   iii. By (r-1)'s complement perform: $(1000100)_2 - (1010100)_2 = (?)_2$

2. a) What is parity bit? Define odd parity and even parity with examples. 1+2+2

   b) Define BCD. Perform addition after converting the values into BCD: $(791)_{10} + (658)_{10} = (?)_{10}$ 1+4

   c) Simplify the boolean expression using K-map for - 15
   $\sum m(0,4,6,8,12,13,14,15,16,17,18,21,24,25,26,28,29,31)$

3. a) Define followings with example: 2x5
   - i. Grey Code
   - ii. Checker Board Pattern
   - iii. Product of Sum
   - iv. Sum of Product
   - v. Universal Gate

   b) Draw the circuits and write the boolean expressions for the following gates using nand gate: 2x6
   - i. AND
   - ii. OR
   - iii. XOR

   Repeat the instruction for i-iii but this time using nor gate.

   c) What will be the simplified boolean expression for this K-map? 1+2
   Prove the expression using a truth table.

	00	01	11	10
0	0	1	0	1
1	1	0	1	0

Figure 1: K-map

4. a) Define combinatorial & sequential circuit with example. 1.5x2

   b) What is full adder? For sum and carry of a 1-bit full adder, give boolean expression, truth table and circuit diagram. 1+6

   c) Simplify the boolean expression using Tabular method for $\sum m(2,3,4,5,6,7,9,13,15)$ 15

B.Sc. Engg. CSE/SWE 2nd Semester 22 August, 2019

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

MID SEMESTER EXAMINATION SUMMER SEMESTER, 2018-2019
DURATION: 1 Hours 30 Minutes FULL MARKS:100

Math 4241: Integral Calculus and Differential equations

Programmable calculators are not allowed. Do not write anything on the question paper.
There are 4(four) questions. Answer any 3(three) of them. **Use separate answer scripts for each sections.**
Figures in the right margin indicate marks.

Section-A

1. a) What is indefinite integral? Explain with examples, why it is necessary to add the integral constant to the result in indefinite integral? 08

   b) Suppose that T months from now, the population P(T) of Gazipur City will be changing at the rate of (550+2T)3/2 people per month. If the current population is approximately 1850000 then what will be the populations after 6 years from now? 13.33

   c) Evaluate the followings (any three): 12

   i) $\int 3x^5\sqrt{x^3+1}\,dx$, ii) $\int Sin(lnx)\,dx$, iii) $\int 8\,cos^2x\,sin^4x\,dx$, iv) $\int_0^{\ln 4}\frac{e^t}{\sqrt{e^{2t}+9}}dt$

2. a) Obtain the reduction formula for $\int cos^n x\,dx$ and then evaluate $\int_0^{\pi/2} cos^5 x\,dx$ 10

   b) Express the integrand as a sum of partial fractions and then evaluate the following: 12

   i) $\int \frac{2x+1}{x^2-7x+12}dx$, ii) $\int \frac{e^{4x}+2e^{2x}-e^x}{e^{2x}+1}dx$

   c) Evaluate $\int_{-r}^{r}\sqrt{r^2-x^2}\,dx$. Also graph the integrand and then verify your result using appropriate formula from geometry. 11.33

Section-B

3. a) Define Degree and Order of a Differential Equation with an example. Find the Differential equation of all straight lines at a unit distance from the origin. 10

   b) Define Exact Differential Equation. Find the necessary and sufficient condition for a Differential equation to be exact. 15

   c) Solve the following Differential Equations: 8.33

   $(ye^x+2e^x+y^2)dx-(e^x+2xy)dy=0$, $y(0)=6$

4. a) What do you know about integrating factor? Show that for first Order Linear Differential Equation integrating factor, $I.F=e^{\int p(x)dx}$ 09

   b) Find the family of curves which satisfy the following Differential equations: 16

   i) $(2x^2+y)dx+(x^2y-x)dy=0$

   ii) $(x^3+y^2\sqrt{x^2+y^2})dx-(xy\sqrt{x^2+y^2})dy=0$

   c) Two 9 volt batteries are connected in series in which the inductance is $\frac{1}{4}$ henry and resistance is 8 ohms. Determine the current i, if the initial current is zero. 8.33

168

B.Sc. Engg. CSE 2nd Semester 23 August 2019 (Morning)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hours 30 Minutes **FULL MARKS:75**

Chem 4241: Chemistry

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **4 (four)** questions. Answer any **3 (three)** of them. Figures in the right margin indicate marks.

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1. a) Define Colligative properties. Why are they so called? Name them. 6
   b) Deduce an expression relating the molecular weight of a solute with the lowering of vapour pressure of a dilute solution. Define vapour pressure and boiling point 10
   c) Suppose 36.4 gm urea is dissolved in 200gm of water at 50^0C. The lowering of vapour pressure is 15mm of Hg. Calculate the molecular weight (MW) of urea when the vapour pressure of water at 50^0C is 92mm of Hg. 9

2. a) State and discuss Henry's law in the dissolution of gases in liquids. Show the effect of temperature on dissolution of gases in liquid through equation. 8
   b) Show the importance of Critical Solution Temperature (CST) in the dissolution of liquid in liquid. Draw and explain CST diagram of Triethylamine- water system. 9
   c) Determine the molarity (m) of a solution containing 86.53g of Na_2CO_3 per litre of the solution in water at 20^0C. The density of the solution at this temperature is 1.0816gm.ml. Calculate also the molality (m) of the solution. 8

3. a) What are the fundamental particles of an atom? Briefly describe them. 6
   b) Discuss Bohr's theory of hydrogen atom. What modifications were proposed by Sommerfeld and why? 10
   c) Derive the equation for calculating the Energy of electron in the orbit of hydrogen atom and calculate energy calculate energy of the electron in the 4th Orbit. 9

4. Write short notes on the following (any four): 4x6.5
   a) Henry's law
   b) AUFBAU principle
   c) Hybridization
   d) Boiling Point and Vapour Pressure
   e) Isotopes and Isobars

B.Sc. Engg. SWE 2nd Semester 27 August 2019 (Morning)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

Hum 4247: Accounting

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) "Pacioli described a unique system to ensure that financial information was recorded efficiently and accurately"- Explain it. 3

   b) Answer each of the following questions by using expanded accounting equation: 4

      i. The liabilities of Mark Company are $90,000. John Mark's capital account is $150,000; drawings are $40,000; revenues, $450,000; and expenses, $320,000. What is the amount of Mark Company's total assets?

      ii. The total assets of Barone Company are $57,000. Nancy Barone's capital account is $25,000; drawings are $7,000; revenues, $50,000; and expenses, $35,000. What is the amount of the company's total liabilities?

   c) Miller's Repair Shop was started on May 1, 2018 by Mark Miller. A summary of May transactions is presented below: 18

   - Invested $10,000 cash to start the repair shop.
   - Purchased equipment for $5,000 cash.
   - Paid $400 cash for May office rent.
   - Paid $500 cash for supplies.
   - Incurred $250 of advertising costs in the Beacon News on account.
   - Received $5,100 in cash from customers for repair service.
   - Withdrew $1,000 cash for personal use.
   - Paid part-time employee salaries $2,000.
   - Paid utility bills $140.
   - Provided repair service on account to customers $750.
   - Collected cash of $120 for services billed in transaction (x).

   Required:

   Prepare a tabular analysis of the transactions, using the following column headings: Cash, Accounts Receivable, Supplies, Equipment, Accounts Payable, M.Miller,Capital; M.Miller,Drawings; Revenues, and Expenses.

2. a) Draw the chart of Golden Rules of Accounting. 6

   b) Mary Jansen is a licensed CPA. During the first month of operations of her business, the following events and transactions occurred. 19

   May 1: Mary invested $25,000 cash in her business.
   May 2: Hired a secretary-receptionist at a salary of $2,000 per month.
   May 3: Purchased $2,500 of supplies on account from Barry Supply Company.
   May 7: Paid office rent of $900 cash for the month.
   May11: Completed a tax assignment and billed client $2,100 for services provided.
   May 12: Received $3,500 advance on a management consulting engagement.
   May 17: Received cash of $1,200 for services completed for Max Company.

May 31: Paid secretary-receptionist $2,000 salary for the month.
May 31: Paid 40% of balance due Barry Supply Company.

Mary uses the following chart of accounts: No. 101 Cash, No. 112 Accounts Receivable, No. 126 Supplies, No. 201 Accounts Payable, No. 205 Unearned Revenue, No. 301 Mary Jansen, Capital; No. 400 Service Revenue, No. 726 Salaries Expense, and No. 729 Rent Expense.

Required:

i. Journalize the transactions.
ii. Post to the ledger accounts.
iii. Prepare a trial balance on May 31, 2018.

3. a) A Mobile Phone shop makes a sale of mobile phones for $1,000 on June 30. The customer is sent a statement on July 5 and a cheque is received on July 10. The Mobile Phone shop follows Revenue Recognition Principle. When is the $1,000 considered to be earned? Explain the reason. 5

b) Which items are included in Deferrals and Accruals? 2

c) Sara Woods started his own consulting firm, Woods Consulting, on May 1, 2017. The trial balance at May 31 is as follows. 18

WOODS CONSULTING
Trial Balance
May 31, 2017

Accounts Title	Debit	Credit
Cash	$ 5,700	
Accounts Receivable	6,000	
Supplies	1,900	
Prepaid Insurance	3,600	
Office Furniture	10,200	
Accounts Payable		$ 4,500
Unearned Service Revenue		2,000
S.Woods, Capital		17,700
Service Revenue		7,500
Salaries Expense	3,400	
Rent Expense	900	
	$31,700	**$31,700**

In addition to those accounts listed on the trial balance, the chart of accounts for Woods Consulting also contains the following accounts and account numbers: No. 150 Accumulated Depreciation—Office Furniture, No. 212 Salaries Payable, No. 229 Travel Payable, No. 631 Supplies Expense, No. 717 Depreciation Expense, No. 722 Insurance Expense, and No. 736 Travel Expense.

Other data:

- $900 of supplies have been used during the month.
- Travel expense incurred but not paid on May 31, 2017, $250.
- The insurance policy is for 2 years.
- $400 of the balance in the unearned service revenue account remains unearned at the end of the month.

- May 31 is a Wednesday, and employees are paid on Fridays. Woods Consulting has two employees, who are paid $800 each for a 5-day work week.
- The office furniture has a 5-year life with no salvage value. It is being depreciated at $170 per month for 60 months.
- Invoices representing $1,200 of services performed during the month have not been recorded as of May 31.

Required:

i. Prepare the adjusting entries for the month of May, 2017.
ii. Prepare an adjusted trial balance at May 31, 2017.

4. a) Your friend Natasha is confused about the accounts that are closed and the accounts that are not closed. Which chart will you show him? 5

b) The trial balance columns of the worksheet for Goode Company at March 31, 2018, are as follows. 20

GOODE COMPANY
Worksheet
For the Month Ended March 31, 2018

Account Titles	Trial Balance	
	Dr.	Cr.
Cash	$ 4,500	
Accounts Receivable	3,200	
Supplies	2,000	
Equipment	11,000	
Accumulated Depreciation-Equipment		$ 1,250
Accounts Payable		2,500
Unearned Revenue		550
T.Goode, Capital		12,900
T.Goode, Drawing	1,100	
Service Revenue		6,300
Salaries Expense	1,300	
Miscellaneous Expense	400	
	$ 23,500	**$ 23,500**

Other data:

- A physical count reveals only $650 of supplies on hand.
- Depreciation for March is $250.
- Unearned revenue amounted to $170 at March 31.
- Accrued salaries are $600.

Required:

i. Enter the trial balance on a worksheet and complete the worksheet.
ii. Journalize the closing entries from the financial statement columns of the worksheet.

172

B.Sc. Engg. SWE 2nd Semester — 23 August 2019 (Morning)

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

MID SEMESTER EXAMINATION — **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

HUM 4249: Business Psychology and Communication

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **4 (four)** questions. Answer any **3 (three)** of them.
Figures in the right margin indicate marks.

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1. a) Why do you think business communication skills are so important for IT professionals? If you want to launch a new software in the market, what kinds of communication challenges might you face? Discuss. 9

   b) Think of English words that probably do not have precise equivalent in some other culture. What do you think are the reasons behind those language equivalency problems? How would you attempt to solve such language equivalency problems? 8

   c) Describe the formal network of communication in an organization with which you are familiar. Discuss why you think the communication network has taken this form and how successfully it seems to meet the business's needs. 8

2. a) "Using precise language with the right shades of meaning, is essential for generating clear meaning and right emotional tone." - Explain the statement with relevant examples. 9

   b) Explain how you would apply the basic principles of adaptation to your choice of words for each of the following writing tasks. 10

      i. An article in a company newsletter.
      ii. A message to company executives requesting approval to purchase new computer hardware.
      iii. A message to employees explaining a change in pension benefits.
      iv. A progress report to the chief engineer explaining how the development of a new software is going.
      v. A letter to company stockholders explaining a change in company reporting dates.

   c) Discuss the statement: "long, involved sentence tend to be difficult to understand. Therefore, the shorter, the better." 6

3. a) Skillful paragraphing is very important for clear communication. Composing paragraphs that are short and unified, use topic sentences effectively and communicate coherently. How would you take care of your paragraph design to ensure clear and skillful communication? 12

   b) "Using short words makes the writing sound too simple and non-professional and using the short sentences too much creates choppy and elementary sounding effect." Discuss the statement with relevant examples. 8

   c) What is "rubber stamps"? How can the rubber stamps convey negative impressions to your readers? 5

4. a) Write short notes for the following terms: 12

   i. You-viewpoint
   ii. Readable formatting
   iii. Strategic buffer
   iv. External operational communication

   b) Imagine you are a vice president of ABC Computer ltd. Early in the morning today you received an e-mail from the director of AB bank limited, a new customer whom ABC computer limited has been trying to attract for months. He placed an order of 500 PCs for his Bank. You usually acknowledge orders with routine messages, but this case is different. You feel the need to welcome this new customer and to cultivate him for future sales. After checking your current inventory and making certain that the goods will be on the way to the Mr. Abdur Rahim, director of AB Bank limited, today. 13
   Write an email to the Mr. Abdur Rahim with a special acknowledgement and thanking him for his business.

DTE 2nd Semester 29 August 2019 (Morning)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-19**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4277: Data Structures and Algorithms

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) What do you understand by data structure? Explain the criteria to select the data structure for an application. 6

   b) What are the main categories of data structures? Explain their hierarchical classification with appropriate diagram. 7

   c) Write short notes on the following data structures mentioning their uses: 12
      i. Stack
      ii. Queue
      iii. Graph
      iv. Tree

2. a) What do you understand by Abstract Data Types (ADT)? Explain ADT with Linear List, Matrix and Tree. 8

   b) Describe how an application program interacts with the data stored in the memory in Abstract Data Type Model. Use figure if necessary. 10

   c) Suppose a dataset S contains n elements. 7
      i. Compare the running time T_1 of the linear search algorithm with the running time T_2 of the binary search algorithm when the value of n is 10,000 and 1,000,000
      ii. Discuss searching for a given item in dataset S when S is stored in a linked list.

3. a) Consider the following algebraic expression: 12

   $$(2x + y)(a - 7b)^3$$

   Using a vertical arrow (↑) for exponentiation and an asterisk (*) for multiplication, represent the expression by a tree. Traverse the tree in Infix, Prefix and Postfix order.

   b) Explain the advantages and disadvantages of using Array and Linked list. 6

   c) An employee personnel record may contain the following data items: Social Security Number, Name, Address, Age, Salary, and Dependencies. 7
   However, Name may be a group item with the subitems Last, First and MI (middle initial). Also, Address may be a group item with the subitems Street address and Area address, where Area itself may be a group item having subitems City, State and ZIP code number. Draw the hierarchical representation of an employee instance.

4. a) Write down the pseudo code for binary search and then represent the same pseudo code in a flowchart. 8

   b) What do you understand by asymptotic notation? Define the following with necessary figures. 9
      i. Omega Notation (Ω)
      ii. Big O Notation (O)
      iii. Theta Notation (Θ)

   c) Write down the pseudo codes to perform following operation on a linked list. 8
      i. Insert an element
      ii. Delete an element

~~B~~ 175

B.Sc. Engg. SWE 4th Semester — 30 August 2019 (Afternoon)

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

MID SEMESTER EXAMINATION — **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

SWE 4401: Software Requirement and Specifications

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

There are **4 (four)** questions. Answer **3 (three)** of them including **question 1 and 2**.

Figures in the right margin indicate marks.

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1. **[Mandatory]**

"The Serpents", a software company, will soon start to work on a Management Information System (MIS) project - "Dengue Data" or D2. A cross-functional team has been built for the project where Munir is a senior developer and Afreen is the team lead. Afreen no longer write code regularly but has very good team management skill. D2 management has appointed Shekh, one of their officers, to work with the team. Here is his description of the project:

There are 50 field stations in 50 upazillas to collect dengue patients information. Each field station has a field officer and 5 to 10 field operators. The field operators collect the data and submit them to field officer. Field officer scrutinize everyone's data and then approve or reject them. The data that are collected includes Patient's name, Patient's age, Patient's sex etc. All the operations are done through a web interface and the operations must be authenticated.

Some field operators may not be expert computer users, therefore the software should have built in tutorials.

The project manager (PM) works in the head office and will usually generate reports once in a week. The reports will usually give some insights of which age group are more vulnerable to dengue, which area are more affected etc. Based on those reports, PM should be able to send Upazilla wise decisions to the field officers that need to be taken through the MIS software.

The data generated through this software is also made available to researchers. Any researcher can request for a data and the PM can approve or disapprove the request. The data will be provided as Spreadsheet.

Afreen has convinced Shekh to participate in the story writing workshop with rest of the team. He has also agreed to regularly collaborate with Afreen. But being a very busy person, he will only meet the development team biweekly. Shekh believes he has a clear vision about the project, therefore his priorities of the requirements will remain somewhat stable. Also, he is OK with checking the progress biweekly or even monthly.

Afreen decides to do Scrum for the D2 project, even though many of the teams at The Serpents follow Kanban.

a) i. Explain why Afreen has chosen Scrum over Kanban. 5+1
   ii. Mention what Scrum roles suite best for Shekh and Afreen.

b) Clearly, PM is a potential user role for the D2 project. 4+5
   i. Identify 4 more user roles.
   ii. Write description of the PM user role.

c) Between Munir, Afreen and Shekh - 4+4
   i. Who should usually write the stories? Why?
   ii. Who should identify technical risks about requirements? Why?

d) Write the card of 7 user stories for D2. You can consider that the stories are generated in the story writing workshop. Use this template for the stories: 7

As a (role), I want (function) so that (business value)

2. **[Mandatory]**

a) The following stories are in descending order of priority. Assume that the team is doing Scrum. 10

Story	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Story Point	5	5	**8**	3	**8**	2	5	**?**	8	3	1	3	2	1

Story C can be split into C1 (point 3) and C2 (point 5) and story E can be split into E1 (point 5) and E2 (point 3). H cannot be estimated because the team do not have knowledge about the required technology. Assume that a spike H1 (point 3) was conducted and the team estimated that the actual task H2 will have story point 3.
Priorities of the broken down stories are same as the original story. Do an iteration plan with the stories considering velocity of 15.

b) The following table below shows some stories' entrance date in different columns in Kanban board. For the sake of simplicity, assume that the dates are from July 2018 and all the entrance times are 8 in the morning. 4+2 +4

	Q	R	S	T	U	V	W	X
ToDo	1	1	1	1	5	5	5	5
Developing	2	1	1	8	6	8	7	5
Testing	3	2	4	10	8	12	9	7
Done	4	3	8	12	11	14	11	8

i. Calculate Lead Time (LT) and Cycle Time (CT) for each of the stories.
ii. Calculate Average LT and Average CT.
iii. What is your comment about story T in terms of its LT and CT?

3. a) Elaborate the term INVEST. 6

b) Two junior developers were discussing during a story writing workshop that why a certain story is not good because it is too big and will be hard to estimate. A senior developer politely asked them to stop the discussion. Why? 6

c) During a user role consolidation, a role was discarded although there were not any roles significantly overlapping that role. What can be the reason behind the role being discarded? 3

d) You find several bug reports and some change requests which are urgent but too small to estimate. What do you do with them? 3

e) Assume that you are working for a medical service software. You find that you cannot estimate a story because there are some medical terms used which you do not understand. 4+3
i. Is the story necessarily a bad one? Justify your answer.
ii. What should you do to properly estimate the story?

4. a) Draw a low fidelity prototype of the system described in Question 1. 8

b) Explain feature freeze and triage in terms of Scrumban. Can the two happen at the same time? Justify. 4+5

c) Describe the steps of user role modeling. 8

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4403: Algorithms

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) If $f(n) = O(g(n))$ and $g(n) = O(h(n))$, prove that $f(n) = O(h(n))$. 5

   b) A polygon is convex if all of its internal angles are less than $180°$ (and none of the edges cross each other). We represent a convex polygon as an array $V[1 \ldots n]$ where each element of the array represents a vertex of the polygon in the form of a coordinate pair (x, y). $V[1]$ is the vertex with minimum x coordinate and the vertices $V[1 \ldots n]$ are ordered counterclockwise. Assume that the x coordinates of the vertices are all distinct, as are the y coordinates of the vertices. 10×2

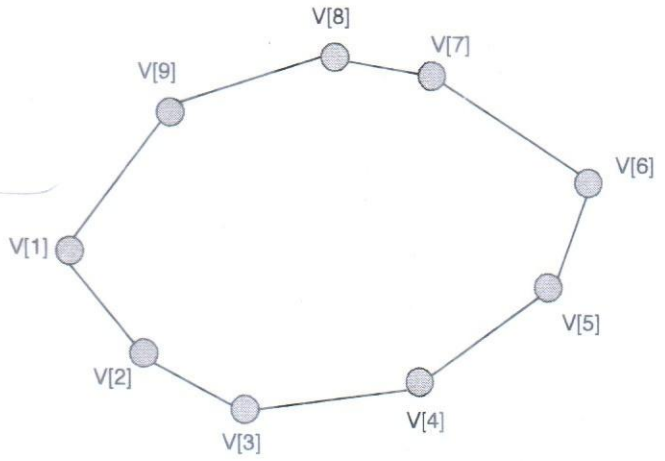

Figure 1: An example convex polygon with $n = 9$ vertices

   i. Give an algorithm to find the vertex with the maximum x coordinate in $O(\log_2(n))$ time.

   ii. Give an algorithm to find the vertex with the maximum y coordinate in $O(\log_2(n))$ time.

2. a) Let $A[1 \ldots n]$ be an array with n distinct numbers. If $i < j$ and $A[i] > A[j]$, then the pair (i, j) is called an inversion of A. Here, $1 \leq i, j \leq n$. 6+4

   i. What array with elements from the set $\{1, 2, \ldots, n-1, n\}$ has the most inversions? How many inversions does it have?

   ii. Is there any relation between the running time of insertion sort and the number of inversions in an input array? Justify your answer.

   b) In an effort to make merge sort faster, you decide to divide the array into k equal sized, disjoint subarrays, where $k > 2$. You have to merge k lists which can be accomplished in $O(n \log_2(k))$ time (Assume). Write the recurrence relation for your algorithm and find the running time of the algorithm. 5

   c) Argue why it is impossible to find a comparison-based sorting algorithm that sorts 5 numbers using at most 6 comparisons in the worst case. 5

   d) Suppose a binary max-heap contains 80 distinct keys. How many distinct positions might contain the smallest element? In which level from the top will they reside in? 5

3. a) You have a hash table with m slots, with simple uniform hashing assumption. Collisions are resolved by chaining. What is the probability that the first slot ends up empty after n insertions? 6

   b) In a hash table where collisions are resolved using chaining, we can replace the linked list with balanced BSTs. Give one reason why it might be useful. Give one reason why it might not be useful. 4+4

   c) Consider using a hash table with $m = 11$ slots for integer values and collision resolving using open addressing. Our hash function is: $h(k, i) = (f(k) + i \times g(k))\%m$, where $f(k) = k\%m$ and $g(k) = (k^2 + 1)\%m$. The table is initially empty. We perform the following operations sequentially: 6+5

   - Insert 3
   - Insert 14
   - Insert 90
   - Insert 2
   - Delete 14

   Now answer the following questions:

   i. Show the contents of the table with values and flags.

   ii. If we search for 13, what is the sequence of slots that we check?

4. a) Give reasonably simplified equation using Newton's Method to find $\sqrt[5]{a}$. Will the algorithm always correctly converge regardless of the choice of the initial guess x_0? 6+6

   b) You came up with a modified version of Karatsuba Multiplication where you divide the number in 3 parts. You reduced the total number of multiplications to 6. Is your algorithm better than that of Karatsuba? 6

   c) While calculating the complexity of High Precision Division $\left(\frac{a}{b}\right)$, we only considered the complexity of calculating $\left(\frac{R}{b}\right)$ ignoring the fact that we still need to find $\left(a \times \frac{R}{b}\right)$ which requires High Precision Multiplication. How does that affect the running time of Newton's Method for finding square roots? 7

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

MID SEMESTER EXAMINATION — SUMMER SEMESTER, 2018-2019
DURATION: 1 Hour 30 Minutes — FULL MARKS: 75

CSE 4403: Algorithms

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **4 (four)** questions. **Question no 3 & 4 are Mandatory to answer.**
Answer any **1 (one)** from the remaining.
Figures in the right margin indicate marks.

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1. a) ***INSERTION_SORT (A)*** 13

```
1.  for j = 2 to A. length
2.      key = A[j]
3.      // insert A[j] into sorted sequence A [1...j - 1]
4.      i = j – 1
5.      while i > 0 and A[i] > key
6.          A [i + 1] = A[i]
7.          i = i – 1
8.      A [i + 1] = key
```

By showing proper mathematical steps, find out the running time of the above-mentioned algorithm in the following cases:

i. Input array(A) has 'n' elements in Ascending order.
ii. Input array(A) has 'n' elements in Descending order.

b) Insert the following elements in a Red-Black tree. 12

$$\{25, 15, 20, 18, 10, 16, 29, 19, 27, 17\}$$

Design a sorting algorithm which will show all the elements stored of this tree in Descending order. What will be the time complexity of the process?

2. a) Show that, 'Merge-Sort algorithm requires $O(n)$ auxiliary space to sort an array of size n.' 7
b) Write the steps to develop any Divide-and-Conquer algorithm. Explain those steps in the context of Merge-Sort algorithm. 8
c) Use a recursion tree to determine a good asymptotic upper bound on the recurrence: 10

$$T(n) = 8T\left(\frac{n}{2}\right) + n^2$$

[Mandatory]

3. a) i. $f(n) = O(g(n))$ *and* $g(n) = O(h(n))$. *Thus* $f(n) =$ ___$(h(n))$. (Fill in the blank with justification.) 3×6
ii. If the input data is almost sorted, Merge sort will perform better than Insertion sort. (True or False? Justify.)
iii. Given an unsorted array of size n, '1-D peak finding algorithm' can find the Global-peak in $O(\log(n))$ time. (True or False? Justify.)
iv. Will the following algorithm successfully Build a Max-heap from a given array? Justify your answer.

```
BUILD_MAX_HEAP(A)
    A. heap_size = A. length
    for i = 1 upto (A. length / 2)
        MAX-HEAPIFY (A, i)
```

v. Binary Search Trees guarantees to find the maximum element of the tree in

180

O(____) time. (Fill in the blank with justification.)

vi. Determine the average processing time $T(n)$ of the following algorithm:

```
int myTest (int n) {
  if (n <= 0) return 0;
  else {
    return myTest (n - 1);
  }
}
```

b) Design a function which will take a node of a *Binary Search Tree* as input and show all of it's *Ancestors*. The algorithm should be able to produce output even if the node doesn't have any ancestor or the node is not present in the tree. 7

[Mandatory]

4. Lately, Bill Gates is thinking of opening a restaurant! Being one of the smartest guys on the planet, obviously he is planning to digitalize it. Each customer will have a membership card which will have information about him/her along with the transactions made so far. Based on that information, a rating is given to the customers. 25

Whenever a customer enters the restaurant, s/he needs to scan the membership card by which the authority tracks who are present at the moment. A big screen is placed in front of the counter where the information is being shown about the current customer being served, the next customer to be served and the total number of customers present at the moment. While choosing the next customer to be served, the system looks for the highest rated customer present at that moment.

As this is Bill Gate's restaurant, a huge number of customers are expected to come every day! To handle the data, he wants to store it in the best possible way! His employees came up with different solutions to store the information so that the information on the big screen can be shown efficiently. Some of the proposed ways are:

i. Array
ii. Linked list
iii. Heap
iv. Binary Search Tree
v. AVL Tree
vi. Red Black Tree

Provide Arguments about the worst-case time complexity for each of the solutions to perform the required operations and choose the best one. Justify your choice.

B.Sc. Engg. / HD CSE 4th Semester 29 August 2019 (Afternoon)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**
DURATION: 1 Hour 30 Minutes **FULL MARKS: 100**

CSE 4405: Data and Telecommunications

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **4 (four)** questions. Answer any **3 (three)** of them.
Figures in the right margin indicate marks.

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1. a) What is data communication? Identify the five components of a data communication system. Describe the three criteria necessary for an effective and efficient network. 2+3+5
   b) Write short notes on the followings: 3x3
   i. Network topology ii. Protocol iii. Process-to-process delivery
   c) What is the difference between a port address, a logical address and a physical address? 3.33
   d) How OSI and ISO are related to each other? Write down the functionalities of bottom three layers of TCP/IP protocol suite. 3+8

2. a) Define the followings with example: 3x3
   i. Jitter ii. Latency iii. Bandwidth-Delay Product
   b) Briefly explain the concept of digital signal as a composite analog signal. Explain the baseband transmission of digital signal. 4+9.33
   c) State the Nyquist bit rate formula. How does Nyquist bit rate formula differ from Shannon capacity formula? Consider a channel having SNR 127 and bandwidth 2 MHz. What will be the approximate signal level and bit rate? 2+2+4
   d) Name different causes of transmission impairments. 3

3. a) Write short notes on any two of the followings: 4x2
   i. DC Component ii. Transmission Modes iii. PCM
   b) Give the taxonomy of line coding schemes and name one scheme from each category. 5
   c) Consider a bit stream: 0110001001. Draw corresponding digital signal for following line coding schemes and also comment on the bandwidth requirement of each of the scheme. 10
   i. AMI ii. NRZ-I iii.MLT-3 iv. Manchester v. polar RZ
   d) What do you mean by scrambling? How does scrambling differ from block coding? Briefly explain the HDB3 scrambling technique. 4+6.33

4. a) Distinguish between synchronous and statistical time division multiplexing (TDM). Briefly explain the strategies used when the input lines of a multiplexer have different data rates? 5+6
   b) Give the taxonomy of digital-to-analog conversion techniques. Briefly explain the Quadrature PSK (QPSK) technique. 3+5
   c) Write short note on any one of the followings: 5
   i. Constellation Diagram ii. Frequency Modulation (FM)
   d) Briefly explain the Frequency Hopping Spread Spectrum (FHSS) technique? How does the FHSS technique differ from the Direct Sequence Spread Spectrum (DSSS) technique? 6+3.33

182

B.Sc. Engg. CSE 4th Semester 22 August 2019 (Afternoon)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 50**

CSE 4407: System Analysis and Design

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) IUTech is an E-commerce website for computer accessories. Customers place orders by telephone, by mailing an order form included with each catalog, or through the Web site. A summary of the Business Activities in IUTech: 8

- When customer orders come in, the item master and the customer master files are both updated.
- If an item is out of stock. the inventory control department is notified.
- If the order is from a new customer, a new record is created in the customer master file.
- Picking slips are produced for the customer order and sent to the warehouse.
- A shipping statement is prepared.
- The process of shipping a customer order involves getting the goods from the warehouse and matching up the customer shipping statement, getting the correct customer address, and shipping it all to the customer.
- The customer statement is generated and a billing statement is sent to a customer once a month.
- An accounts receivable report is sent to the accounting department.

Based on the given information, draw the following diagrams for IUTech E-commerce.

i. Context Diagram
ii. Diagram 0

b) What is SDLC? Describe the actions the system analyst takes in each step of SDLC 6

c) Differentiate between Probes and Bipolar questions. 2.66

2. a) What is JAD (Joint Application Design)? Discuss the people who are involved and their respective roles in JAD. 7

b) Catherine's Catering is a small business that caters meals, receptions, and banquets for business and social occasions such as birthdays and weddings etc. At first it was a small company. Catherine talked to the customers over the phone to determine the number of people, the type of meals, and other information necessary to cater an event. Catherine was able to manage the business using spreadsheets and word processing but found difficulty in keeping up with endless phone calls about what types of meals were available, changes to the number of guests attending the event, scheduling part time employees etc. 7

Create a formal problem definition from the above scenario. The problem definition should contain Problem statement, Issues with proper weight, objectives, requirements and constraints.

c) What are the different ways of arranging questionnaires? 2.66

3. a) What are the alternative choices of software for a system analyst? Give advantages and disadvantages for each alternative. 5

   b) Write short notes on the following: 3×2
      i. Miracle and Black hole.
      ii. Logical and physical Data Flow Diagrams.

   c) What is feasibility study? Explain the main areas of feasibility. 5.66

4. a) Draw an ER diagram to model the application with the following assumptions: 7
   - We have a set of teams, each team has an ID (unique identifier), 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 took yellow card, and whether or not he took red card.
     - During the match, one player may substitute another player. We want to capture this substitution and the time at which it took place.
   - Each match has exactly three referees. For each referee we have an ID (unique identifier), 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 capture the above requirements. State any assumptions you have made that affects your design. Make sure cardinalities and primary keys are indicated.

   b) Define the following terms and mention how to solve them: 2×3
      i. Leniency
      ii. Average tendency
      iii. Halo effect

   c) Differentiate between the nominal and interval measurement scale with examples. 3.66

Islamic University of Technology

Organisation of Islamic Cooperation (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 50**

CSE 4409: Database Management System II

Programmable calculators are not allowed. Do not write anything on the question paper. There are **4 (four)** questions. **Question no. 3 is compulsory.** Answer any **2 (two)** from the remaining questions. Figures in the right margin indicate marks.

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1. (a) Prior to the introduction of database management systems data was processed using file processing systems. Cite one real-life example where traditional file processing is preferable to database management systems. Justify your choice with logical arguments. Now suppose you are going to automate a very large banking systems, establish the fact that traditional file processing system is not an ideal solution in this context. Also briefly explain 3 major properties that must exist in todays modern database system for large scale system development such as banking. [6.66]

   (b) Suppose you are going to appoint a Database Administrator (DBA) for a large company. Briefly explain how you should select a candidate for this position. [5]

   (c) Mention two important purposes of foreign key. Place suitable example with data to explain them. Explian the guidelines to select a primary key. [5]

2. (a) Consider the following 2 entities (pk stands for primary key, fk[x] indicates foreign key referencing entity x): [6.66]

```
DEPT(deptid,name,establishdate,
EMP(empid (pk),name,hiredate,salary,commission,managerid(fk[EMP]),
deptid(fk[DEPT],location)
```

   Write the SQL statements for the following queries:

   i. Find the list of employees id, name, mananger's name, his salary status. Salary status is determined as follows:

      If salary is above 100000 then it gets the status *high*. If it is between 50000 and 100000 then it is *moderate*, else it is *low*.

   ii. Find the list of department name, establishdate along with its total number of employees.

   iii. Remember the salary in the table indicates basic salary for the employee. Total salary for a particular employee is calculated as follows:

      - House rent is 40% of the basic
      - Transport allowance is 10% of the basic
      - Excellence bonus is 150% of the COMMISSION (if any value exists). Remember there may be some *null values*.

Total Salary = House rent + Transport allowance + Excellence bonus

      Now write an SQL to list all employees along with their first name and total salary (in decreasing order of the salary).

   (b) Consider the EMP table of Question 2.(a). Write a function *getstatus* as directed below: Input: ID Output: status Algorithm: If total *yearly salary* is below 500000 then the status is POOR. If it is between 500000 and 800000 then it is ORDINARY, otherwise it is GOOD. (Remember the salary given in table EMP is the salary per month and total salary is calculated as mentioned in Question 2.(a)). [6]

(c) Consider the EMP table as described in Question 2.(a). The programmer designed the ID such that it conveys some useful information. So the format of ID becomes DESIGNATION.DOB.NNN, where DOB is the date of birth and NNN is the sequential increment number. Your task is to criticize this design with appropriate arguments. [4]

3. **(Compulsory)**

Consider the following scenario:

ABC is a large bank with few hundreds of *branches* located at different parts of the country. *Customers* must provide their *profile information* such as Name, Date of Birth, Address before opening any *account*. Once a customer's profile is available he/she can open multiple accounts reusing the profile information. After opening account regular *transactions* are made. There are two types of transactions such as withdraw and deposit. Apart from personal account, any *organization* can open account. For an *organization only one person* (existing customer) must be attached to the account who will be the operating person on behalf of the organization.

Bank offers loans. Only existing customers who have valid accounts are primarily eligible for getting a loan. There are 3 types of loan schemes such as Platinum, Gold and Silver . Each loan has its own properties as described in table 1.

Table 1: Properties of loan schemes for Question No. 3

Loan Scheme	No. of Instalment	Interest Rate (per year)	Eligibility
Platinum	60	5	Total Transaction (i.e. add both types of transactions) in the last 12 months must be $\geq$ 2000000
Gold	36	8	Total Transaction in the last 12 months must be between 2000000 and 1500000
Silver	24	12	Total Transaction in the last 12 months must be between 1500000 and 1000000

Your tasks are:

(a) Design the ER diagram and write the required DDLs to reflect your design. [4]

(b) Write a function to assign a customer to a specific category of loans as mentioned. (assume that each customer makes regular transactions such as deposit and withdraw). [4]

Input: Account No.

Output: Rejected or Accepted, if Accepted it should also show which type of loan can be granted based on the *Eligibility* parameter as described in table.

(c) Once a customer is assigned to a specific loan scheme, write a procedure to schedule the loan. Assume each installment must be paid after 1 month interval (i.e Monthly payment). This procedure may have additional procedure or function. [8.66]

Input: Account No, Loan Scheme, Total Amount, Starting Date of Payment.

Note: After approving a loan the Customer receives an amount of `Total Amount` but in return he/she must pay back a *Total Payback Amount* of `(Total Amount + x)` where x is the total interest amount to be paid over the entire period.

Output: It will schedule n number of equal installments based on *Total Payback Amount* and No. of Instalment of that particular loan scheme. The schedule information should include: account no, loan scheme, Instalment no.(starts from 1 to n),Instalment amount (i.e. *Total Payback Amount* will be equally distributed), Payment Date (i.e. after every 6 months from

the Starting Date), Payment Status. All fields except Payment Status should be initialised by the procedure. Payment Status should be set to null.

4. (a) Consider the table *citizens(id, name, dob, salary)*. The Government of Bangladesh (GOB) has created one fund of total BDT *total_aid_amount*. [8.66]

GOB wants to ensure (but can not guarantee) each citizen receives an amount *gob_allownace* such that after receiving it his/her total earning *(i.e. salary + gob_allownace)* is equal to the average income of the country (average is computed before any *gob_allownace* is given). The citizens having more than the average salary of the country are not eligible for this scheme.

For this purpose GOB invites applications from needy and interested people. The applications are stored in *applied(citizen_id,date of application)* table (assume only the valid persons apply).The citizens who have not applied will not be considered even his/her salary is very low.

The citizen (who applied) with the lowest salary will get the highest priority to receive *gob_allownace* and *gob_allownace* amount is determined by the difference of his/her salary and average salary of the citizen. GOB can not ensure sufficient fund for all needy citizens. So the process terminates whenever the fund is exhausted (i.e. *total_aid_amount*=0 or *total_aid_amount is less than the difference of the average salary and the salary of the particular citizen*).

When a citizen receives *gob_allownace* an appropriate update of *citizens* table should be made.

- Your task is to write a procedure *distribute_allowance* satisfying the above requirements. The procedure will take only one IN parameter i.e. *total_aid_amount.*[Hint: use explicit cursor, pay special attention to define the cursor as per the description]

(b) Present the formal definition of data warehouse. Highlight the key features from the definition. [4]

(c) What are the differences between operational database system and data warehouse? Also explain why people should separate data warehouse from its operational database. [4]

187

B.Sc. Engg. SWE 4th Semester

29 August 2019 (Afternoon)

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

MID SEMESTER EXAMINATION — **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

CSE 4411: Data Communication and Networking

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) What is data communication? Describe the components and fundamental characteristics of effective data communication system. 9

   b) Write short notes on the followings: 7

   i. DC Component ii. Self-Synchronization iii. Baseline Wandering

   c) Distinguish the four levels of addresses (used in internet) based on their roles. 5

   d) Suppose we have a channel with a 5-MHz bandwidth. The SNR of the channel is 123. What is the appropriate bitrate and signal level. **(Explain any assumption in your calculation and mention the formula)**. 4

2. a) Assume that a voice channel occupies a bandwidth of 4-kHz. We need to combine three voice channels into a link with a bandwidth of 12 kHz from 64 to 76 kHz. Show the **configuration** using **Block Diagram (both multiplexing and demultiplexing)** using frequency domain (assume that no guard band is present) 9

   b) Find out the **bit sequence** for the given digital signals from the following figures. For the Figure-1, consider **NRZ** and **NRZ-I** coding. And for the Figure-2, consider **Manchester** and **Differential Manchester** coding schemes. 7

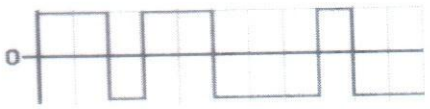

Figure 1: sample graph for Question 2. (b)

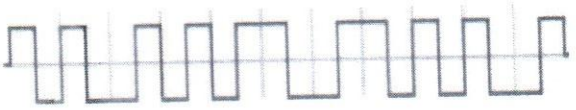

Figure 2: sample graph for Question 2. (b)

   c) Show the hierarchical organization of the Internet using figure with clear notation. 5

   d) How many bits can bit can fit on a link with a 3-ms delay if the bandwidth of the link is : 4

      i. 2 Mbps
      ii. 10 kBps
      iii. 150 Mbps

3. a) Briefly explain the three processes of Pulse Code Modulation (PCM) technique for digitization. Include **Block diagrams** to show different components of PCM encoder. 10

   b) Consider a bit stream: **0110001001**. Draw corresponding digital signal for following line coding schemes and also comment on the bandwidth requirement of each of the scheme. 9

   i. AMI ii. Polar RZ iii. MLT-3

   c) Write down the advantages and disadvantages of optical fiber technology. 6

4. a) Describe the three Analog-to-Analog conversion techniques in brief. Your answer should contain the block diagram representing the conceptual implementation of each technique. 10

   b) In Figure 3 the Physical Address is represented with English letter and Logical Address is represented with numerical value. Example: Top-Left PC (sender) has physical address P and Logical Address 11. Only write the Datagram and Frame with '?' sign mentioning the numbers. 9

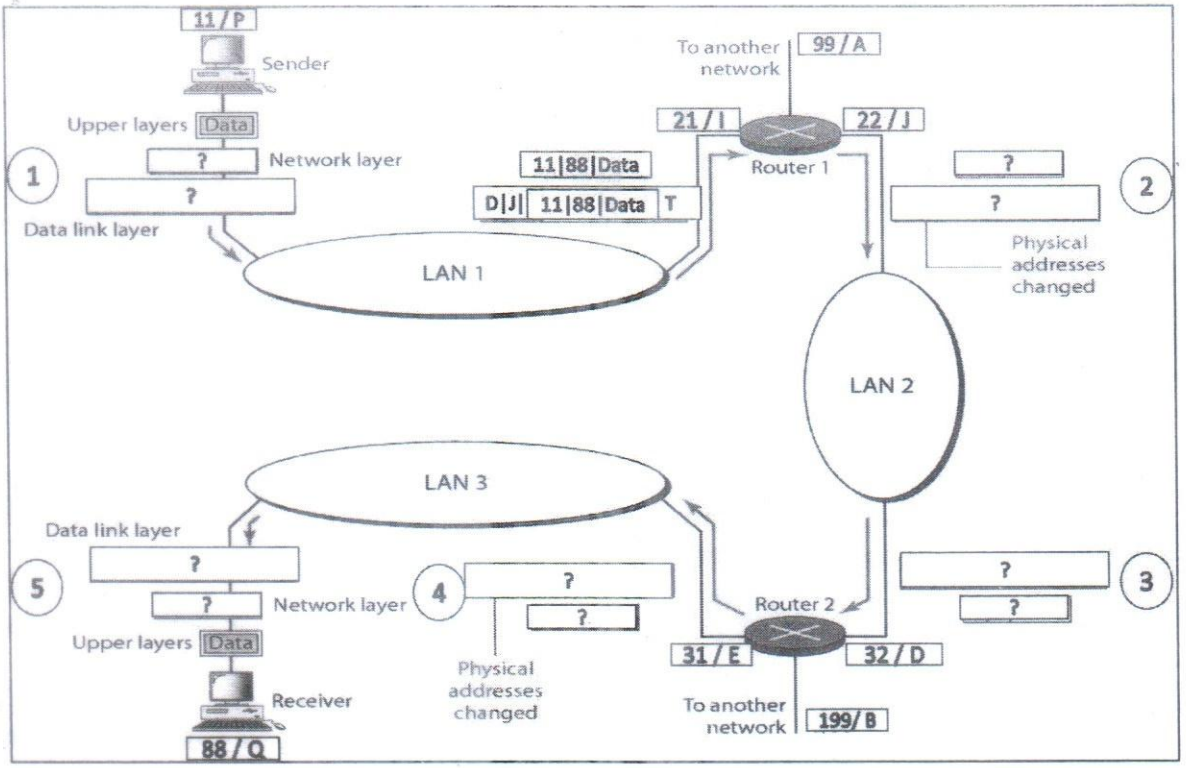

Figure 3: sample diagram for Question 4. (b)

c) Write down the differences between Synchronous TDM and Statistical TDM. 6

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

Math 4441: Probability and Statistics

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **4 (Four)** questions. Answer any **3 (Three)** them. Figures in the right margin indicate marks. Programmable calculators are not allowed. Do not write on this question paper. The symbols used have their usual meaning.

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1. a) Define Sample, Population, Sample Space and Event Space 5

   b) Monitor three consecutive phone calls going through a telephone switching office. Classify each one as a voice call (v) if someone is speaking, or a data call (d) if the call is carrying a modem or fax signal. Your observation is a sequence of three letters (each letter is either v or d). For example, two voice calls followed by one data call corresponds to vvd. Write the elements of the following sets: 12

   (1) A_1 = {first call is a voice call} (2) B_1 = {first call is a data call}
   (3) A_2 = {second call is a voice call} (4) B_2 = {second call is a data call}
   (5) A_3 = {all calls are the same} (6) B_3 = {voice and data alternate}

   For each pair of events A_1 and B_1, A_2 and B_2, and so on, identify whether the pair of events is either mutually exclusive or collectively exhaustive or both.

   c) The odds against 'A' solving a problem are 13 to 7 and the odds in favour of B solving the problem are 15 to 8. What is the probability that if both of them try, the problem will be solved? 8

2. a) A circuit system is given below. Assume the components fail independently. 10

   (i) What is the probability that the entire system works?

   (ii) Given that the system works, what is the probability that the component A is not working?

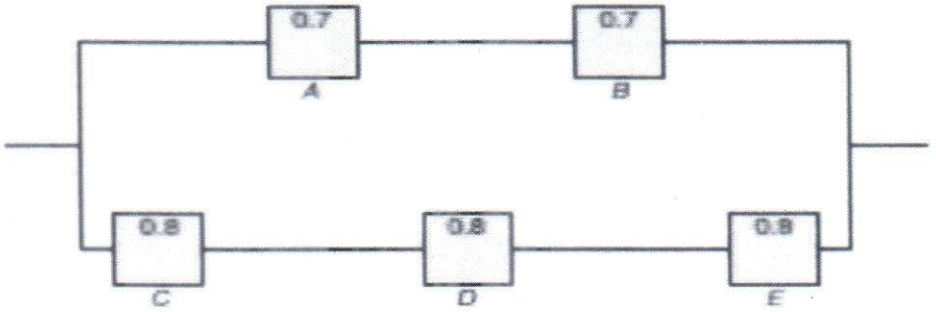

Figure 1: Figure for question 2.a.

b) One prominent physician claims that 80% of those with lung cancer are chain smokers. If his assertion is correct, find the probability that of 20 such patients recently admitted to a hospital fewer than half are chain smokers? 7

c) A wholesale gift shop supplies gift items to the customers. The manager has the standing instruction to the sales person to remove the price tag while wrapping the gift boxes. It is observed that the sales persons inadvertently forgot to remove the tag in 2 cases out of every 1000. The gift boxes are supplied in bundles of 10. Calculate the number of bundles containing boxes with (i) no price tag, (ii) one price tag, (iii) at most 2 price tag in a consignment of 10,000 bundles. 8

3. a) The Random Variable X has the CDF: 15

$$F_X(x)=\begin{cases}0, & \text{if } x<a\\ \dfrac{x-a}{b-a}, & a\le x\le b\\ 1, & \text{if, } x>b\end{cases}$$

(i) Find $P\left(X\le\dfrac{2a+b}{3}\right)$. (ii) If $a=-1$, $b=3$ find $P\left(|X|\le\dfrac{2}{3}\right)$

b) Suppose that the number of cars X that pass through a car wash between 4:00 P.M. and 5:00 P.M. on any sunny Friday has the following probability distribution: 10

x	4	5	6	7	8	9
$P(X=x)$	1/12	1/ 12	1/ 4	1/ 4	1/6	1 /6

Let $g(X) = 2X-1$ represent the amount of money, in dollars, paid to the attendant by the manager. Find the attendant's expected earnings for this particular time period.

4. a) The IQ's of 7 years old is assumed to be normal random variable. It is known that 15% of the children have IQ's under 90 and 2% exceed 135, what percentage of children have IQ's between 100 and 120? (Necessary chart 1 is attached). 10

b) Roll two fair four-sided dice. Let X_1 and X_2 denote the number of dots that appear on die 1 and die 2, respectively. Let A be the event $X_1 \ge 2$. What is P[A]? Let B denote the event $X_2 > X_1$. What is P[B]? What is P[A|B]? 7

c) Continuous random variable X has PDF 8

$$f_X(x)=\begin{cases}\dfrac{1}{4}, & -1\le x\le 3\\ 0, & \text{otherwise}\end{cases}$$

Define the random variable Y by $Y = h(X) = X^2$.
(i) Find E[X] , Var[X], (ii) Find h(E[X]) and Var[Y].

191

B.Sc. Engg. HD/CSE 4th Semester
B.Sc. SWE 4th Semester

27 August 2019 (Afternoon)

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

MID SEMESTER EXAMINATION — **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

Hum 4441: Engineering Ethics

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) What is engineering ethics? Analyze the concept "Great power brings great responsibility". 7
   b) What is trade secret? Explain obligation of confidentiality of an engineer with a generic case study where you used to work for Galactic motors and working now for Ford as an Auto design engineer. 5
   c) Evaluate the concepts with a proper example that, "Some facts are ethical but illegal whereas some facts are unethical but legal." 5
   d) Samuels worked as a programmer and Matthews worked as robot operator at cybernetics Inc. Matthews was crushed into death when the robot started his wave hand violently. Samuel was charged the cause of death of Matthews due to the malfunction of the robot where a particular piece of robot program written by Samuels responsible for this malfunction. What is the ethical misconduct occurred in this situation? Analyze your thoughts. 8

2. a) What is the definition of professionalism? State their characteristics. 10
   b) Why do professional have special ethical responsibility? 5
   c) Therac-25 machines was built by Canada Atomic Commission ltd. What was various responsibility for the accident occurred in 1985-87 by this machine? 10

3. a) What is conflict of interest? Why does a conflict of interest seem unethical? 7
   b) What can you do to avoid a conflict of interest? 5
   c) How will you maintain ethical behavior as a research students? 5
   d) Imagine that you and your friend Kevin are in "examining engineer" job position for the last 10 years. You noticed that an increasing lack of interest from Kevin in his job and he is not taking sufficient care in the execution of his role of examining engineer, and that this breach of duty may be impacting the safety of rail bridges. You know that you and he both have a duty to ensure that work is conducted with care and competence, but you must decide firstly what such a duty requires in this case, and secondly whether any breach is the fault of your colleague or the system in which you are both working. On top of this, you must also contend with conflicts that might arise between your professional duties and your loyalty to your friend. What should you do? Discuss this case with appropriate summery. 8

4. a) What are statements of ethical principles? Explain their categories. 7
   b) What is organizational behavior? Why organizational behavior matters. 5
   c) What is the Skill Survival Kit? Can you consider Journaling as a developmental tool? Explain. 5
   d) Bill is a software engineer who is asked to give an opinion in court as to the level of security offered by a company's data protection procedures. Bill suspects that the system may not be completely secure, though he has not had the opportunity to inspect it as thoroughly as he would like. Should Bill accept the request to appear as an expert witness? If so, how should he phrase his testimony? 8

192

BBA (TM) 4th Semester 23 August 2019 (Afternoon)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4461: Computer Science and Technology II

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. Consider the following database schema:

Actor *(act_id, act_firstname, act_lastname, act_gender)*
Director *(dir_id, dir_name, salary)*
Movie *(mov_id, title, year, release_date, budget)*
Casts *(act_id, mov_id, role)*
Direction *(dir_id, mov_id)*
Reviewer *(rev_id, rev_name)*
Rating *(mov_id, rev_id, stars)*

The underlined attributes are keys. *Actor*, *Director* and *Movie* table stores information about different actors/actresses, directors and movies. *Casts* table portrays which actor/actress acted in which movie. *Direction* table shows which director directed which movie. *Reviewer* and *Rating* tables store information about the reviewers and how many stars they gave to a movie.

a) Suppose all the tables have been created except *Movie, Casts* and *Direction.* Write DDL statements to create these tables. Make sure to include proper integrity constraints and references. 5

b) Write SQL statements to perform the following operations: 2.5×8

i. Find the year when the movie 'Avengers' was released.
ii. List all movie titles and their director names.
iii. Find all information of actors/actresses who have not acted in a movie. (Hint: 'Not In' clause)
iv. Find the names of the movies having 'The' in its title.
v. Find the title of the movie that has the maximum budget.
vi. Find the names of all directors who have a higher salary than at least one director.
vii. Find the title of the movies that got average rating of more than 7 stars. Sort the result in alphabetical order of titles.
viii. Delete all directors with salary less than 10,000.

2. a) Define *super key*, *candidate key* and *primary key*. Provide examples of each key using a single table. 6

b) What is the difference between writing SQL queries with **"natural join"** and **"inner join....on"** keywords? 5

c) From the database schema in Question 1, write an SQL statement to create a view *MovieDirector* which will include every director id along with the movies they directed. If any director did not direct any movie, include them in the list too. 3+3
What is the difference between this view and a materialized version of it?

d) Write appropriate SQL statements to create the following authorization graph shown in Figure 1. For each statement, identify which user will execute the command. Assume that you are only granting the SELECT privilege on *Movie* table based on the database schema 6+2

in question 1. Explain what happens in the context of Oracle Database when DBA revokes privilege from U1.

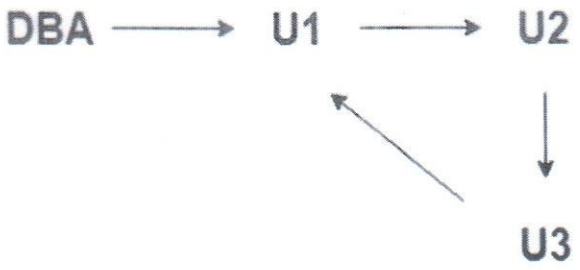

Figure 1: Authorization Graph

3. It is the year 2050. Due to massive advancement in technology, helicopters have become very cheap and accessible. Helicopter-pooling is accepted and promoted by people around the globe. In this system, pilots create a ride from one city to another based on the request of the users. As a young entrepreneur, you are on the verge of launching a helicopter-pooling app called **Uthao**. To create the app database, you need to model it. The initial requirements are as follows:
   - The app *Uthao* will record its app identity number, name of the CEO and budget.
   - The users need to register on the app providing name, contact no. and email. One user can have multiple phone numbers. The pilots also need to register providing similar attributes as user. The pilots can be of two types: 'Captain' or 'First Officer'. In the beginning, *Uthao* may not have any users but to start the business it must have at least one pilot.
   - *Uthao* has helicopters in its stock. Each helicopter has its own model no, color and year of built. The company must have at least one helicopter in its stock.
   - Each pilot is assigned a helicopter. A pilot can have from no helicopter up to at most one helicopter assigned to him/her.
   - The user rides with a pilot by requesting rides on the app. Ride information such as destination city, fare etc are recorded in the relation.
   - Every user will have preferences. For example, what type of music he/she likes, does he/she like to chitchat with the pilot, are pets allowed etc. These preferences can be same for different users. (Hint: preferences will have discriminators)

   a) Create an ER model based on the above mentioned specifications. Your ER model must be neat, concise and legible. 15

   b) Reduce the ER model that you have designed into a set of relations with proper justification. Identify the appropriate primary key for each relation. 10

4. a) What are the drawbacks of using file systems? Explain with examples. 9

   b) What is the difference between (a) and (b) in Figure 2? 3

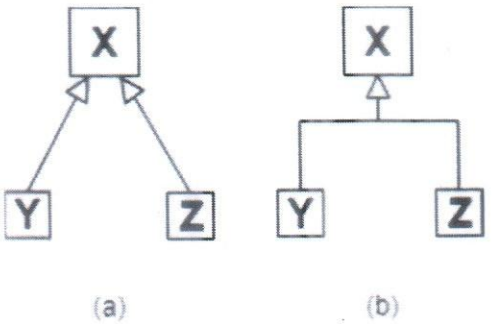

Figure 2: Figure for the question no. 4 (b)

c) Classify the constraints on generalization or specialization based on: 5
   i. Attribute of higher-level entity determines lower-level entity membership
   ii. Completeness

d) Describe appropriate scenarios where you can demonstrate the application of the following cardinalities: 2x2
   i. One-to-many
   ii. Many-to-many

e) BTM 17, as brilliant and as creative they are, have been the best students. They are thinking of opening a buy and sell website where IUTians can buy or sell different items. They have decided that they will call the website GOOD BUY. They will need a database to store all the information. To store product information, they will need a table named **"GoodBuy"** which will store product id, product names, expiry dates, product type and a **"Students"** table which will store student id, name, department, batch, contact no etc. 4
Write appropriate DDL statements to create the tables. Make sure to include proper integrity constraints.

195

B.Sc. Engg. / HD CSE 6th Semester — 23 August 2019 (Morning)

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

MID SEMESTER EXAMINATION — **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 50**

CSE 4615: Wireless Networks

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) How are collisions handled in Back2F (back to frequency) protocol? Explain with appropriate contention diagrams. 6
   b) Explain in brief a proposed channel access mechanism which is most similar to CSMA/CA and uses deterministic back-off. 7
   c) What is the difference between partial ordering and total ordering? 3.66

2. a) Illustrate a timeline diagram of a successful retransmission (a collision and then a successful transmission) in the current WLAN protocol (802.11) when 3 stations are trying to access the channel at the same time. Usage of RTS and CTS is optional. 6
   b) From the given Figure 1, identify which of the nodes are "exposed" and which are "hidden". 3

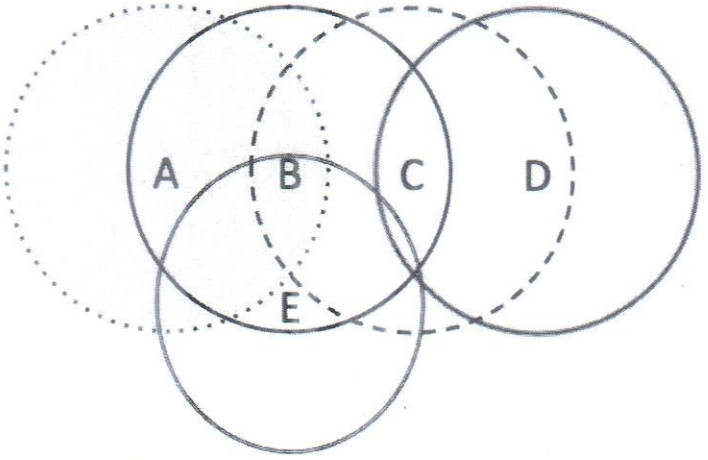


Figure 1: Figure for question 2 (b)

   c) Does 802.11 (WLAN) solve the problems of Hidden and Exposed Terminal? Give appropriate reason. How does CSMA/CN contribute to solve these problems? 3 + 4.66

3. a) What is HiBo? How does it minimize traditional contention time? 4+3
   b) PC protocols have two phases – Learning phase and Transmission phase. What happens in each phase? Provide necessary figures. 9.66

4. a) What is standardization? "Making any change to the current network protocol is a lengthy process without any certainty of approval" - Explain. 1.66 + 3
   b) "The building blocks of wireless networks may or may not have centralized control. However, the presence of such a control is paramount to maintain Quality of Service (QoS)." – Express in terms of networking terminologies. 6
   c) The backbone network of an ESS can be a variety of protocols. The distribution system (DS) connects several BSS together. Can the backbone network (or part of it) be compared to the Internet (a service view)? If so, how? 6

196

B.Sc. Engg. /HD CSE 6th Semester

26 August 2019 (Morning)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4617: Artificial Intelligence

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

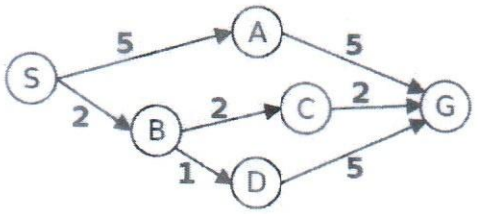
There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

1. a) Briefly describe the Turing Test for artificial intelligence. Distinguish between programming with and without AI. 7

   b) Why rationality is different from omniscient? Explain the following properties of environment in respect to a chess game with a clock: observability, determinism, episodic, static, and discrete. 8

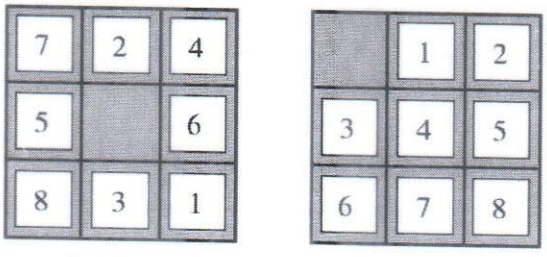
   c) What is uninformed search? Stepwise show the uniform cost search applied over the following weighted graph (where S and G represent start and goal nodes respectively). Does this search guarantee optimal and complete solution? Justify your answer. 10



2. a) Considering the following initial and goal states of an 8-puzzle problem: 8

   i. Write two admissible heuristic functions that can be considered here. Which heuristic is better than the other, and why?

   ii. Perform a greedy best first (state space) search to find the goal state. Stop the search as soon as the search expands a state at level three. Use the Manhattan distance (not including the blank) as a heuristic to guide the search.

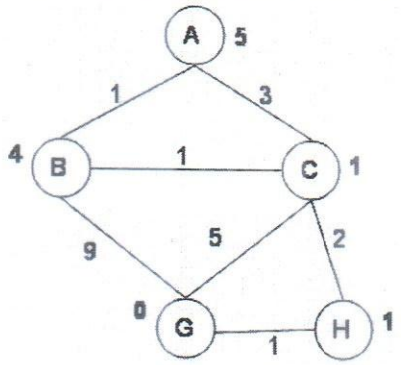


Start State Goal State

   b) How SMA* search can overcome the drawbacks of recursive best-first search (RBFS)? Explain with necessary examples. 8

   c) Consider the graph shown below where the numbers on the links are link costs and the numbers next to the states are heuristic estimates. Note that the arcs are undirected. Let A be the start 9

state and G be the goal state. Simulate A* search with a strict expanded list on this graph. Explain, whether the given heuristic is admissible and/or consistent.



3. a) "A local search can solve a n-queens problem (or get stuck in a local minima) in almost constant time for arbitrary n with high probability in solving a CSP problem" – Justify the statement by performing a local search of a 4-queens [Q_1, Q_2, Q_3, Q_4] problem starting from the following initial configuration [1, 2, 1, 2], as shown in the following figure. Here, the queens Q_1, Q_2, Q_3, and Q_4 are dedicated to the columns 1, 2, 3, and 4 respectively, and one single (usually the most aggressive) queen can be moved at a time. 8

b) How can you overcome the difficulties caused by ridges in hill climbing search? Briefly explain the working principle of simulated annealing process. 8

c) How a local search can be applied to a travelling salesman problem using two-opt neighbourhood? Explain with an example. 9

4. a) What is arithmetic crossover? Why is it important to have mutation operator in a genetic algorithms (GA)? 6

b) What is higher order constraint in a constraint satisfaction problem (CSP)? Explain, which variable should be assigned next, and in what order should its values be tried for improving the backtracking speed in solving the following cryptarithmetic problem, where each letter of the problem has to be substituted with a digit within 0 to 9, with no repeating values. 12

$$\begin{array}{r} \text{T W O} \\ +\ \text{T W O} \\ \hline \text{F O U R} \end{array}$$

c) How can you detect inevitable failure early using Arc Consistency for improving backtracking efficiency? Explain with a relevant example. 7

B.Sc. Engg. / HD CSE 6th Semester — 30 August 2019 (Morning)

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

MID SEMESTER EXAMINATION — **SUMMER SEMESTER, 2018-2019**
DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

CSE 4619: Peripherals and Interfacing

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **4 (four)** questions. Answer any **3 (three)** of them.
Figures in the right margin indicate marks.

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1. a) Write short note on ATmega16 Microcontroller. 10
   b) Differentiate between Microcontroller and Microprocessor. 10
   c) Suppose, it is given V_{in} = **0.7 volt**, V_{ref} = **1 volt** and 8-bit of resolution for a Successive Approximation A/D conWverter. Find an 8-bit digital output for the given V_{in}. 5

2. a) What are the steps involved in Analog-to-Digital (A/D) data conversion? Briefly explain the conditions to ensure accurate and precise A/D data conversion. 10
   b) Write the pros and cons of Delta-Sigma and Flash A/D converter. Suppose, you are given an analog quantization size of **2.50 volt**, where V_{min}=**0 volt** and V_{max}=**10 Volt**. Calculate the desired number of bits for an A/D converter. 10
   c) Write short notes on: 5
      i. Microprocessor controlled data transfer
      ii. Peripheral controlled data transfer

3. a) Distinguish between One-shot Mode and Software-triggered mode of 8254 PIT. 10
   b) Suppose, an 8086 microprocessor is asked to address the 15th 8255 and to write a control word at the control register of that 8255. Consider, Port-A is in Mode-2, Port-B is in Mode-1 as an output port and Port-C is working for handshaking signals. Now, derive the binary values of A7 – A0 pins and draw the control word format for 8255. 10
   c) Draw the sequential timing diagram for Port-B considering the handshaking and data signals (consider the scenario of Question 3.b). 5

4. a) Write down the features of 8255 PPI. 10
   b) Consider that an 8-bit control word is to be written to an 8254 PIT, where the control command asks for a 16-bit binary-counting from Counter # 2 using a square-wave generator. Now, derive the Control Logic pin values and draw the control word parameters. 10
   c) Write a short note on output handshake signals of 8155 Programmable Peripheral Interface. 5

199

B.Sc. Engg. CSE 6th Semester 29 August 2019 (Morning)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4631: Digital Signal Processing

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) Name four key contribution areas of Digital Signal Processing. Which one among them is your favorite? Why? 2+4

   b) Determine if each of the following signals is periodic or not. If the signal is periodic, determine its fundamental period. 9

   i. $x_1(t) = e^{(-1+j)t}$

   ii. $x_2(n) = u(n) + u(-n)$

   iii. $x_3(n) = \cos(\frac{\pi}{2}\, n)\cos(\frac{\pi}{4} n)$

   c) A discrete-time signal $x(n)$ is shown in Figure 1. Sketch and label each of the following signals: 10

   i. $x(-n)$

   ii. $x(3-n)$

   iii. $x(n-1)\delta(n-2)$

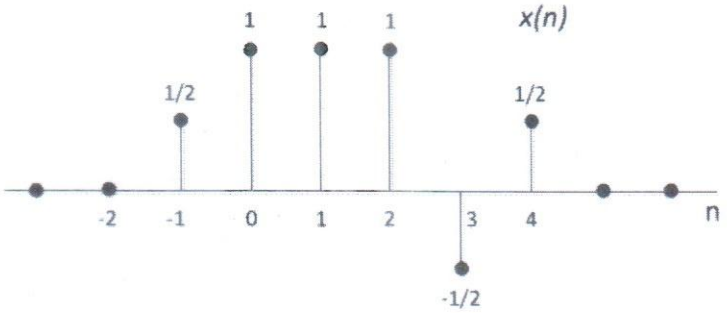

Figure 1: $x(n)$

2. a) Echoes are added to audio signals to make the listener "feel" that they are in a particular size of room. Assume that an audio signal is sampled at 44 kHz, and that sound propagates at 332 meters/second. In a "small" room, a person stands about 3 meters from the walls. 8

   i. In a small room, how long is the delay between a person making a sound and its echo from the walls?

   ii. How many samples does this correspond to in the digital signal?

   iii. What is the impulse response of a digital system simulating this echo, if the amplitude of the echo is 20%?

   b) Why would you use Polar notation instead of Rectangular notation? What are the nuisances associated with polar notation? 3+7

c) Why is decomposition important? Determine and sketch the even and odd parts of the signal depicted below: 3+4

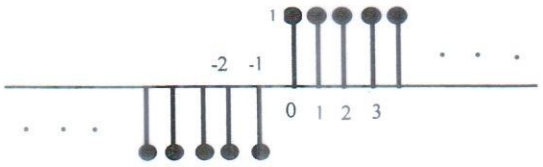

Figure 2: Signal

3. a) Two signals, x(n) and h(n), are defined as follows: 8
x(n): 1, 0, 2, 3, 2, 1,-1,-2,-1, 0, 2, 3, 3, 2, 1, 1 (samples 0-15)
h(n): 1, 2, 3,-3,-2,-1 (samples 0-5)

If y(n) = x(n)*h(n),
i. Use the input side algorithm to determine the contribution to y(n) from x(4).
ii. Use the output side algorithm to determine the value of y(10)

b) From calculus, you know that the derivative and integral are inverse operations; one undoes the effect of the other. Prove that the first difference and the running sum are also inverse operations. That is, show that the cascade of these two systems is identical to the delta function. 7

c) Why is correlation important? Compute the correlation of the following signals. [Bold signals denote origin] 3+7
$x(n) = \{\mathbf{1}, 2,3,4,5,6\}$; $h(n) = \{\mathbf{2}, 3,4\}$

4. a) You have taken a 256 point DFT of a sinusoid and in the DFT, a peak appears at index number 19. 10
i. What is the frequency of the peak expressed as a fraction of the sampling rate?
ii. What is the frequency of the peak expressed as a natural frequency?
iii. What is the sampling rate if the peak corresponds to 21.5 kHz in the analog signal?

b) Describe a real time use of Spectral Analysis. Why is Hamming Window used in spectral analysis? 4+4

c) A signal containing 1000 points is to be convolved with a signal containing 128 points. 7
i. What is the length of the resulting signal?
ii. If frequency domain convolution is used, what length of DFT is appropriate?
iii. If a 1024 point DFT is used, how many samples are correct, and how many are corrupted by circular convolution?

201

B.Sc. Engg. / HD CSE 6th Semester 29 August 2019 (Morning)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4635: Web Architecture

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1 a) Consider an application in which the results of football games are to be represented in XML. 6×3

For each game:

- We want to be able to represent the two teams involved.
- The final score of the game.
- Which team was playing at home and which team was playing away.
- Which players scored goals (some of which may have been penalties) and the time when each goal was scored.
- Which players were shown yellow or red cards.
- All the referees of the match (minimum of 3 and a maximum of 6)

You might use some attributes.

i. Write the DTD suitable for defining a document in the above format.

ii. Suppose the details of two games are as follows:

Home Team	Away Team	Score	Scorers	Time
Barcelona	Real Madrid	2-1	Messi	31:20
			Messi	62:17
			Marcelo	75:41
Arsenal	PSG	0-0		

Produce the XML for the games above. It should be in conformity with the DTD defined earlier. (Note: You can assume other information that are not provided but you deem necessary).

iii. Use XSLT elements to convert the XML to XHTML and the output should show only the matches of Barcelona.

b) What is Servlet Filter? Give examples. Draw the directory structure of a java web application containing servlets, Static pages, JSPs, images and configuration files 7

2 a) With the help of a diagram, explain the life cycle of a JSP. 10

b) What is JSTL? What are the main JSTL tag Libraries? 10

```
<html>
  <body>
    <h1>Count Using Scriplets</h1>

    <%
        int n = Integer.parseInt(request.getParameter("number"));
        for(int i=1;i<=n;i++)
        { %>
          <%=i%><br/>
    <% } %>
  </body>
</html>
```

Figure 1

Given the count.jsp in Figure 1 above, write a JSP file that will perform the same function using only JSTL and no Scriplets.

c) When an HTTP request is sent to a servlet container, how does the container choses which servlet to invoke 5

3 a) Given the Login.jsp in Figure 2 below, 12

```
<body>
  <h1>Login: </h1>
  <form action="LoginServlet" method="post">
    Name: <input type="text" name="name"/><br/>
    Password: <input type="password" name="password"/><br/>
    <input type="submit" value="Login"/>
  </form>
</body>
```

Figure 2

Write a servlet having URL, 'LoginServlet', which will check for user authentication, then will set the name and password in the session scope and write another servlet 'WelcomeServlet', which will get the value from session scope and display the name.

b) Explain the mechanisms of sendRedirect and forward methods. Give examples 8

c) What are the differences between HTML and SGML 5

4. a) What are Listeners in java web application? Give examples. 5

b) Assume that you are asked to develop a web application that would count the number of active sessions. And one of the requirements is that the total number of active sessions should be kept to a maximum of 30. When the number of sessions is 30, no new session can be created. If a new user attempts to create a new session, an error message should be sent to him that no more than 30 users can access the server at the same time. (Hint: Use listeners). 10

c) With the help of diagrams, explain the Model-2 web architecture with real world scenario implementation and advantages. 10

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

Hum 4641: Accounting

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) "Pacioli described a unique system to ensure that financial information was recorded efficiently and accurately"- Explain it. 3

   b) Answer each of the following questions by using expanded accounting equation: 4

      i. The liabilities of Mark Company are $90,000. John Mark's capital account is $150,000; drawings are $40,000; revenues, $450,000; and expenses, $320,000. What is the amount of Mark Company's total assets?

      ii. The total assets of Barone Company are $57,000. Nancy Barone's capital account is $25,000; drawings are $7,000; revenues, $50,000; and expenses, $35,000. What is the amount of the company's total liabilities?

   c) Miller's Repair Shop was started on May 1, 2018 by Mark Miller. A summary of May transactions is presented below. 18

   - Invested $10,000 cash to start the repair shop.
   - Purchased equipment for $5,000 cash.
   - Paid $400 cash for May office rent.
   - Paid $500 cash for supplies.
   - Incurred $250 of advertising costs in the Beacon News on account.
   - Received $5,100 in cash from customers for repair service.
   - Withdrew $1,000 cash for personal use.
   - Paid part-time employee salaries $2,000.
   - Paid utility bills $140.
   - Provided repair service on account to customers $750.
   - Collected cash of $120 for services billed in transaction (x).

   Required:

   Prepare a tabular analysis of the transactions, using the following column headings: Cash, Accounts Receivable, Supplies, Equipment, Accounts Payable, M.Miller,Capital; M.Miller,Drawings; Revenues, and Expenses.

2. a) Draw the chart of Golden Rules of Accounting. 6

   b) Mary Jansen is a licensed CPA. During the first month of operations of her business, the following events and transactions occurred. 19

   May 1: Mary invested $25,000 cash in her business.
   May 2: Hired a secretary-receptionist at a salary of $2,000 per month.
   May 3: Purchased $2,500 of supplies on account from Barry Supply Company.
   May 7: Paid office rent of $900 cash for the month.
   May11: Completed a tax assignment and billed client $2,100 for services provided.
   May 12: Received $3,500 advance on a management consulting engagement.
   May 17: Received cash of $1,200 for services completed for Max Company.

May 31: Paid secretary-receptionist $2,000 salary for the month.
May 31: Paid 40% of balance due Barry Supply Company.

Mary uses the following chart of accounts: No. 101 Cash, No. 112 Accounts Receivable, No. 126 Supplies, No. 201 Accounts Payable, No. 205 Unearned Revenue, No. 301 Mary Jansen, Capital; No. 400 Service Revenue, No. 726 Salaries Expense, and No. 729 Rent Expense.

Required:

i. Journalize the transactions.
ii. Post to the ledger accounts.
iii. Prepare a trial balance on May 31, 2018.

3. a) A Mobile Phone shop makes a sale of mobile phones for $1,000 on June 30. The customer is sent a statement on July 5 and a cheque is received on July 10. The Mobile Phone shop follows Revenue Recognition Principle. When is the $1,000 considered to be earned? Explain the reason. 5

b) Which items are included in Deferrals and Accruals? 2

c) Sara Woods started his own consulting firm, Woods Consulting, on May 1, 2017. The trial balance at May 31 is as follows. 18

WOODS CONSULTING
Trial Balance
May 31, 2017

Accounts Title	Debit	Credit
Cash	$ 5,700	
Accounts Receivable	6,000	
Supplies	1,900	
Prepaid Insurance	3,600	
Office Furniture	10,200	
Accounts Payable		$ 4,500
Unearned Service Revenue		2,000
S.Woods, Capital		17,700
Service Revenue		7,500
Salaries Expense	3,400	
Rent Expense	900	
	$31,700	**$31,700**

In addition to those accounts listed on the trial balance, the chart of accounts for Woods Consulting also contains the following accounts and account numbers: No. 150 Accumulated Depreciation—Office Furniture, No. 212 Salaries Payable, No. 229 Travel Payable, No. 631 Supplies Expense, No. 717 Depreciation Expense, No. 722 Insurance Expense, and No. 736 Travel Expense.

Other data:

- $900 of supplies have been used during the month.
- Travel expense incurred but not paid on May 31, 2017, $250.
- The insurance policy is for 2 years.
- $400 of the balance in the unearned service revenue account remains unearned at the end of the month.

- May 31 is a Wednesday, and employees are paid on Fridays. Woods Consulting has two employees, who are paid $800 each for a 5-day work week.
- The office furniture has a 5-year life with no salvage value. It is being depreciated at $170 per month for 60 months.
- Invoices representing $1,200 of services performed during the month have not been recorded as of May 31.

Required:

i. Prepare the adjusting entries for the month of May, 2017.
ii. Prepare an adjusted trial balance at May 31, 2017.

4. a) Your friend Natasha is confused about the accounts that are closed and the accounts that are not closed. Which chart will you show him? 5

b) The trial balance columns of the worksheet for Goode Company at March 31, 2018, are as follows. 20

GOODE COMPANY
Worksheet
For the Month Ended March 31, 2018

Account Titles	Trial Balance	
	Dr.	Cr.
Cash	$ 4,500	
Accounts Receivable	3,200	
Supplies	2,000	
Equipment	11,000	
Accumulated Depreciation-Equipment		$ 1,250
Accounts Payable		2,500
Unearned Revenue		550
T.Goode, Capital		12,900
T.Goode, Drawing	1,100	
Service Revenue		6,300
Salaries Expense	1,300	
Miscellaneous Expense	400	
	$ 23,500	**$ 23,500**

Other data:

- A physical count reveals only $650 of supplies on hand.
- Depreciation for March is $250.
- Unearned revenue amounted to $170 at March 31.
- Accrued salaries are $600.

Required:

i. Enter the trial balance on a worksheet and complete the worksheet.
ii. Journalize the closing entries from the financial statement columns of the worksheet.

206

B.Sc. Engg. / HD CSE 6th Semester 22 August 2019 (Morning)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4643: Mobile Application Development

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) Discuss on different ***types of mobile applications*** along with their pros and cons. 12
   b) Discuss on various SDK versions. State the relationship between the SDK versions in development environment. 8
   c) What is AVD? Discuss its importance in Mobile Application Development platform. 5

2. a) What are the meanings of version number, code name, and API level of android applications? 10
   b) List various components of an ***Android Project***. Explain various internal components of ***res*** folder of an Android Project. 10
   c) What are the functions of a ***Manifest*** file? What is the function of ***Gradle***? 5

3. a) How ***Dangerous Permissions*** are needed to be managed from API Level 23? How is it needed to manage prior of API Level 23? Name five Dangerous permission name. 10
   b) List data storage options for android applications. With example show how data can be *saved to* and *retrieved from* shared preferences. 2+8
   c) Discuss the uses of ***ContentValues*** in android with example. 5

4. a) By using a Block Diagram show the steps of producing an android app. What is Dalvik Debug Monitor Server (DDMS)? 9
   b) Draw ***Activity Life Cycle*** flow chart and discuss key blocks. 8
   c) Write down the basic code to implement a SQLite database with a table named *zoo* having following schema: 8
   zoo(_id integer primary key autoincrement, name text, description text, file_path text)

207

B.Sc.TE 2nd Semester (2 Year) 27 August 2019 (Afternoon)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4673: Operating System and System Programming

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) With the help of figures explain user-mode and kernel mode. 10
   b) Show what happens in the background when a standard C code contains call to a built-in function such as printf (). Include the entire process from the function call within the code to all the possible system calls that happens. 10
   c) What are the differences between a multicore and a multiprocessor system? 5

2. a) What are the differences between Virtualization and Emulation? Explain why one can use a Virtual machine when trying to use Linux in a Windows system but would have to use an emulator when they need to use Android in said Windows system. 6
   b) With figures show the various processes of interprocess communication. Also, differentiate between them. 9
   c) Write short notes on: 5×2
      i. Remote Procedure call
      ii. Peer to peer architecture

3. a) With figures describe the cloud computing architecture. 9
   b) With the help of queuing diagram show a representation of process scheduling. Also, justify when one might add a mid-term scheduler in process scheduling. 12
   c) What are ordinary pipes? Explain briefly with figures. 4

4. a) What is a process control block? Show the structure of a process control block. 9
   b) What is the producer-consumer problem? Write code snippets for the producer and consumer process when a bounder buffer is being used as a shared memory. 10
   c) Write the differences between direct and indirect communication. What is non-blocking send? 4+2

208

B.Sc. Engg. CSE 8th Semester — 26 August 2019 (Morning)

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

MID SEMESTER EXAMINATION — **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

CSE 4801: Compiler Design

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) What is a translator? What is the difference between compiler and interpreter? 3
   b) What are the various phases of compilation process? 10
   c) Discuss the roll of lexical analyzer in a compiler. What are the benefits of implementing lexical analyzer as a separate layer? 7
   d) Show that the following grammar is ambiguous: 5

   S → **if** (E) **then** S **else** S
   S → **if** (E) **then** S
   S → **x**
   E → **true**
   E → **false**

2. a) A grammar is given below:

   G → L
   L → E ; L
   L → E
   E → E + T
   E → T
   T → **id**
   T → **id** ( )
   T → **id** (L)

   i. Derive a leftmost derivation for the string x + y ; z (y ( )) and show the corresponding parse tree. 10
   ii. Modify the grammar (if necessary) to implement predictive parsing. 5
   iii. Find the set of FIRST and FOLLOW for each of the non-terminal. 10

3. a) Discuss in brief about Left Recursion, elimination of Left Recursion and Left Factoring with examples. 8
   b) Consider the following grammar G:

   S → Ea | bEc |dc | bda
   E → d

   i. Find the canonical collection of LR(0) items (transition diagram for SLR parsing). 9
   ii. Build SLR parse table and discuss your observations. 8

4. a) You need to generate a calculator program using both lex and yacc. The calculator should support division, multiplication, addition, subtraction, and power operations in proper precedence and associativity. The calculator should also support first bracket within the expression. 15

   Write down the lex and yacc file. Afterwards explain how to build the calculator program from the lex and yacc source file. Use block diagram if necessary.

   b) Write short notes on the followings- 10
   yytext, yylex(), yyparse(), yywrap(), yyleng, yylval.

210

B.Sc. Engg. CSE 8th Semester — 30 August 2019 (Morning)

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

MID SEMESTER EXAMINATION — **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

CSE 4803: Graph Theory

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) Define with example (figure if necessary) 2×5
   - i. Eccentricity
   - ii. Rank
   - iii. Semi-Eulerian Graph
   - iv. Cut-Vertex
   - v. Bipartite Graph

   b) Use Cayley's theorem to draw the labeled tree represented by the sequence (1,5,5,1,2). After drawing the graph interchage the labels 1 and 5. Then, recalculate the labeled sequence. 5+5

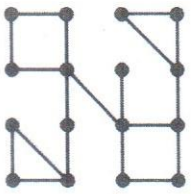
   c) Prove that there are at lesat two pendant vertices in any tree with two or more vertices. 5

2. a) How many vertices and edges does each of the following graphs have? 5×2
   - i. $K_{m,n}$
   - ii. C_n
   - iii. W_n
   - iv. Q_n
   - v. K_n

   b) Define Hamiltonian Cycle. Prove that a complete bipartite graph $K_{3,4}$ does not have a Hamiltonian Cycle. 2+5

   c) Let G be a simple graph on n vertices and m edges. If G has k components, then prove that G satisfies: $n-k \leq m \leq (n-k)(n-k+1)/2$ 8

3. a) Define spanning tree. How many spanning trees does the following graph have? 2+6
   [Hint: If an edge of a graph is a 'bridge', then it must belong to every spanning tree generated from the graph.]

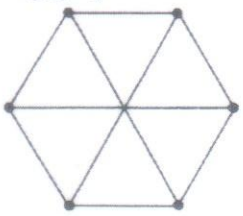


   b) Prove that any simple graph with n vertices and more than (n-1)(n-2)/2 edges is connected. 7

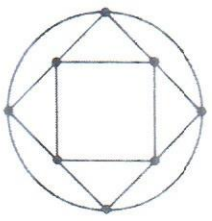
   c) Prove that a connected planar graph with n vertices and e edges has e-n+2 regions. 10

4. a) Determine: Edge connectivity, Vertex connectivity and Cocycle (at least six of them) for the following graphs: 4×3

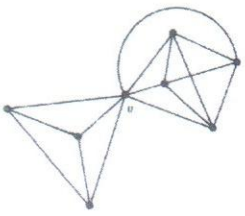
   i.



   ii.



   iii.



   b) Prove that a connected graph G is Eulerian if and only if the degree of each vertex of G is even. 8

   c) Mention the common properties of Kuratowski's graphs. 5

2+1

B.Sc. Engg. CSE 8th Semester 27 August 2019 (Morning)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4807: IT Organization and Project Management

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) Planning involves two important elements: goals and plans. What steps should managers follow in setting goals? What are the characteristics of a well-designed goal? 5+4

   b) Strategic management is what managers do to develop the organization's strategies. Even the best strategies can fail if management does not implement or evaluate them properly. Explain the steps that managers should follow while managing strategies of their organizations. Also explain SWOT analysis. 12+4

2. a) There are four management functions: planning, organizing, leading, and controlling. However, you do not have to be a manager in order to plan, organize, lead, and control, so understanding these processes is important for everyone. Briefly define what each of these functions encompasses. 8

   b) What are the barriers to effective interpersonal communication? How can you overcome those? 6+5

   c) Information technology has radically changed the way organizational members communicate. Give some examples of it. While the economic benefits of information technology are obvious, managers must not forget to address the psychological drawbacks. Give examples of some psychological drawbacks of the use of information technology. 3+3

3. a) Management is coordinating work activities so that they are completed efficiently and effectively with and through other people. What are effectiveness and efficiency in management? What are the distinctions between a manager and a leader? 4+3

   b) What are the three leadership styles of Behavioral Theories? Which one is the most effective leadership style? Discuss on the basis of performance level of the group members and subordinate satisfaction. 7

   c) Based on Follower's Readiness, describe the leadership model given by Hersey and Blanchard. 8

   d) Explain three current issues in leadership. 3

4. a) An organization is a deliberate arrangement of people who act together to accomplish some specific purpose. Your university is an organization, so is the Bangladesh Bank. These examples are all organizations because they have three common characteristics. What are those? 3

   b) The best-known theory of motivation is probably Abraham Maslow's hierarchy of needs theory. It proposed that, within every person there is a hierarchy of five needs. Explain the hierarchy of Needs theory. 5

   c) Differentiate Theory X with Theory Y of management. Explain the implications of motivation-hygiene theory. 4+4

   d) Explain the Expectancy theory of employee motivation. What are the steps to increase employee motivation using expectancy theory? 9

212

B.Sc. Engg. CSE 8th Semester — 23 August 2019 (Morning)

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

MID SEMESTER EXAMINATION — **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 50**

CSE 4809: Algorithm Engineering

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

There are **4 (four)** questions. Answer any **3 (three)** of them including **Question 1 (mandatory)**.

Figures in the right margin indicate marks.

Mandatory

1. a) What is reducibility of a problem? Explain its usage in deciding tractability of a problem. 4
   b) Prove that circuit satisfyability problem is NP-hard. 8
   c) Given the recursion 8

$$T(n) = aT(n/b) + f(n), \quad a \geq 1, b > 1$$

Prove that if $f(n) = O(n^{(\log_b^a - \varepsilon)})$ for some constant $\varepsilon > 0$ then $T(n) = \Theta(n^{\log_b^a})$

2. a) Show the results of inserting the keys 8

F, S, Q, K, C, L, H, T, V, W, M, R, N, P, A, B, X, Y, D, Z, E

with minimum degree 3.

   b) Prove the correctness of Dijkstra's algorithm for finding single source shortest paths. 7

3. a) Write down the recursive equations for all-pair shortest path problems including the formulation given by Floyd-Warshall. 5
   b) Briefly explain the *path-relaxation* property for shortest path problems. 5
   c) Why does Bellman-Ford algorithm for negative weight cycle relax all the edges several times? How many times does the algorithm relax the edges? 5

4. a) Comment on the hardness of the problem of 'data mining'. 5
   b) What is Apriori property? Why does every data mining algorithm uses Apriori property? 5
   c) How does FP-Tree/ FP-Growth algorithm improve over Apriori algorithm for association pattern mining? 5

2.13

B.Sc. Eng. CSE 8th Semester 29 August 2019 (Morning)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4839: Internetworking Protocols

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) What is the difference between routing and forwarding? 5

   b) Write short note on forwarding process in a router when used in following networks, 9

      i. *Connection less Packet Switched Network*

      ii. *Virtual-circuit network*

   c) Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has three links, of rates R1 = 500 kbps, R2 = 2 Mbps, and R3 = 1 Mbps. 7

      i. Assuming no other traffic in the network, what is the throughput for the file transfer?

      ii. Suppose the file is 4 million bytes. Roughly how long will it take to transfer the file to Host B?

   d) What is the key difference between a tier-1 and tier-2 ISP? 4

2. a) How does a newly arriving host in a subnet get an IP address automatically? Describe the procedure with appropriate diagram. 7

   b) An organization is granted the block 130.56.0.0/16. The administrator wants to create total of 1024 subnets. 8

      i. Find the subnet masks.

      ii. Find the number of address in each subnet.

      iii. Find the first and last address in the first subnet.

   c) Consider the network shown in Figure 1, and assume that each node initially knows the costs to each of its neighbors. Consider the distance-vector algorithm and show the distance table entries at node *z*. 5

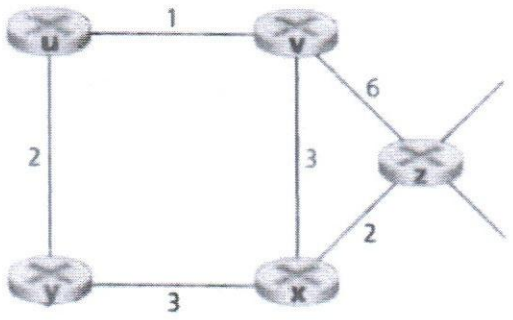

Figure 1: network for Question 2.(c)

   d) Describe the role of Internet Group Management Protocol (IGMP) and multicast routing protocol in multicast routing. 5

3. a) Suppose you purchased a wireless router and connected it to your cable modem. Also that your ISP dynamically assigns your connected device (that is, your wireless router) one IP address. Also suppose that you have five PCs at home that use 802.11 to wirelessly connect to your wireless router. How are IP addresses assigned to the five PCs? Does the wireless router use NAT? Why or why not? 7

   b) Compare and contrast the delays in connectionless and connection-oriented services. 6

c) A multicast address for a group is 232.24.60.9. What is its 48-bit Ethernet address for a LAN using TCP/IP? 6

d) Does Reverse Path Broadcasting (RPB) in Distance Vector Multicast Routing Protocol (DVMRP) actually create a shortest path tree? Explain. What are the leaves of the tree? 6

4. a) Consider an autonomous system named *AS1*, where *RIP* is utilized as its interior routing protocol. The routing table in a particular router *R1* of *AS1* has 20 entries. It does not receive information about five routers for 150s. How many *RIP timers* are running at this time? 8

b) Briefly describe the services provided by Network Layer at the source computer. 8

c) A router *D* using *RIP* (*Routing Information Protocol*) has the routing table shown in Table 1. 9

Table 1: Routing table for router *D* in Question 4. (c)

Destination	*Cost*	*Next Router*
Net1	4	*B*
Net2	2	*C*
Net3	1	*F*
Net4	5	*G*

i. Show the RIP response message sent by this router.

ii. Consider router *D* receives a RIP response message from router *C*, which is summarized as: (Net1, 2), (Net2, 1), (Net3, 3), (Net4, 7).
Show the updated routing table for router *D*.

215

B.Sc. Engg. CSE 8th Semester — 22 August 2019 (Morning)

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

MID SEMESTER EXAMINATION — **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour and 30 Minutes — **FULL MARKS: 75**

CSE 4841: Introduction to Optimization

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) Consider a wireless ad hoc network with n stations, where n is an even number. Assume, at any moment, half the stations (denoted as $s_i, i = 1, 2, \dots, n/2$) transmit data to the remaining half of the stations (denoted as $d_j, j = 1, 2, \dots, n/2$), where the i-th station transmits to the j-th station when $i = j$. The power transmitted by the i-th station faces attenuation h_{ij} by the time it reaches the j-th destination. For the j-th destination, the sum of the powers received from all the stations (excepts its transmitter) is considered as interference, i.e., for the j-th destination when $i \neq j$, the received power is considered as interference. For reliable communication, the signal to interference and noise ratio (SINR) for the i-th transmitter must exceed a certain threshold γ_i. The target of the network is to minimize the power transmitted by all stations while maintaining a reliable communication. Formulate the scenario as an optimization problem. Assume noise power of σ^2 for the wireless channel. — 10

   b) The WorldLight Company produces two light fixtures (products 1 and 2) that require both metal frame parts and electrical components. Management wants to determine how many units of each product to produce so as to maximize profit. For each unit of product 1, 1 unit of frame parts and 2 units of electrical components are required. For each unit of product 2, 3 units of frame parts and 2 units of electrical components are required. The company has 200 units of frame parts and 300 units of electrical components. Each unit of product 1 gives a profit of \$1, and each unit of product 2, up to 60 units, gives a profit of \$2. Any excess over 60 units of product 2 brings no profit, so such an excess has been ruled out.

   i. Formulate an optimization problem for this scenario. — 8

   ii. Use the graphical method to solve this problem and to find the resulting total profit. — 7

2. a) Consider the following optimization problem: — 12

minimize

$$f(\boldsymbol{x}) = x_1^2 + 3x_3^2 + 2x_1x_3 + 4x_1 + 6x_2 + 5x_3$$

subject to

$$x_1 + 2x_3 = 3$$
$$4x_1 + 5x_2 = 6$$

Use the method of direct substitution to this problem.

   b) Consider the following optimization problem: — 13

minimize

$$f(\boldsymbol{x}) = \frac{1}{2}(x_1^2 + x_2^2 + x_3^2)$$

subject to

$$x_1 - x_2 = 0$$
$$x_1 + x_2 + x_3 - 1 = 0$$

Find the optimum solution of the above problem by applying the Lagrange multiplier method.

3. A transistor radio company manufactures models A, B and C which have profit contributions of 8, 15 and 25, respectively. The weekly minimum production requirements are 100 for model A, 150 for model B and 75 for model C. Each type of radio requires a certain amount of time for the manufacturing of component parts, for assembling and packing. Specially, a dozen units of model A require three hours of manufacturing, four hours of assembling and one hour of packing. The corresponding figures for a dozen units of model B are 3.5, 5 and 1.5 and for a dozen units of model C are 5, 8 and 3. During the forthcoming week the company has available 150 hours of manufacturing, 200 hours of assembling and 60 hours of packing time.

   a) Formulate a linear programming model for this problem. 8
   b) Solve the LPP by working through the simplex method step by step in tabular form. 11
   c) Identify the basic feasible solutions for the LPP. 6

4. a) Consider the following LP problem: 12

   $Minimize\ Z = 3x_1 + 2x_2 + 4x_3,$

   subject to

   $$2x_1 + x_2 + 3x_3 = 60$$
   $$3x_1 + 3x_2 + 5x_3 \geq 120$$
   $$x_1 \geq 0, \quad x_2 \geq 0, \quad x_3 \geq 0.$$

   Using the two-phase method, work through the simplex tableau step by step to solve the problem.

   b) Consider the following LP problem: 13

   $Maximize \quad Z = x_1 + 2x_2,$

   subject to

   $$x_1 + 3x_2 \leq 8$$
   $$x_1 + x_2 \leq 4$$
   $$x_1 \geq 0, \quad x_2 \geq 0.$$

   Work through the revised simplex method step by step to solve the problem.

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**
DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4849: Human Computer Interaction

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **4 (four)** questions. Answer any **3 (three)** of them.
Figures in the right margin indicate marks.

---

1. a) Suppose an ATM cash machine has several information which it displays trough a set of user interfaces. For any operation the first page in the UI allows the user to enter their PIN (Personal Identification Number). If this is correct for the customer's card, the machine shows the next page which allows the user to select one of several functionalities. If they select the withdraw cash service they are presented with a page from which they can select a predetermined amount of cash, or can select an option to allow them to determine how much they want. If they select this option they are then presented with a page which allows them to enter a value up to 20000 Taka in BDT. Once the amount of money has been entered (either by selecting a predetermined amount or entering their own amount) the machine returns the card and then the cash to the customer. Answer the followings:
   i. Explain the relationship between GOMS model and MHP for the scenario. 5
   ii. Construct a GOMS model of a customer withdrawing money from an ATM cash machine. 10
   iii. How can you measure human performance based on MHP for this task? Explain. 5

   b) Consider that a user has perceptual processing time $\tau_p = 150\ ms$, cognitive processing time $\tau_c = 50\ ms$, and motor processing time $\tau_m = 50\ ms$. Two symbols appear on the computer terminal. If the second symbol matches the first, the user presses "Y" and presses "N" otherwise. What is the time between the second signal and response? 5

2. a) How do we perceive color? Considering the design implications of color in UI design, give justification of the following statements: 7
   i. We should avoid Green and Red in the periphery
   ii. Older users required brighter color
   iii. Blue color should be avoided for text, lines, and small shapes.

   b) Suppose you want to design a text-based interaction where the font size will be changed according to the distance from the user to display screen. If the screen resolution is 120 dpi, distance is 15 inch, and the visual angle is 30 minutes of the arc then what will be the font size of the text? 6

   c) What are binocular and monocular depth cues of visual perception? Explain with example. 12

3. a) Consider the musical note signal in Figure 1. 6

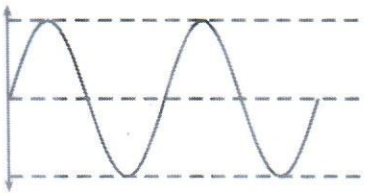


Figure 1: A musical note

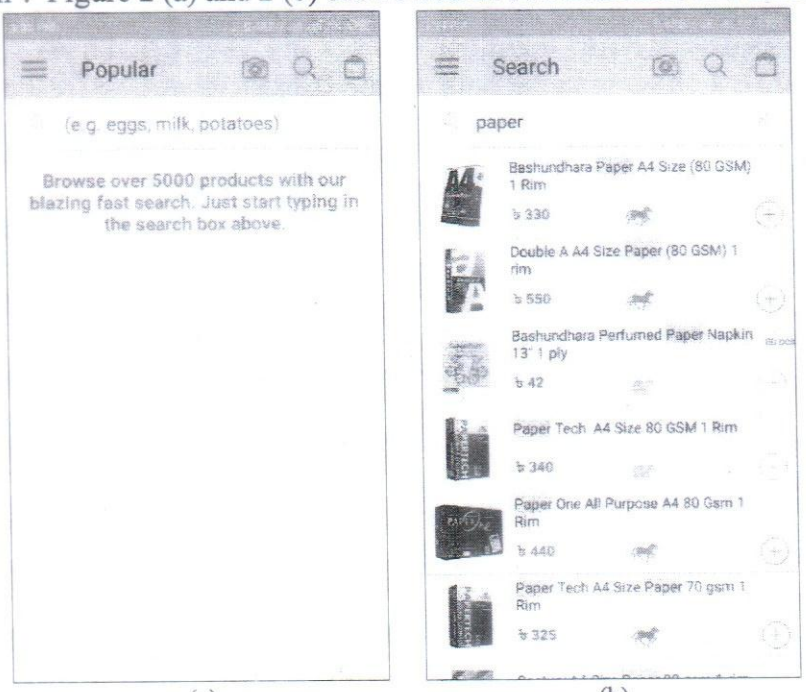
Redraw the diagram for a note:
   i. With higher pitch
   ii. That is louder
   iii. That is softer

b) What is Fitts' law? According to Fitts' law, answer the followings: 7

i. Microsoft Toolbars offer the user the option of displaying a label below each tool. Name at least one reason why labeled tools can be accessed faster. (Assume, for this, that the user knows the tool and does not need the label just simply to identify the tool.)

ii. What is the bottleneck in hierarchical menus and what techniques could make that bottleneck less of a problem?

c) Humans are capable of retaining 7±2 items in the short-term memory. This phenomenon raises design implications to many user interface considering the design principle, 'Recognition is better than recall'. Figure 2 (a) and 2 (b) shows Search box interfaces in a mobile application.



(a) (b)

Figure 2: Search interfaces in a mobile application

Answer the followings:

i. For Figure 2(a) and 2(b), identify the tasks related to memory recall and recognition and list at least two problems related to concept of information retrieval. 6

ii. Redesign the interfaces of Figure 2(a) and 2(b) by drawing hand sketches. 6

4. a) Consider the searching task in the interface shown in Figure 2 (a) and 2 (b). You are given a choice to select two interaction styles for the task. One is writing query string in the search box and another one is giving voice commands using natural language. Use interaction framework to analyze interaction problems involved for the task. 15

Describe different gulfs with examples in each stage of the interactions for these two styles of interaction and justify which interaction style will give better user experience.

b) Micro-interaction is a kind of interaction that gives user experience of using an application far more involved and personalized. An example of a micro-interaction is the little thumbs-up hand icon within the Facebook Messenger app which grows larger the longer you hold your thumb on it. App developers have realized that their users simply adore these novel little features. 10

For the both of the interaction styles (Writing search strings and giving voice commands) in the interface of Figure 2(a), design two micro-interactions for each considering the interaction design issues with proper explanation. [Illustrate using hand sketches if required].

B.Sc. TE (2 Yr) 4th Semester
B.Sc. TE (1 Yr) 2nd Semester

219

27 August 2019 (Morning)

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

MID SEMESTER EXAMINATION — **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

CSE 4873: IT Project Management

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) Planning involves two important elements: goals and plans. What steps should managers follow in setting goals? What are the characteristics of a well-designed goal? 5+4

   b) Strategic management is what managers do to develop the organization's strategies. Even the best strategies can fail if management does not implement or evaluate them properly. Explain the steps that managers should follow while managing strategies of their organizations. Also explain SWOT analysis. 12+4

2. a) There are four management functions: planning, organizing, leading, and controlling. However, you do not have to be a manager to plan, organize, lead, and control. So understanding these processes is important for everyone. Briefly define what each of these functions encompasses. 8

   b) What are the barriers to effective interpersonal communication? How can you overcome those? 6+5

   c) Information technology has radically changed the way organizational members communicate. Give some examples of it. While the economic benefits of information technology are obvious, managers must not forget to address the psychological drawbacks. Give examples of some psychological drawbacks of the use of information technology. 3+3

3. a) Management is coordinating work activities so that they are completed efficiently and effectively with and through other people. What are effectiveness and efficiency in management? What are the distinctions between a manager and a leader? 4+3

   b) What are the three leadership styles of Behavioral Theories? Which one is the most effective leadership style? Discuss on the basis of performance level of the group members and subordinate satisfaction. 7

   c) Based on Follower's Readiness, describe the leadership model given by Hersey and Blanchard. 8

   d) Explain three current issues in leadership. 3

4. a) An organization is a deliberate arrangement of people who act together to accomplish some specific purpose. Your university is an organization, so is the Bangladesh Bank. These examples are all organizations because they have three common characteristics. What are those? 3

   b) The best-known theory of motivation is probably Abraham Maslow's hierarchy of needs theory. It proposed that, within every person there is a hierarchy of five needs. Explain the hierarchy of Needs theory. 5

   c) Differentiate Theory X with Theory Y of management. Explain the implications of motivation-hygiene theory. 4+4

   d) Explain the Expectancy theory of employee motivation. What are the steps to increase employee motivation using expectancy theory? 9

220

B.Sc. TE 2nd Semester (1-Yr)
B.Sc. TE 4th Semester (2-Yr)

22 August 2019 (Morning)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**
DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4885: Human Computer Interaction

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **4 (four)** questions. Answer any **3 (three)** of them.
Figures in the right margin indicate marks.

---

1. a) Suppose an ATM cash machine has several information which it displays trough a set of user interfaces. For any operation the first page in the UI allows the user to enter their PIN (Personal Identification Number). If this is correct for the customer's card, the machine shows the next page which allows the user to select one of several functionalities. If they select the withdraw cash service they are presented with a page from which they can select a predetermined amount of cash, or can select an option to allow them to determine how much they want. If they select this option they are then presented with a page which allows them to enter a value up to 20000 Taka in BDT. Once the amount of money has been entered (either by selecting a predetermined amount or entering their own amount) the machine returns the card and then the cash to the customer. Answer the followings:
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   ii. Construct a GOMS model of a customer withdrawing money from an ATM cash machine. 10
   iii. How can you measure human performance based on MHP for this task? Explain. 5

   b) Consider that a user has perceptual processing time $\tau_p = 150\ ms$, cognitive processing time $\tau_c = 50\ ms$, and motor processing time $\tau_m = 50\ ms$. Two symbols appear on the computer terminal. If the second symbol matches the first, the user presses "Y" and presses "N" otherwise. What is the time between the second signal and response? 5

2. a) How do we perceive color? Considering the design implications of color in UI design, give justification of the following statements: 7
   i. We should avoid Green and Red in the periphery
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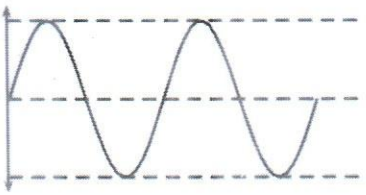
   iii. Blue color should be avoided for text, lines, and small shapes.

   b) Suppose you want to design a text-based interaction where the font size will be changed according to the distance from the user to display screen. If the screen resolution is 120 dpi, distance is 15 inch, and the visual angle is 30 minutes of the arc then what will be the font size of the text? 6

   c) What are binocular and monocular depth cues of visual perception? Explain with example. 12

3. a) Consider the musical note signal in Figure 1. 6



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b) What is Fitts' law? According to Fitts' law, answer the followings: 7

i. Microsoft Toolbars offer the user the option of displaying a label below each tool. Name at least one reason why labeled tools can be accessed faster. (Assume, for this, that the user knows the tool and does not need the label just simply to identify the tool.)

ii. What is the bottleneck in hierarchical menus and what techniques could make that bottleneck less of a problem?

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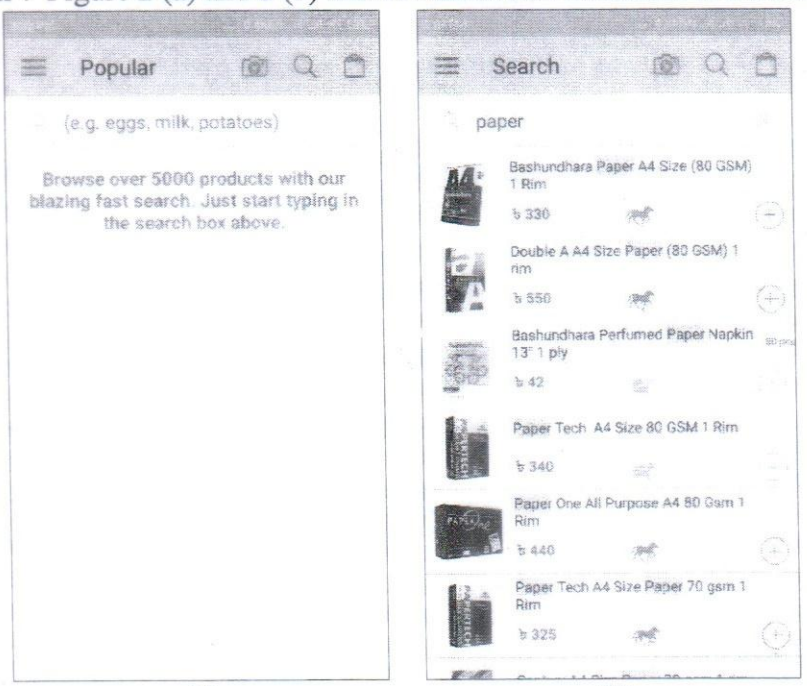

(a) (b)

Figure 2: Search interfaces in a mobile application

Answer the followings:

i. For Figure 2(a) and 2(b), identify the tasks related to memory recall and recognition and list at least two problems related to concept of information retrieval. 6

ii. Redesign the interfaces of Figure 2(a) and 2(b) by drawing hand sketches. 6

4. a) Consider the searching task in the interface shown in Figure 2 (a) and 2 (b). You are given a choice to select two interaction styles for the task. One is writing query string in the search box and another one is giving voice commands using natural language. Use interaction framework to analyze interaction problems involved for the task. 15

Describe different gulfs with examples in each stage of the interactions for these two styles of interaction and justify which interaction style will give better user experience.

b) Micro-interaction is a kind of interaction that gives user experience of using an application far more involved and personalized. An example of a micro-interaction is the little thumbs-up hand icon within the Facebook Messenger app which grows larger the longer you hold your thumb on it. App developers have realized that their users simply adore these novel little features. 10

For the both of the interaction styles (Writing search strings and giving voice commands) in the interface of Figure 2(a), design two micro-interactions for each considering the interaction design issues with proper explanation. [Illustrate using hand sketches if required].

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**
DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 6241: Wireless Sensor Networks

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **4 (four)** questions. Answer any **3 (three)** of them.
Figures in the right margin indicate marks.

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1. a) Define *Access Networks* along with an appropriate diagram. 7
   b) Describe inherent characteristics of *Wireless Sensor Networks (WSNs)* in brief. 6
   c) Define *interference range* and *transmission range* of a wireless transmitter. 6
   d) Compare *frequency division multiple access (FDMA)*, and *space division multiple access (SDMA)* with appropriate diagrams. 6

2. a) Briefly discuss few effective approaches that enhance the network lifetime of energy-constrained *WSNs*. 8
   b) How does a wireless station detect its collided transmission? Is there any difference in collision detection mechanism in wired and wireless networks? 5
   c) "Failure to identify the actual cause of packet loss in dense *Wireless Sensor Networks* significantly reduces the network lifetime". Justify the statement with proper argument. 6
   d) 6

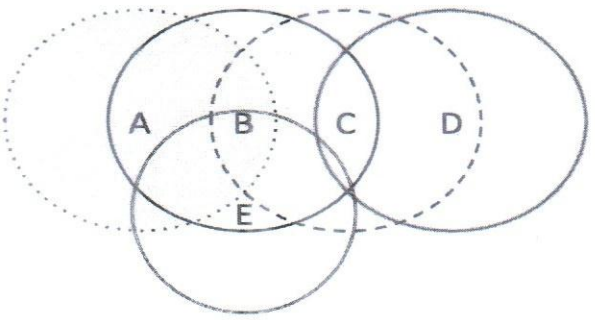

Figure 1: network topology for question 2.d

Consider the topology of a wireless sensor network illustrated in Figure 1. 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, find the exposed terminal and hidden terminal stations while the station D communicates with station C. Answer should include appropriate justification.

3. a) Consider a *multi-hop WSN* consists of η number of distributed sensor nodes ($10<\eta<15$), where all of the participating nodes share a common channel through a contention based medium access mechanism. Let a station titled *X* has just captured a wireless link and transmitted a frame to a station titled *Y*, which is within its transmission range. Thus this channel capture at link (X-Y) restricts few more *neighboring links* (within certain geographical area) to be captured for certain time duration Δt. 6

Considering the above scenario, *draw a diagram* to correctly identify these restricted neighboring *links* during Δt period. Assume the network topology and node's individual transmission ranges by yourself.

b) Mention two fundamental issues of *random access based channel contention* those lead to higher channel wastage. 7

c) What is the fundamental idea of *Sensor-MAC (S-MAC)* protocol? 7

d) Have a comparative analysis on layered architecture and clustered architecture of WSNs. 5

4. a) Discuss the steps followed by the participating sensor nodes during the *Setup-Phase* of *Low-Energy Adaptive Clustering Hierarchy (LEACH)* protocol. 9

b) 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

c) Briefly discuss few promising applications for tomorrow's Internet of Things (IoT). 7

224

Ph.D./M.Sc. Engg CSE 29 August 2019 (Afternoon)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 6263: Advanced Optimization Techniques

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

There are **3 (three)** questions. Answer any **all** of them.

Figures in the right margin indicate marks.

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1. a) Distributed power generation is a key concept in the next generation of power systems. Small scale generators and renewable energy sources can be collected together to supply heterogeneous power demands. Because of its distributed structure, the system is more reliable in terms of maintenance and services, as well as is more flexible in using renewable energy sources. 10

Integrating distributed power units into a framework, using information, communication and smart technologies, is known as a smart power grid. This grid, characterized by power flexibility and reliability, enables the incorporation of various components such as renewable power resources and distributed micro-generators.

A unit of the grid, known as a microgrid (MG), is a group of small generators and loads connected to the grid in multiple points. As a considerable capability, each MG can operate in islanded and grid-connected operation modes. In the grid-connected operation mode, as in Figure 1 given below, each MG interacts with other MGs to establish a set of regulating power flows in the grid. As a result of this regulation, a grid-wide balance between supply and demand is provided, which results in a low operational cost.

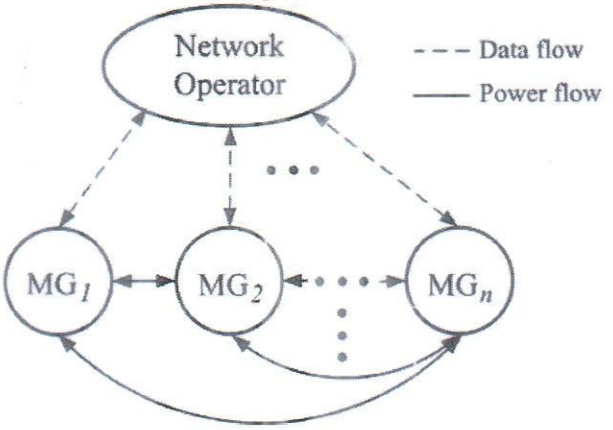

Figure 1.

Consider a distributed power grid consisting of a set N of MGs interconnected through a power and data transmission infrastructure. Power demand within each MG_i, $i = 1, 2, \ldots, N$, is assumed to be γ_i. Moreover, it is assumed that total power generated in MG_i must not exceed σ_i. The objective of the network operator is to establish a set $X = \{x_{ij}\}$ of power flows among MGs in order to minimize a cost function of the system-wide power generation. x_{ij} is the amount of power transmitted from MG_i to MG_j.

Under the assumption of a quadratic cost function for power generation at each MG, i.e., the square of the sum of the total power generated at an MG, formulate the optimization problem.

b) The Whitt Window Company is a company with only three employees which makes two different kinds of hand-crafted windows: a wood-framed and an aluminum-framed window. They earn \$60 profit for each wood-framed window and \$30 profit for each aluminum-framed window. Doug makes the wood frames, and can make 6 per day. Linda makes the aluminum

frames, and can make 4 per day. Bob forms and cuts the glass, and can make 48 square feet of glass per day. Each wood-framed window uses 6 square feet of glass and each aluminum-framed window uses 8 square feet of glass.

The company wishes to determine how many windows of each type to produce per day to maximize total profit.

i. Formulate an optimization problem for this problem. 7

ii. Use the graphical model to solve this model. 8

2. a) Consider the constrained optimization problem: 12

Minimize $f(x_1, x_2, x_3) = x_1^2 + 3x_3^2 + 2x_1x_3 + 4x_1 + 6x_2 + 5x_3$

subject to

$$x_1 + 2x_3 = 3$$
$$4x_1 + 5x_2 = 6$$

Use the method of direct substitution to solve this problem.

b) Use the method of constrained variations to solve the constrained optimization problem: 13

Minimize $f(x_1, x_2) = 2x_1 + +x_2^2$

Subject to $x_1^2 + x_2^2 = 4$

3. Consider the following LP problem:

Minimize $Z = 3x_1 + 2x_2,$

Subject to

$$2x_1 + x_2 \geq 10$$
$$-3x_1 + 2x_2 \leq 6$$
$$x_1 + x_2 \geq 6$$
$$x_1 \geq 0, \quad x_2 \geq 0.$$

a) Using the Big M method, construct the complete first simplex tableau for the simplex method and identify the corresponding initial (artificial) BF solution. 4

b) Work through the simplex method step by step to solve the problem. 8

c) Using the two-phase method, construct the complete first simplex tableau for phase 1 and work through phase 1 step by step. Construct the complete first simplex tableau for phase 2 and Work through phase 2 step by step to solve the problem. 13

M.Sc. Engg. CSE 26 August 2019 (Afternoon)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 6255: Advanced Internet Computing

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) What are Stateful and Stateless protocols? With examples explain which type of Internet applications require these protocols and why. 10

   b) Suppose you are asked to construct a web application (web app) where chunks of data transferred from the server to the client are minimal. It is very agile, responsive, lightweight, highly interactive web app that can be easily transformed into a mobile app. For this application, which web application model would be suitable? Provide enough justification of your chosen web model including the implementation technologies you are going to use. Draw the web application model. 15

2. a) Are there documents that are both HTML and XHTML documents? Is every HTML document also an XHTML document? Is every XHTML document also an HTML document? Explain. 6

   b) Consider the BookML in Figure 1, as an example XML document:

```
<?xml version ="1.0" standalone ="yes"?>
<!DOCTYPE books SYSTEM "books.dtd">
<books>
<book status ="In Print">
<title>Internet Application Architecture</title>
<subtitle> Principles, protocols and practices</subtitle>
<author firstName ="X" lastName ="Y"/>
<author firstName ="P" lastName ="Q"/>
<info>
<pages count ="500"/>
<price usd ="45" bp ="27.50"/>
<publication year ="2011" source ="&jw;"/>
</info>
<summary> An in-depth examination of the basic concepts and general
        principles associated with Web application development,
</summary>
</book>
<!--<book><TBD>
</book> -->
<notes><![CDATA[
     &lt; !-- This is our CDATA example that hides syntactically
     incorrect comments and XML fragments -->
<books><book>
]]>
</notes>
</books>
```

Figure 1: An example XML document

Answer the followings:

i. Define an XML DTD externally for this BookML named, 'books.dtd'. 9

ii. Write an XSL file to display only book title and price for which the year of publication is greater than 2009. 10

3. a) The Model-View-Controller paradigm provides separation of content from presentation, which means that the same model can be presented using many different views. Why does application might require multiple views? Explain. 10

   b) What is session tracking? Show a simple servlet that uses session tracking to count the number of times a client has accessed a web page. 10

   c) When a client request is sent to the servlet container, how does the container choose which servlet to invoke? Explain. 5

4. a) Consider a set of servlets that sell 'Pizza' and share a chef's special pizza of the day. The administrative servlet sets the special of the day (e.g. Name of special pizza and date). Other servlets on the server can access the special pizza and display the message, 'Our special pizza on '26 August, Monday' is 'Pizza di Kampala'. 15

   Write two collaborative servlets (Administrative servlet named, 'SpecialSetter' and other servlet named 'SpecialGetter') for the scenario described above. Is it possible to collaborate with servlets from other web context? Explain.

   b) Demonstrate with an example implementation of the web application Model-2 using JSP and JavaBean technologies. 10

228

PhD. / M.Sc. Engg. CSE 27 August 2019 (Afternoon)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 6265: Advanced Digital Image Processing

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

There are **3 (three)** questions. Answer **all** of them.

Figures in the right margin indicate marks.

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1. a) What are the illumination and reflectance components of an image formation model? How is the intensity level defined from this model? 7

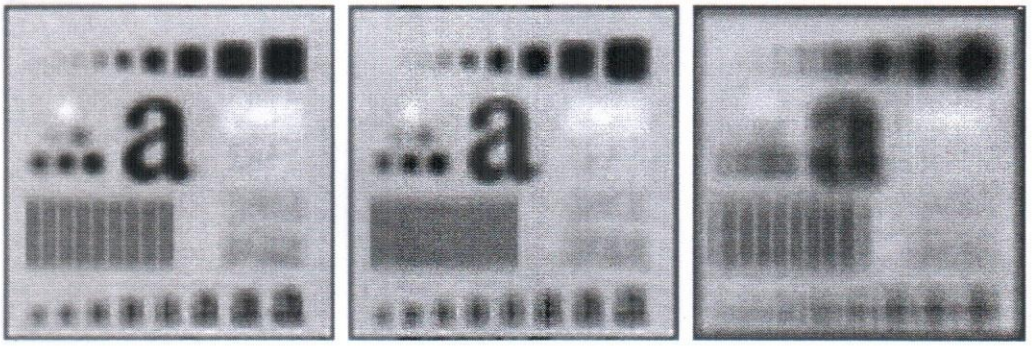
   b) When is an operation H called linear? Show that the absolute operator is not linear. 6

   c) Image subtraction is used often in industrial applications for detecting missing components in product assembly. The approach is to store a "golden" image that corresponds to a correct assembly; this image is then subtracted from incoming images of the same product. Ideally, the differences would be zero if the new products are assembled correctly. Difference images for products with missing components would be nonzero in the area where they differ from the golden image. What conditions do you think have to be met in practice for this method to work? 6

   d) After separately applying channel-wise Histogram Equalization on a RGB color image, what will be average intensity of the equalized output? Justify your answer. 6

2. a) Is Median filter a smoothing or sharpening filter? Explain your choice. 6

   b) The three images shown in Figure 1 were blurred using square averaging masks of sizes n = 23, 25, and 45, respectively. As shown below, the vertical bars on the left lower part of Figure 1.(a) and 1.(c) are blurred, but a clear separation exists between them. However, the bars have merged in Figure 1.(b), in spite of the fact that the mask that produced this image is significantly smaller than the mask that produced Figure 1.(c). Explain the reason for this. 12



(a) **(b)** **(c)**

Figure 1.

   c) Design a single filter which can perform high-boost filtering with a single pass of convolution operation. 7

3. a) How does Homomorphic filter act as both low-pass and high-pass filter? 7

   b) Why does Ringing effects appear when Ideal filters are applied? 5

   c) The two Fourier spectra shown in Figure 2 are of the same image. The spectrum on the left corresponds to the original image, and the spectrum on the right was obtained after the image was padded with zeros. Explain the significant increase or decrease in signal strength along the vertical and horizontal axes of the spectrum shown on the right. Also explain 8

whether there will be increase of decrease of the spectrum value in the DC component for the padded image.

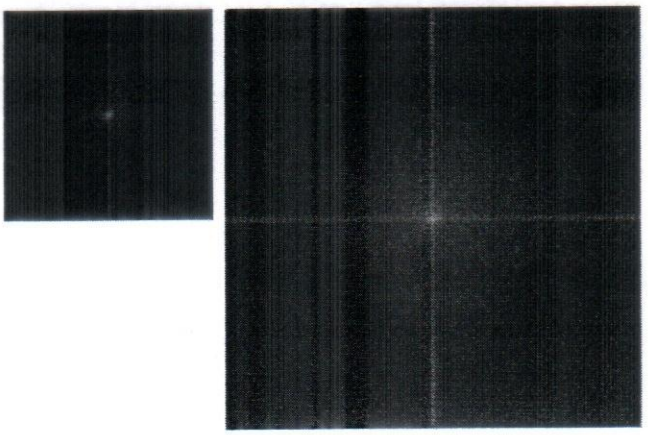


Figure 2.

d) Among the Butterworth and Gaussian filters, which one do you prefer more? Justify your choice. 5

Islamic University of Technology

Organisation of Islamic Cooperation (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 6279: Big Data Analysis and Management

Programmable calculators are not allowed. Do not write anything on the question paper. **Answer all questions.** Figures in the right margin indicate marks.

1. (a) The term "Big Data" is a misnomer. Explain. Although there are a number of different ways to define big data, IBM uses three parameters for big data. Briefly explain each of them with relevant reference data and example. [5]

   (b) *Big Data introduces a paradigm shift in terms of analytic focus. We are moving from descriptive analytics to predictive and prescriptive analytics.* Explain this concept. [5]

   (c) Explain the matrix-vector multiplication by MapReduce. Also describe the technique to cope with the situation when the vector v does not fit in main memory. [10]

2. (a) Mining massive dataset is often considered as the discovery of "models" from different aspects such as statistics and machine learning. In particular special care must be taken if machine learning is the correct choice for building models. Briefly strengthen the argument. [5]

   (b) Explain the Bonferroni's Principle (BP) to avoid "bogus" false positive. Consider the following scenario: [5+10]

   Objective: To detect "evil doers" We assume that such people periodically gather at a hotel to plot.

   Assumptions:

   - There are 50 million people who might be evil doers.
   - Everyone goes to a hotel one day out of 50 days.
   - A hotel's capacity is 50 persons.
   - Total observation period is 500 days.

   Your task is to apply the BP to test if this approach to detecting evil doers is feasible.

   (c) What is power law? Prove that it is essentially a transformation from exponential to linear relationship. Mention few applications that exhibit power law. [5]

3. (a) Define Jaccard Similarity. This measure can not capture the preference of the users. Justify with example. Propose an alternative measure to address it and comment on its upper limit. Finally show your previous example for this new measure. [5]

   (b) What is shingle? Comment on its size. Is the traditional shingle capable to identify similar news article on the web? Justify your position. [5]

(c) What is Minhash Signature? Why is it used for large number of document similarity? Consider the following tables for input matrix and random permutation matrix. Your task is to construct the Minhash Signature for each column and show its correctness (approximate). [5+10]

Table 1: Input Matrix

C-1	C-2	C-3	C-4
1	0	1	0
1	0	0	1
0	1	0	1
0	1	0	1
0	1	0	1
1	0	1	0
1	0	1	0

Table 2: Random Permutation Matrix

P1	P2	P3	P4
3	7	2	1
4	5	1	6
7	4	6	2
6	2	3	4
1	3	5	3
2	6	4	7
5	1	7	5

(d) What is Locality-Sensitive Hashing (LSH) for documents? *"It addresses both memory and computational time"*- Justify with a suitable example. [5]

232

PhD/ M.Sc. Engg. CSE

30 August 2019

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

MID SEMESTER EXAMINATION — **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

CSE 6283: Advanced Algorithms

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

There are **3 (three)** questions. Answer all of them.

Figures in the right margin indicate marks.

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1. a) Define Turing Machine. How did Turing prove that, the 'Halting Problem' is undecidable? 9

   b) Prove that circuit satisfiability problem is NP-hard. 8

   c) Given the recursion 8

   $$T(n) = aT(n/b) + f(n), \quad a \geq 1, \; b > 1$$

   Prove that if $f(n) = \Omega(n^{(\log_b^a + \varepsilon)})$ for some constant $\varepsilon > 0$ and if $af(n/b) < cf(n)$ then, $T(n) = \Theta(f(n))$

2. a) Show the results of inserting the keys in a B-Tree with minimum degree 3: 9

   S, F, S, Q, K, C, L, H, T, V, W, M, R, N, P, A, B, X, Y, D, Z, E

   b) Given the flow network defined by the adjacency list below: 8

   source -> $v_1 = 16$
   source -> $v_2 = 13$
   v_1 -> v_3 = 12
   v_2 -> v_1 = 4
   v_2 -> v_4 = 14
   v_3 -> v_2 = 9
   v_3 -> sink = 20
   v_4 -> v_3 = 7
   v_4 -> sink = 4

   Find the maximum flow for the network.

   c) Prove the correctness of Dijkstra's algorithm for finding single source shortest paths. 8

3. a) In an e-commerce site customers browse the products randomly by clicking on the links and thumbnails. The browsing habits indicate their buying habits and hence can be mined for product recommendations. Elaborate the idea of using association rule mining, sequence mining, and graph mining in click streams for product recommendations. 15

   b) Construct/Define the dynamic programming algorithm/equation for DTW and Viterbi algorithms. 10

233

M.Sc. TE 2nd Semester

22 August 2019 (Afternoon)

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

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 6293: Data Warehousing and Mining

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) Bioinformatics is one of the most impactful area of Data Mining. It is the science of storing, analyzing, and utilizing information from biological data such as sequences, molecules, gene expressions, and pathways. Though it is one of the promising areas, it comes with a lot of challenges. Outline the major research challenges of data mining in Bioinformatics. 15

   b) Outliers are often discarded as noise. However, one person's garbage could be another's treasure. For example, exceptions in credit card transactions can help us detect the fraudulent use of credit cards. Give two more examples where outlier information can be useful. 10

2. a) Briefly outline how to compute the dissimilarity between objects described by mixed attribute. 3×4

   b) What are the challenges faced during Data Integration? 9

   c) Differentiate *Interval-scaled attributes* from *Ratio-scaled attributes.* 4

3. a) Data quality can be assessed in terms of several issues, including accuracy, completeness, and consistency. For each of the above three issues, discuss how data quality assessment can depend on the intended use of the data, giving examples. Propose two other dimensions of data quality. 10

   b) Suppose that the data for analysis includes the attribute age. The age values for the data tuples are (in increasing order): 3×3

   13, 15, 16, 16, 19, 20, 20, 21, 22, 22, 25, 25, 25, 25, 25, 30, 33, 33, 35, 35, 35, 35, 36, 40, 45, 46, 52, 70, 82, 86.

   i. Give the five-number summary of the data.
   ii. Is there any outlier here? What are those?
   iii. Show a boxplot of the data.

   c) "Manhattan distance and Euclidean distance are variations of Minkowski distance." – Justify this statement. 6

4. a) Given two objects represented by the tuples (-2, 1, 42, 10) and (21, 0, -6, 10): 5×4

   i. Compute the Euclidean distance between the two objects.
   ii. Compute the Manhattan distance between the two objects.
   iii. Compute the Minkowski distance between the two objects, using h = 4.
   iv. Compute the supremum distance between the two objects.
   v. Which distance among them is the most suitable one. Justify your Answer.

   b) What are the different types of data used in Data Mining applications? 5

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
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MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 6297: Wireless Sensor Networks

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) Define *Access Networks* along with an appropriate diagram. 7
   b) Describe inherent characteristics of *Wireless Sensor Networks (WSNs)* in brief. 6
   c) Define *interference range* and *transmission range* of a wireless transmitter. 6
   d) Compare *frequency division multiple access (FDMA)*, and *space division multiple access (SDMA)* with appropriate diagrams. 6

2. a) Briefly discuss few effective approaches that enhance the network lifetime of energy-constrained *WSNs*. 8
   b) How does a wireless station detect its collided transmission? Is there any difference in collision detection mechanism in wired and wireless networks? 5
   c) "Failure to identify the actual cause of packet loss in dense *Wireless Sensor Networks* significantly reduces the network lifetime". Justify the statement with proper argument. 6
   d) 6

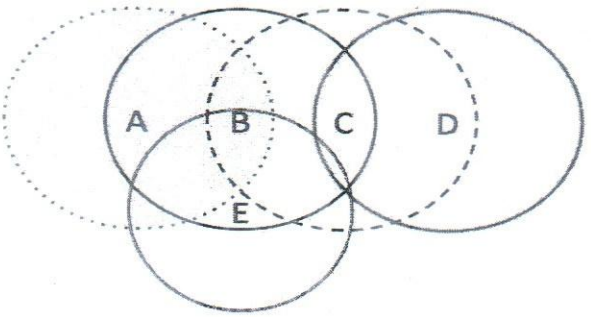

Figure 1: network topology for question 2.d

Consider the topology of a wireless sensor network illustrated in Figure 1. 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, find the exposed terminal and hidden terminal stations while the station D communicates with station C. Answer should include appropriate justification.

3. a) Consider a *multi-hop WSN* consists of η number of distributed sensor nodes ($10<\eta<15$), where all of the participating nodes share a common channel through a contention based medium access mechanism. Let a station titled *X* has just captured a wireless link and transmitted a frame to a station titled *Y*, which is within its transmission range. Thus this channel capture at link (X-Y) restricts few more *neighboring links* (within certain geographical area) to be captured for certain time duration Δt. 6

   Considering the above scenario, *draw a diagram* to correctly identify these restricted neighboring *links* during Δt period. Assume the network topology and node's individual transmission ranges by yourself.

b) Mention two fundamental issues of *random access based channel contention* those lead to higher channel wastage. 7

c) What is the fundamental idea of *Sensor-MAC (S-MAC)* protocol? 7

d) Have a comparative analysis on layered architecture and clustered architecture of WSNs. 5

4. a) Discuss the steps followed by the participating sensor nodes during the *Setup-Phase* of *Low-Energy Adaptive Clustering Hierarchy (LEACH)* protocol. 9

b) 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

c) Briefly discuss few promising applications for tomorrow's Internet of Things (IoT). 7

M.Sc. TE (2-Yr) 4th Semester — 26 August 2019 (Afternoon)

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

MID SEMESTER EXAMINATION — **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

CSE 6491: Advanced Internet Computing

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) What are Stateful and Stateless protocols? With examples explain which type of Internet applications require these protocols and why. 10

   b) Suppose you are asked to construct a web application (web app) where chunks of data transferred from the server to the client are minimal. It is very agile, responsive, lightweight, highly interactive web app that can be easily transformed into a mobile app. For this application, which web application model would be suitable? Provide enough justification of your chosen web model including the implementation technologies you are going to use. Draw the web application model. 15

2. a) Are there documents that are both HTML and XHTML documents? Is every HTML document also an XHTML document? Is every XHTML document also an HTML document? Explain. 6

   b) Consider the BookML in Figure 1, as an example XML document:

```
<?xml version ="1.0" standalone ="yes"?>
<!DOCTYPE books SYSTEM "books.dtd">
<books>
<book status ="In Print">
<title>Internet Application Architecture</title>
<subtitle> Principles, protocols and practices</subtitle>
<author firstName ="X" lastName ="Y"/>
<author firstName ="P" lastName ="Q"/>
<info>
<pages count ="500"/>
<price usd ="45" bp ="27.50"/>
<publication year ="2011" source ="&jw;"/>
</info>
<summary> An in-depth examination of the basic concepts and general
          principles associated with Web application development.
</summary>
</book>
<!--<book><TBD>
</book> -->
<notes><![CDATA[
     &lt; !-- This is our CDATA example that hides syntactically
     incorrect comments and XML fragments -->
<books><book>
]]>
</notes>
</books>
```

Figure 1: An example XML document

Answer the followings:

i. Define an XML DTD externally for this BookML named, 'books.dtd', 9

ii. Write an XSL file to display only book title and price for which the year of publication is greater than 2009. 10

3. a) The Model-View-Controller paradigm provides separation of content from presentation, which means that the same model can be presented using many different views. Why does application might require multiple views? Explain. 10

   b) What is session tracking? Show a simple servlet that uses session tracking to count the number of times a client has accessed a web page. 10

   c) When a client request is sent to the servlet container, how does the container choose which servlet to invoke? Explain. 5

4. a) Consider a set of servlets that sell 'Pizza' and share a chef's special pizza of the day. The administrative servlet sets the special of the day (e.g. Name of special pizza and date). Other servlets on the server can access the special pizza and display the message, 'Our special pizza on '26 August, Monday' is 'Pizza di Kampala'. 15

   Write two collaborative servlets (Administrative servlet named, 'SpecialSetter' and other servlet named 'SpecialGetter') for the scenario described above. Is it possible to collaborate with servlets from other web context? Explain.

   b) Demonstrate with an example implementation of the web application Model-2 using JSP and JavaBean technologies. 10