B.Sc. Engg. SWE 1st Semester 27 February 2020 (Afternoon)

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

SWE 4101: Introduction to Software 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 No. 1.**

Figures in the right margin indicate marks.

(Mandatory to Answer)

1. a) Every semester students sit for the examinations and obtain marks which are eventually converted to letter grades. Subject-wise credits and letter grades are then converted to a GPA (Grade Point Average) for the student in that particular semester using the rules: 10

   - First the subject wise letter grades will be converted to a point. For example, if a student gets A+ he/she will be awarded 4.0; subsequently he/she will get 3.75 for A, 3.5 for A-, 3.25 for B+, 3.00 for B, 2.75 for B-, 2.50 for C+, 2.25 for C and 2.0 for D. F grade is not assigned any point and if any student gets F grade, his/her GPA will not be calculated.
   - Then subject-wise points is calculated by multiplying the letter grade with the subject's credit. For example, if a student gets A+ in a 3 credit subject he/she will receive 4×3=12 points for the particular subject.
   - The total points received is calculated by summing up all the subject-wise points.
   - GPA is the points received per credit on an average.

   Write an algorithm in pseudo-code or flow chart format to calculate the GPA of a student. Assume data structures: *subjectWiseCredit* and *subjectWiseLetterGrade* and *numberOfSubjects* which will be provided as input. For example: *subjectWiseCredit*[1] will show the credit for subject 1 and *subjectWiseLetterGrade*[1] will provide the letter grade.

   Your algorithm should have a sub algorithm to find the point for each letter grade. For example: you may have a procedure *getPointForLetterGrade* (letterGrade) for this purpose.

   b) Convert $(55)_{10}$ to a 6
      i. Base-3 number.
      ii. Base-7 number.

   c) Perform the following 2's complement arithmetic assuming 4-bit computer system and comment on the validity of the result: 6
      i. 5 - 2
      ii. -4 -4

   d) Convert $(1234)_5$ to a base-25 number. 3

2. a) Suppose a programmable Fan has three speed levels including Off mode which can be activated by sending commands 00, 01, and 02. You want to program another speed level for 'stepping speed'. In stepping speed mode, the speed will gradually increase and then decrease and will repeat. Suppose the Fan has a ROM to store your commands and can be recalled by a command number assigned. 7
   Program the device 'Fan' for the 'Stepping speed' mode.

   b) How does the computer define/ generate the clock speed. Why is it so difficult to fabricate very high speed processor? 6

   c) Explain the steps of the scenario from when you type an URL on the browser to how you get a web page in response. 12

3. a) Internet Service Providers (ISPs) are normally the enablers who connect the users to the internet. Mention 3 (Three) different technologies with brief description that enable you to connect to the internet. 6

b) What is the need of the compiler when assembler is sufficient to do computer programming? Why is a linker needed? 3+3

c) Briefly describe the keyboard technologies. 6

d) Briefly describe the technologies inside an optical mouse. 7

4. a) Write the algorithm to convert a decimal number to a number of another base ***B***. 6

b) Write down the design differences of HTTP and FTP protocols. 6

c) What is BIOS? Write its importance for a computer system. 4

d) Write the difference(s) between computer virus and other malwares. Briefly describe the attacking model of *ransomware*. 6

e) What is a server from the perspective of hardware and software? 3

B.Sc. Engg. CSE 1st Semester — 27 February 2020 (Afternoon)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

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

CSE 4105: Computing for Engineers

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.**

Figures in the right margin indicate marks.

(Mandatory to Answer)

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      i. Base-3 number.
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      ii. -4 -4

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Library-

B.Sc. Engg. CSE 1st Semester
B.Sc. in SWE 1st Semester

25 February, 2020 (Afternoon)

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**
DURATION: 1 Hour 30 Minutes **FULL MARKS:100**

Math 4141: Geometry and Differential Calculus

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.
Draw the figure or figures where necessary.

Section-A

1 a) Find the angle for which the axes rotate to remove the xy term in the equation $3x^2+2xy+3y^2-18x-22y-50=0$. Also find the transformed equation. 10

b) Find the value of λ, so that the conic $6x^2+2\lambda xy+12y^2+22x+31y+20=0$ represent a pair of straight lines. 8

c) Define conic sections in a plane. Write the different conditions that the general equation of second degree represents a conic. Discuss the nature of the conic $x^2-y^2-6xy-4y+6=0$. 15.33

2 a) Suppose AB be any line, where A= (1,-1, 1) and B= (2, 1,-1), Find the directions angles of this line. If CD is another line, where C= (-1, 0, 1) and D= (1, 2, 3), then find the projection of the line AB on the line CD by using two different methods. 20

b) Find the distance of a point (-2, 3, 4) from the line through the point (-1, 3, 2) whose direction cosines are proportional to (12,-3,-4). 13.33

Section-B

3 a) A function is defined by the formula: 10

$$f(x) = \begin{cases} x+2, & when\ x < -1 \\ x^2, & when\ 1 > x \geq -1 \\ x, & when\ x \geq 1 \end{cases}$$

Sketch graph, and determine the Domain and Range of the function.

b) Determine whether the following functions are even, odd, or neither. 10

$$f(x) = |x| - 1 \text{ and } g(x) = 3\sqrt{x}$$

Using the graphs also state whether the functions are symmetric with respect to the y-axis or the origin.

c) Find x - intercepts and y - intercepts of the linear functions: 13.33

$$g(x) = 3x - 1 \text{ and } h(x) = -5x + 2.$$

What are the average rate of change of the functions in the interval $[-2, 2]$? Also comment whether the functions are increasing or decreasing within the interval.

4 a) What transformations are to be used to obtain the function $g(x) = 2|\frac{1}{2}x - 1| + 1$ from $f(x) = |x|$. Explain your arguments providing graph. 10

b) Let us consider two functions 13.33

$$f(x) = \frac{1}{1+x} \text{ and } g(x) = \frac{1}{x} + 1.$$

Determine the domains of $f(g(x))$ and $g(f(x))$. Do you think the functions are inverse of each other? Find the inverse of the function $f(x) = ln\,(x-1)$ if possible.

c) Using the concept of limit, find the horizontal asymptotes of the function 10

$$f(x) = \frac{5x^2+8x-3}{3x^2+2}.$$

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Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

Phy 4141: Physics 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 4**.

Figures in the right margin indicate marks.

Use single answer script

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1. a) State and explain Coulomb's law in electrostatics. With the help of an example show that electric charge is conserved. 7

   b) State Gauss's law in electrostatics. Write down Gauss's law for electricity, magnetism and the gravitation. A hypothetical cylinder of radius R is immersed in a uniform electric field E, the cylinder axis being parallel to the field. Show that the electric flux ϕ_E for this closed surface is zero. 10

   c) The distance r between the electron and proton in hydrogen atom is about 5.3×10^{-11} meter. Calculate the magnitude of electrical force and the gravitational force between these two particles. ($G = 6.7 \times 10^{-11}$ nt-m^2/kg^2, $\varepsilon_0 = 8.85$ x 10-12 coul^2/nt-m^2) 8

2. a) Define electric field E. Obtain an expression for the electric field E at a distance y from an infinitely long line charge of linear charge density λ. 7

   b) What is an electric dipole and the dipole moment? Find the electric field E due to a dipole at a distance r along the perpendicular bisector of the dipole. Plot E for a point charge and a dipole as function of r with E being on the Y-axis and r along the X-axis. 10

   c) Calculate the magnitude of the electric field strength E such that an electron placed in the field, would experience an electric force equal to its weight ? 8

3. a) Define electric potential V. How is V related to the electric field E? What is an equipotential surface ? Draw equipotential surfaces for a point charge and an electric dipole. 7

   b) Show that potential due to a point charge is given by $V \frac{1}{4\pi\varepsilon_o}\frac{q}{r}$ where the symbols have their usual meaning. 10

   c) Calculate the electric potential at the surface of a gold nucleus. The radius of gold nucleus is 6.6 x 10-15 meter and the atomic number of gold Z = 79. 8

[Mandatory]

4. a) What is Fresnel biprism? How did Fresnel construct a biprism in order to study interference of light? 7

   b) Give a diagram showing clearly how coherent sources are produced in a biprism. How is the separation between such coherent sources measured in the experiment with biprism. Explain how you determined the wave length of light using biprism experiment. 10

   c) In a biprism experiment the eyepiece is placed at a distance of 1.2 m from the source. The distance between the virtual sources was found to be 7.5×10^{-4} m. Find the wavelength of light, if the eyepiece is to be moved transversely through a distance of 1.89 cm for 20 fringes. 8

B.Sc. Engg. SWE 1st Semester — Library — 02 March 2020 (Afternoon)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

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

Phy 4143: Physics 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. a) Discuss the characteristics of a junction diode. Distinguish an ideal diode and a practical (commercial) diode. Define diode cut-in voltage, the reverse saturation current, and the breakdown voltage? 7

   b) Discuss the characteristics of a practical diode. How would you draw the load-line of a diode? Draw I-V characteristics of an ideal diode and a practical diode and discuss these two curves in terms of diode response to an AC and a DC signal. Assume any values of I and V to draw the load line. 10

   c) Draw a diode characteristics curve to show that the device ideally acts as a low resistance path to current in the reverse direction much like a switch that passes current in only one direction. 8

2. a) State and explain Kirchoff's voltage (KVL) and current laws (KCL). What is an equivalent circuit? Draw three voltage sources V_1, V_2 and V_3 in series and hence transform it to the equivalent circuit. 7

   b) Three resistor of values : 10 Ohms, 20 Ohms and 30 Ohms, respectively are connected in series across a 12 Volt battery supply. Calculate : 10

      i. the total resistance
      ii. the circuit current
      iii. the current through each resistor
      iv. the voltage drop across each resistor
      v. hence verify that Kirchoff's voltage law holds true

   c) Answer the followings: 8

      i. Draw a network of resistors R_1, R_2 and R_3 in "Y form" and in "T form"
      ii. Draw a network of resistors R_1, R_2 and R_3 in "Δ form" and in "Π form"

3. a) State and explain Thevenin and Norton theorem. Define a linear network. What do you mean by source transformation ? 7

   b) Find the Thevenin equivalent of the circuit shown below at the terminal a-b. 10

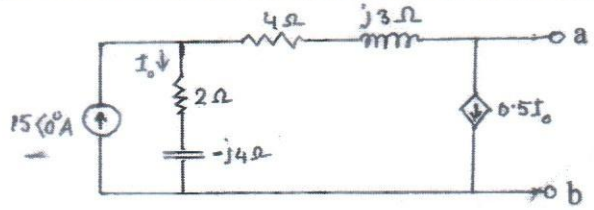

Figure 1: Figure for question 3.b.

   c) What are dependent and independent sources? What are the Thevenin and Norton equivalent of an AC circuit consist of? 8

4. a) What are Phasors? How would you represent a pure sinusoidal graphically by a phasor? Draw the phasor diagrams for a resistor, for an inductor and for a capacitor. 7

   b) A sinusoidal voltage is given by $v(t) = 50 \cos (30t + 10^{o})$ V. Find the followings: 10

      i. the amplitude V_m
      ii. the period T
      iii. the frequency f , and also $v(t)$ at $t = 10$ ms

   c) Transform the following sinusoids to Phasors: 8

      i. $i = 6 \cos(50t - 40^{o})$ A
      ii. $v = -4 \sin(30t + 50^{o})$ V

B.Sc. Engg. SWE 3rd Semester — 25 February 2019 (Afternoon)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

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

SWE 4301: Object Oriented Concepts II

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) Describe Liskov Substitution Principle (LSP) in no more than 4 sentences. 4

   b) Give a code example where the inheritance used for code re-usability but it violates the Liskov Substitution Principle. Rewrite the code with composition. 13+8

2. a) Describe Open-Closed Principle (OCP) in no more than 4 sentences. 4

   b) Give a code example where the Open-Closed Principle is violated. Assume that the code has been refactored so that OCP violation is no longer there. Draw a class diagram for the refactored version of the code. 13+8

3. a) Can you fix a bug by refactoring a code? Justify your answer. 5

   b) Explain why unit test is important for refactoring. 5

   c) Two facts about code are that code will change over time, and that code is read more times than it is written. What are the implications of these two facts? 5

   d) Assume that Cat and Dog are subtypes of Animal. Which of the statements from line 11 to 15 will compile, which will not? 10

```
1. void doWithCat(Cat cat) {
2. }
3.
4. void doWithAnimal(Animal animal) {
5. }
6.
7. void demo() {
8. Animal a = new Animal();
9. Cat c = new Cat();
10.      Dog d = new Dog();
11.      a = c;              // 1
12.      c = a;              // 2
13.      d = c;              // 3
14.      doWithCat(a);       // 4
15.      doWithAnimal(c);    // 5
16.      }
```

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
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MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

CSE 4303: Data structures

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

There are **4 (four)** questions. **Question no 4 is Mandatory to answer.**

Answer any **2 (two)** from the remaining.

Figures in the right margin indicate marks.

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1. a) Suppose a C++ parser is created which uses Reverse Polish notation. The following statement exhibits the result after being parsed using this parser. 7

```
a value . 3 4 s sin * + =
```

Here '*sin*' is a function of one argument and '.' is the member access operator, while 'a' and 's' are variables. How would this statement appear in the normal C++ programming language?

b) Implement a Queue using a Singly Linked List. The operations En-queue and De-queue should take $O(1)$ time. Explain the usefulness of Circular Queue in this scenario. 12

c) Find the Time-complexity of the following program assuming n is the size of the input data and b is a positive integer greater than 1. 6

```
1. void main(){
2.   j=1;
3.   Repeat step 4 and 5 while j<=n
4.     Function_1();
5.     j=b×j;
6. }

1. void Function_1(){
2.   i=2;
3.   repeat step 4 while i<=1000
4.     i=i×i;
5.   cout<<i;
6. }
```

2. a) A tree has Pre-order-depth-first and Level-order traversals respectively defined as: 6

```
A B C D E G F
A B C D E F G
```

Determine the original tree from this information.

b) Briefly propose an algorithm to implement a First-in-First-out queue with a priority queue. 7

c) With proper mathematical arguments prove that, the process of building a Max-heap from an arbitrary set of numbers can be done in linear time. 12

3. a) Perform the following operations in an AVL Tree: 15

```
insert(100)
insert(150)
insert(200)
insert(250)
insert(225)
insert(210)
insert(110)
delete(150)
insert(220)
insert(205)
insert(115)
delete(110)
delete(100)
delete(210)
```

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

b) Show that, "If a node in a binary search tree has two children, then its successor has no left child and its predecessor has no right child". 10
Justify the statement again considering the condition of having two children being withdrawn.

[Mandatory]

4. a) The n^{th} Fibonacci number is defined as the sum of the two previous Fibonacci numbers where the 0^{th} and 1^{st} Fibonacci numbers are defined as 1. Suppose that each all of the function occupies 100 bytes on the call-stack. 10

```
int Fibonacci(int n){
    return (n<=1) ? 1 : Fibonacci(n-1) + Fibonacci(n-2);
}
```

What is the maximum size of the stack when this function is called with the argument n = 4? What is the total number of function calls made, including the initial call? Draw necessary figures to justify your answer.

b) What is the difference between the Binary-search-tree property and the Min-heap property? Can the min-heap property be used to print out the keys of an n-node tree in sorted order in $O(n)$ time? Justify your answer. 8

c) Where can the smallest element reside in a max-heap, assuming that all the elements are distinct? What will be the worst-case time complexity to find that element? (use tight-bound) 7

B.Sc. Engg. in CSE/SWE 3rd Semester — 27 February 2020 (Afternoon)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

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

CSE 4305: Computer Organization and 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) To asses a system following SPEC benchmark suit, we have to consider a specific calculation procedure. 12
   i. Mention each steps of that calculation procedure using respective evaluation flowchart.
   ii. What type of mean will be used to calculate overall metric? Justify your assertion.
   iii. How does this assessment procedure will take into account a system with multiple processors?

   b) A hypothetical machine has three instruction with their binary code: 8

   0001 = Load AC from memory
   0010 = Store AC to memory
   0101 = Add to AC from memory
   0011 = Load AC from I/O device
   0111 = Store AC to I/O device

   In these cases, the 12-bit address identifies a particular I/O along with memory locations. Show the program execution only drawing registers, buffers of I/O devices and memory contents in hexadecimal for the following program:
   i. Load AC from I/O device 5
   ii. Add content of memory location 940
   iii. Store AC to device 6
   iv. Store the I/O device address (where final result was stored) to memory location 941

   [Hints: You should follow the instruction cycle state diagram to complete the program execution. Also assume I/O device 5 has the value of 3 and the memory location 940 contains a value of 2.]

   c) Define following terms: 5
   i. XU
   ii. RC delay
   iii. ISR
   iv. Thrashing
   v. Sense Amplifier

2. a) What happens when a check bit rather than a data bit is in error? How many check bits are needed if the Hamming error correction code is used to correct single bit and detect double bits errors in a 1024-bit data word? Justify your answer. 5

   b) Draw the structure of the IAS computer figuring out its all major components proposed by von Newmann. Also quote the key points from his proposal based on what this structure was outlined. 10

   c) Consider a machine with a byte addressable main memory of 2^{16} bytes and block size of 8 bytes. Assume that a direct mapped cache consisting of 32 lines is used with this machine. 10
   i. How is a 16-bit memory address divided into tag, line number, and byte number?

ii. Into what line would each of the following byte addresses be stored?

0001 0001 0001 1011
1100 0011 0011 0100
1101 0000 0001 1101
1010 1010 1010 1010

iii. Suppose the byte with address 0001 1010 0001 1010 is stored in the cache. What are the addresses of the other bytes stored along with it?

iv. How many total bytes of memory can be stored in the cache?

v. Why the tag is also stored in the cache?

3. a) Suppose that the processor has access to two levels of memory. Level 1 contains 1000 words and has an access time of 0.01 μs; level 2 contains 100,000 words and has an access time of 0.1 μs. Assume that if a word to be accessed is in level 1, then the processor accesses it directly. If it is in level 2, then the word is first transferred to level 1 and then accessed by the processor. For simplicity, we ignore the time required for the processor to determine whether the word is in level 1 or level 2. If 95% of the memory accesses are found in level 1, what is the average time to access a word? 5

b) Consider the following 20-bit data: 20

01010000111100111001

i. How many additional bits are required to develop an SEC-DED code for the data mentioned above?

ii. Develop the algebraic expression to calculate the check bits respectively.

iii. Develop an SEC-DED code and present all data and check bits properly following their layout.

iv. Show that your derived expressions will correctly identify an error in data bit 5.

4. a) Criticize different types of approaches to handle multiple interrupts concisely. 5

b) "The set associative mapped cache can be implemented as fully associative cache or direct mapped cache as well" – justify this statement. Draw figures if necessary. 7

c) Table 1 shows the execution times, in seconds, for five different benchmark programs on three machines: 13

Table 1: Execution time in seconds for different processors.

Benchmark	Processor		
	R	M	Z
E	417	244	134
F	83	70	70
H	66	153	135
I	39,449	35,527	66,000
K	772	368	369

i. Compute the speed metric for each processor for each benchmark, normalized to machine ***R*** treating as the reference system. Compute the arithmetic mean value for each system.

ii. Repeat question (i) using M as the reference machine.

iii. Which machine is the slowest based on each of the preceding two calculations?

iv. Repeat the calculations of questions (i) and (ii) using the geometric mean. Which machine is the slowest based on the two calculations?

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

CSE 4309: Theory of 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) State the differences between a DFA and an NFA. 5

   b) i. Consider a finite automaton $A = (Q, \Sigma, \delta, q_0, F)$. Explain the meaning of the elements of the 5-tuple. Explain δ for both DFA and NFA. 5+2

   ii. Suppose a DFA A is expressed as $A = (Q, \Sigma, \delta, q_0, F)$. Now, write down the values of A for the following DFA:

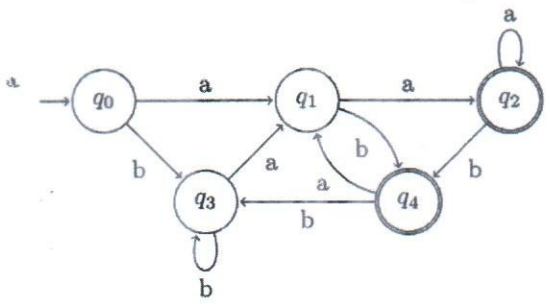

Figure 1: DFA for Question 1.b

   c) Draw state diagram and transition table of a DFA that starts with 0 and has 110 as a substring where $\epsilon = \{0,1,2\}$. 6

   d) Convert the following NFA into DFA and also draw the transition diagram of the DFA. 7

	P	Q
→A	{A,B}	{A}
B	{C}	{C}
C	{D}	Φ
*D	{D}	{D}

2. a) Define regular expression. What are the operators of regular expression? Mention the order of precedence followed by the operators. 5

   b) Convert the following Regular Expression into NFA: 8
   (A+B+CD)+(IJ)*+((E+F)GH)

   c) Construct a Regular Expression of a grammar that starts with 3 ones (1), then consists a substring of zeroes (0) and ones (1) starting and ending with zero (0) and then again 2 ones (1). 4

   d) Consider the following ε-NFA: 8

	Є	0	1	2
→A	{B,C}	Φ	{B}	{C}
B	Φ	{A}	{C}	{A,B}
C	Φ	Φ	Φ	Φ

i. Find out the ε-closure for each state
ii. Convert it into DFA
iii. Construct the Transaction Table for the converted DFA
iv. Give all the strings of length two or less accepted by the automaton

3. a) What is the difference between the strings and the words of a language? 2
b) Design NFA's for the following languages. 9
i. The NFA recognizes all strings that contain two 0's separated by a substring whose length is a multiple of 3 over the alphabet {0, 1}.
ii. The set of all strings that consist of either 01 repeated one or more times or 010 repeated one or more times over the alphabet {0, 1}.
c) The following diagram is an NFA accepting all strings that end in 01. Describe the states the NFA is in during the processing of input sequence 00101 (with diagram). 8

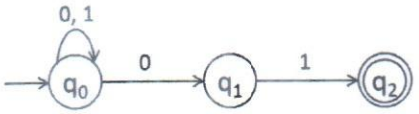

Figure 2: NFA for Question 3.c

d) Write regular expressions for the following languages 6
i. The set of strings of 0's and 1's whose tenth symbol from the right end is 1
ii. The set of strings of 0's and 1's with at most one pair of consecutive 1's.
iii. The language { w | w contains at least two a's, or exactly two b's }

4. a) Explain the language of the automaton of diagram below. 4

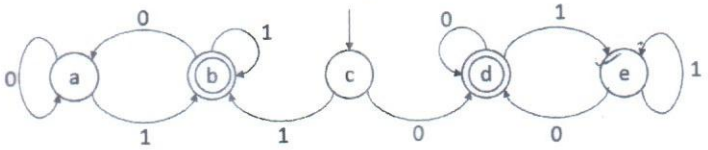

Figure 3

b) i. Explain the terms Decidability and Intractability. 9
ii. Write down the applications of finite automata
iii. What is the difference between empty string and empty language?
c) Find out the Regular Expression for the following Finite Automata: 5

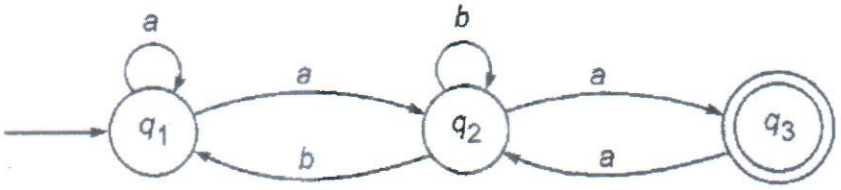

Figure 4: Finite Automata for Question 4.c

d) Draw state diagram and transition table of a DFA that accept strings where every 'a' is never followed by 'ab' over input alphabets $\sum$ = {a, b} 7

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

CSE 4361: Computer Science and Technology I

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

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

Figures in the right margin indicate marks.

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1. a) What is the basic definition of a computer? Describe different types of computers based on number of persons using at the same time and their sub categories. 2+6

   b) What are the fundamental parts of a computer system? 4

   c) Perform the following operations: 9

      i. $(26B.C12)_{16}$ (Convert from Hexadecimal to Decimal)

      ii. $(101001.010011101)_2$ (Convert from Binary to Decimal)

      iii. $(917.25)_{10}$ (Convert from Decimal to Octal)

   d) What would be the output of the program in Figure 1? 4

```
#include <stdio.h>
#include <math.h>
int main()
{
      int a, b;
      a = 2;
      b = 5;
      int temp;
      temp = a;
      a = b;
      b = temp;
      a++;
      b--;
      temp = a+b;
      temp+=2;
      temp = sqrt(temp);
      printf("%d %d %d",a, b, temp);
      return 0;
}
```

Figure 1: Code for question no. 1(d)

2. a) What is software? Describe different types of softwares with examples. 5

   b) Write short notes on different types of *Memory* and *Storage* devices. Give an example of Infinite loop using FOR and WHILE loop separately. 6+6

   c) What would be the output of the program in Figure 2? 8

```
#include <stdio.h>
int main()
{
    int i;
    for(i=1;i<100;i++)
    {
        if(i%5==0 && i%3==0) printf("%d\n",i);
        else if(i%5==0) printf("?\n");
        if(i>45)break;
    }
    return 0;
}
```

Figure 2: Code for question no. 2(c)

3. a) Write short notes on the Information Processing Cycle. What is the significance of comments in code? 4+3

b) Perform binary subtraction on the following numbers and convert the binary result into decimal for justifying your answer. 7

$$(-21)_{10} - (5)_{10}$$

c) Write a C program to find whether a given year is a leap year or not. If it is a leap year print YES, otherwise print NO. You have to take input from the user. 5

d) Take an integer N as input. Print all the numbers divisible by 7 from 1 to N. Use FOR loop to do the task. 6

4. a) Sakib likes to throw balls into the air with all his might. He becomes happy if the ball reaches greater heights. However, he does not know how to calculate the maximum height his ball attains. Write a C program that will help him find the height of his projected ball. Assume that the ball is thrown in the direction perpendicular to the earth surface with an initial velocity of V ms^{-1} (V is the only input provided by the user and you have to print the maximum height of the ball). 7

[**Hint**: Use the formula $v^2 = u^2 + 2as$, where u is the initial velocity, v is the final velocity, s is the displacement and a is the acceleration, and the acceleration due to gravity is 9.8 ms^{-2}]

b) Write a C program to find whether a given number is prime or not. If prime, then print YES, otherwise, print NO. You have to take input from the user. 10

c) Find out the number of bugs in the following program. Briefly explain about each bug in one or two sentences. 8

```
#include <stdio.h>

int main()
{
    float a,b;
    a = 6.0;
    b = 5.0;
    int c = a % b;
    printf("%f",c);
    int num1 = 10;
    int num2 = 5/10;
    int res = num1/num2;
    print("%d",res);
    return 0;
}
```

Figure 3: Code for question no. 4(c)

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

SWE 4501: Design Patterns

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.

This is an Open Book exam.

The examinees can keep **one copy** of book or other printed materials with them, however, they cannot share the materials with other examinees. The material must be in book binding or spiral binding.

For all three questions, consider that you are developing a game "save the animals" where the main character, Ratul, fights the bad guys to free animals they have illegally captured. When answering the questions, consider the followings:

- Use standard symbols when drawing a class diagram. Underline a method that is abstract.
- If your solution uses a factory method or a template method design patterns, write pseudo code for the factory/template method even if the question asks only a class diagram.
- Use meaningful names of items in both code and class diagram instead of random characters like "A", "X", "M" etc.
- When it is asked to write code, you can write pseudo code instead of code in a particular language.

1. Ratul has two actions: close action and distant action. 20

   The gamer can choose from one of three close actions for Ratul: *punch*, *kick* and *head*.

   The distant action is a sequence of acts: *move*, *grab* and *hit*. The gamer can choose from one of two distant actions: *power* and *skill*.

   When using *power* action, Ratul moves to a nearby enemy, picks the enemy up and slams the enemy to the ground. When using the *skill* action, Ratul moves to a nearby enemy, holds the enemy's collar, and hit the enemy's belly with a knee. Note that the *move* part is exactly the same for the two actions, but the *grab* and *hit* parts vary.

   Draw a class diagram using types, methods and fields from the scenario above.

2. Gamers' statistics are usually stored in a plain text file. However, some users prefer to keep their statistics secret so they want to encrypt the file. For some, the data is very large so a compression facility is also required. Additionally, Some people prefer to keep their data as base-64 encoding. 17

   These conversions of the data file can be done in any sequence and the same conversion can be applied multiple times.

   Write code for the scenario above.

   Also, demonstrate the usage of your code for the following cases:

   - A data file is first compressed then encrypted.
   - A data file is encrypted, then compressed, then encoded, then compressed again.
   - No conversion is done to the data file.

3. The users of "save the animals" can save their preferences. To implement this, you need to write a `Preference` class with the following considerations: 13

- There should be a `void setPreference(string key, string value)` method to store a preference.
- There should be a `string getPreference(string key)` method to retrieve a preference.
- A single instance of the `Preference` class should be maintained throughout the application so that all the code gets the same preference values.
- Make sure that no code can accidentally create additional instances of `Preference` class.
- The instance of the `Preference` class should be created only when it is needed for the first time.
- Computer games are usually multi-threaded programs.

Write the `Preference` class.
Write a method `demo()` outside the `Preference` class to demonstrate the usage of `setPreference()` and `getPreference()` methods. Your `demo()` method should not contain more than five statements.

B.Sc. Engg. / HD CSE 5th Semester

24 February 2020 (Morning)

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

CSE 4501: Operating Systems

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 the advantages of using Operating Systems (OS) over one single monolithic program? 5
   b) Write short note on Time Shared Operating System. State the difference between Soft and Hard Real time systems 3+4
   c) "The operating system should include applications such as web browsers and email program" - Is the statement true? Justify your answer. 5
   d) Give two reasons why caches are useful. What problems do they solve? What problems do they cause? If a cache can be made as large as the device for which it is caching (for instance, a cache as large as a disk), why not make it that large and eliminate the devices? 8

2. a) What is a system call? Mention three process-related and three file-related system calls with unix examples. 1+6
   b) It is sometimes difficult to achieve a layered approach if two components of the operating system are dependent on each other. Identify a scenario in which it is unclear how to layer two system components that require tight coupling of their functionalities. How these difficulties can be mitigated? 4+4
   c) What is the purpose of the command interpreter (shell)? Why is it usually separate from the kernel? 1+2
   d) What is the main advantage of the microkernel approach to system design? How do user programs and system services interact in a microkernel architecture? What are the disadvantages of the microkernel approach? 2+3+2

3. a) What is context-switching? Where and when is context switching done inside OS? Describe the actions taken by kernel to context switch between processes. 1+3+3
   b) Differentiate between process and thread with suitable examples. What are the benefits of Multithreaded Process? 4+4
   c) What are two differences between user-level threads and kernel-level threads? Under what circumstances is one type better than the other? 5
   d) Can a multithreaded solution using multiple user-level threads achieve better performance on a multiprocessor system than on a single-processor system? Explain. 5

4. a) Describe the differences among short-term, medium-term, and long-term scheduling. 6
   b) Write short notes on the following.
      i. Shared Memory 4
      ii. Message Passing 4
   c) Write a short note on process state with state diagram. 5

d) What will be the output of the following Program? You must maintain the execution order of parent and child processes. 6

```
#include<stdio.h>
#include<stdlib.h>
#include<string.h>
#include<unistd.h>
#include<sys/types.h>

int globalVariable = 2;

int main()
{
        char sIdentifier[20];
        int iStackVariable = 80, i;

        pid_t pid = fork();
        if (pid == 0)
        {
                strcpy(sIdentifier, "Child Process: ");
                for(i=0; i<100; i++)
                {
                        globalVariable++;
                }
                for(i=10; i>0; i--)
                {
                        iStackVariable--;
                }
        }
        else if(pid<0)
        {
                printf("Failed to fork\n");
        }
        else
        {
                strcpy(sIdentifier, "Parent Process: ");
                wait(NULL);
        }

      printf("%s Stack variable: %d\n", sIdentifier, iStackVariable);
      printf("%s Global variable: %d\n", sIdentifier, globalVariable);

       return 0;
}
```

Library

B.Sc. Engg. / HD CSE 5th Semester — 27 February 2020 (Morning)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

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

CSE 4503: Microprocessors and Assembly Language

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) Derive the contents of the `Flag` (`CF, PF, ZF, SF, AF`) register of `8086` microprocessor upon executing the following instructions: 10

   i. `CMP AL, ABh` ; Assume `AL` initially contains `ABh`.
   ii. `ADD AX, 8000h` ; Assume `AX` initially contains `8000h`.

   b) Write appropriate assembly language codes for 8086 to accomplish the following tasks: 8

   i. 0Fh × (225 - 200) + 127
   ii. 0FFFh × 10h + 10101010b

   c) What is an assembler? Using an appropriate example, briefly explain the concept for fetching of an instruction/data from the memory. 2+5

2. a) Considering following memory addresses and instructions, mention the output (i.e., values) of register A, B and Stack Pointer (SP) after execution of all the instructions. Assume, initially the stack is empty. 10

Memory Address	Assembly Language
0100h	**MVI** A, 250
0102h	**MVI** B, 10
0104h	**ADD** B
0106h	**PUSH** A
0108h	**POP** B

   b) Briefly explain about the stack operation of 8086 microprocessor. 8

   c) Write an assembly language code to take a single-character as an *input* and show the same character as an *output* with new line and carriage return. 7

3. a) Derive the machine codes of the following `MOV` instructions using its coding template and also show how the machine codes of the instructions are to be stored in memory: 10

   i. `MOV AL, 255`
   ii. `MOV SS:[SI], DH`

   b) How do `8085` and `8088` microprocessors differ with each other in terms of flag register? 8

   c) Write an assembly language program structure to allocate exactly 64 Kbytes of memory for *code segment and data segment*, and also 1024 Bytes for *stack segment*. 7

4. a) Write an assembly language program equivalent of *if-else* using conditional jump instructions for accessing following conditional levels L1, L2 and L3; where, take two values at AL and BL, respectively. 10

Condition	Operations for Levels
`If AL>BL`	`L1: Add AL with BL`
`If AL<BL`	`L2: Subtract BL from AL`
`If AL=BL`	`L3: X-or between AL and BL`

b) Write short notes on Addressing Codes from memory 8

c) Explain the procedure to perform `SUB` and `CMP` operation in assembly language. 7

B.Sc. Engg. / HD CSE 5th Semester — 25 February 2020 (Morning)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

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

CSE 4511: Computer 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) Briefly explain the changes that Standard Ethernet has gone through before moving to the higher data rates. 7

   b) Explain why a minimum frame size is required for Ethernet. Suppose that the distance between two ends of an Ethernet LAN is *d*. Derive a formula to find the minimum frame size needed for an Ethernet packet. 3+5

   c) Derive the maximum achievable throughput of a slotted ALOHA network. Derive the formula to determine the average transfer delay of a slotted ALOHA network. 4+6

2. a) Draw the taxonomy of multiple-access protocols. 4

   d) What is the significance of D (Duration) field in an IEEE 802.11 frame? What does it signify when both the *To DS* and *From DS* flags of the Frame Control (FC) field of IEEE 803.11 frame represent 0? 2+3

   c) Mention the effective length of a one-slot frame and a three-slot frame of Bluetooth? In a Bluetooth frame why does 54-bit header portion contain three identical 18-bit sections? 3+3

   d) Draw the flowchart for CSMA/CA used in wireless LANs those can handle hidden station problem and use P-persistence method as a persistence strategy. What is the significance of inter frame space (IFS) and contention window (CW) in CSMA/CA? 6+4

3. a) With the aid of necessary diagrams demonstrate the major problem of a transparent bridge. 7

   b) Briefly explain the concept of variable length subnet masks (VLSMs) and private IP addresses. 4+4

   c) Mention the major disadvantages of connectionless service of packet switching. Briefly explain the setup phase of the connection-oriented service of packet switching. 3+7

4. a) What is the subnet and broadcast of the host 172.16.88.255/20? A router receives a packet on an interface with the destination address of 172.16.46.191/26. What the router will do with the packet? 2+2

   b) Briefly explain how an ISP uses address aggregation and longest mask matching principle. 4+4

   c) Suppose you are working in a reputed ISP. You are given a class B network address 172.16.0.0 and you are asked to create subnets from the given network using the subnet mask 255.255.255.192. As a network expert answer the following questions:

      i. How many subnets can be there? 2

      ii. How many hosts per subnets? 2

      iii. What are the valid first six and last two subnets? 3

      iv. What are the broadcast addresses for first six and last two subnets? 3

      v. What are the valid hosts in first six and the last two subnets? 3

(116) (102)

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

CSE 4513: Software Engineering and Object-Oriented 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) Consider the following UML diagram. 4

Separate the following statements into those that are true and those that are false.

i. No two companies can have the same name
ii. No two employees can have the same name
iii. No two companies can be at the same address
iv. No two employees can work at the same address
v. Each employee works for at least one company
vi. No employees work for more than one company
vii. Each company has at least one employee
viii. Two employees with the same name cannot work for the same company

b) Below are the functional requirements of an elevator control system: 8+8

- The elevator control system shall allow the passenger to call the elevator and to select the destination floor.
- When the passenger pushes the external button (to call the elevator), or the internal button (to select the destination floor), the central control system switches the button light on.
- When the passenger calls the elevator or selects the destination floor, the central control system opens/closes the elevator door.
- When the passenger calls the elevator or selects the destination floor, the central control system moves/stops the elevator to/at the passenger call floor or to/at the passenger destination floor.
- When the passenger leaves the elevator, the central control system switches the button light off.

i. Draw the use case diagram for the above elevator control.
ii. Also describe the use case for "Select Floor".

c) What are the five principles of SOLID? What are the different principles of component cohesion and component coupling? 2+3

2. a) What are the four key values of agile development? How does product backlog differ from sprint backlog? 4+2

b) What questions must be answered by the developers involved in pair programming? 3

c) Describe various kinds of scrum events and artifacts. 8+8

3. a) To conduct an exam, an instructor first notifies the students about the exam date and the material to be covered. He then prepares the exam question (with sample solutions for the TAs), makes enough copies for the class, and hands it out to students on the designated time and location. The students write their answers to exam questions and hand in their papers to the instructor. The instructor then gives the exam papers to the TAs, along with sample solutions to each questions, and gets them to mark it. The instructor then records all marks and returns the papers to the students. 15

Draw a sequence diagram that represents the above scenario.

b) Assume, the velocity of your team is 50 story points. You have 20 user stories (US1-US20) in your project backlog. You have estimated the user stories to have a difficulty/complexity expressed in story points as follows: 4+4+2

- Each of US1 to US5 equals 3 story points
- Each of US6 to US10 equals 5 story points
- Each of US11 to US15 equals 8 story points
- Each of US16 to US20 equals 13 story points

i. If you have a team of 4 developers and weekly sprints (1 week = 5 days = 40 hours), which user stories would you be able to implement in the next sprint and achieve the highest possible value without violating your capacity (effort) constraint?

ii. How would your result change if the following needs to be implemented with highest priority?
   - US3 must be implemented together with US11
   - US7 must be implemented together with US16
   - US17 must be implemented together with US18

iii. What is the minimum number of sprints required to complete the project?

4 a) Describe the tools and techniques of requirement gathering. 8

b) What is usability? Describe the usability criteria those are used to evaluate user interface. 2+5

c) With proper example define functional and non-functional requirement of a software system. Mention four advantages and four disadvantages of prototyping. 6+4

B.Sc. Engg. CSE 5th Semester 03 March 2020(Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

CSE 4531: E-Commerce and Web Security

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. Mr. Hasan is a renowned chef in Boardbazar, who owns the famous restaurant named **"Dhaka Kabab House (DKH)"**. To upgrade his business, he is planning to step on the E-Commerce domain. He wants to start home delivery service from both the web and mobile apps. He wants to have his own delivery team whereas established food delivery services like "HataoFood", "KuberEats", "MealPanda" are already competing the market and restaurants like "HelloBurger", "PizzaStart", "Burger&Pizza" have free delivery services. Mr. Hasan has a large customer base specially among IUTians and other local peoples. His team is very experienced in restaurant business but not in technology. Though it is a challenging goal to achieve with his moderate capital, Mr. Hasan loves taking challenges.

   a) Prepare a possible business model of "Dhaka Kabab House" discussing the key elements. 16

   b) What are some possible options Mr. Hasan can exploit if he runs out of his *Seed Capital*? 5

   c) How do *Venture Capitalists* differ from *Angel Investors*? 4

2. a) What is e-commerce? What are some of the unique features of e-commerce technology? 2+8

   b) Provide possible revenue models and real life examples for the following B2C business models: 9

      i. E-tailer
      ii. Portal
      iii. Community Provider
      iv. Content Provider
      v. Transaction Broker

   c) Categorize e-commerce by the nature of the market relationship with appropriate example. 6

3. a) Suppose, DKH has recruited a tech team lead by you. You are in charge of developing DKH's e-commerce presence. Consider your options for building the company's e-commerce presence in-house with existing stuffs, or outsourcing the entire operation. Choose a suitable strategy for your approach with proper justification. What problems you may face? 4+2+2

   b) What are the main factors to consider when developing an e-commerce presence? 5

   c) Prepare a SWOT analysis of DKH's business plan. 8

   d) What are the advantages and disadvantages of mobile first design? 4

4. a) What are some of the major limitations of today's Internet? 5

   b) What are the potential capabilities of the Internet of the future? Discuss some features that can be useful for the business plan of DKH. 7

   c) What are the eight most important factors impacting website design, and how do they affect a site's operation? 8

   d) List a few e-commerce website features that annoy the customers. 5

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

SWE 4537: Server Programming

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) Two samples of HTTP request message and HTTP response message are given in figure 1 and 2 respectively. Explain the format of the messages in the figures. Explain each of the terms in no more than two sentences. 2×8

```
POST /login HTTP/1.1
Host: www.stackunderflow.com
Content-Type: application/json
Content-Length: xx
User-Agent: Mozilla/4.0 (compatible; MSIE5.01; Windows NT)
Accept-Language: en-us
Accept-Encoding: gzip, deflate
Connection: Keep-Alive

{"username":"myusername","password":"mypassword"}
```

Figure 1: Sample HTTP request message for question 1.a

```
HTTP/1.1 409 Conflict
Content-Type: application/json
Content-Length: xx

{"message": "Invalid username or password"}
```

Figure 2: Sample HTTP response message for question 1.a

b) Suppose you have requested a server that has given you response with status code in one of the following formats. What will you understand by the following status codes? Explain each in one sentence. 3×2

i. 2xx
ii. 4xx
iii. 5xx

c) In which context the CONNECT HTTP method is used? 3

2. a) There are four layers of web service technology stack. Mention the responsibility of each layer with one of the mechanisms or standards to implement them. 12.5

b) Suppose you are going to develop an application named Stack Underflow where users can post their blog articles. You will make a RESTful web service for that. Now you will let the user to request to your web service to add, edit, delete, get all the articles and get a single article through your service. 5×2.5

What will be the URLs and HTTP verbs for the requests? Mention which URLs will be used for which purposes.

3. a) What are the five factors used for user authentication in web applications? Give example of each. 10+3

If you are allowed to use only one-factor authentication, which factor would you use and why would you choose that?

b) Explain the structure of JSON Web Token (JWT) used in token-based authentication and how is it being constituted in server. How JWT is used for verification of a token? 9+3

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

CSE 4551: Computer Graphics and Multimedia Systems

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) A widescreen Full HD TV having a resolution of 1080p and aspect ratio of 16:9 is showing a 1 hour and 30 minutes duration color movie (24 bit color depth) at 60 fps. Calculate the size of that video file assuming that no video compression takes place. 8

   b) i. Derive the Rotation Matrix required to perform rotation in a 2D space. Draw necessary figures. 6+3

   ii. What properties of this rotation matrix can you directly identify?

   c) Explain C0, G1, C1 and C2 continuity using their properties. In case of connecting two Bezier curves, how should the control points be placed to guarantee C1 continuity? 4+4

2. a) What is the main idea for a Spline? What are the properties of Bezier curves? 3+5

   b) Derive Bresenham's Line generation algorithm and show how the decision parameter P_k is updated in each step. Provide necessary illustrations. 9

   c) What is meant by a Linear operation? Is Translation a linear operation? Give mathematical reasoning for your answer. 4+4

3. a) Suppose v_{os} and n_{os} are respectively the original tangent and normal vectors, and v_{ws} and n_{ws} are respectively the transformed tangent and normal vectors. If M is the transformation matrix, then show mathematically how this is applied on the original tangent and normal vectors to get the transformed ones. 7

   b) How is Transformation handled during Scene Graph Traversal? Why is it a bad idea to undo transformation by multiplying with inverse matrix? Suggest a solution for this with proper instructions on how to implement it. 4+3+3

   c) Suppose the clipping window is defined from $(x_{min}, y_{min}) = (0, 0)$ to $(x_{max}, y_{max}) = (10,10)$ and a line is drawn from (1, -1) to (11, 2) in the world coordinate system. Use the Cohen-Sutherland Algorithm to determine how the line will be clipped. Show the result of each step in separate figures. 8

4. a) Write short notes on the following: 3×3

   i. Tessellation

   ii. Basis vectors

   iii. Hierarchical Modeling

   b) What is clipping? Why do we need to perform clipping? 3+3

   c) What are the different ways of representing surfaces? What are the pros and cons of surface representation using Triangle Meshes? 3+3

   d) What are the motivations behind the use of Matrix notation in Linear Transformations? 4

B.Sc. SWE 5th Semester | 27 February 2020 (Morning)

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

MID SEMESTER EXAMINATION | **WINTER SEMESTER, 2019-2020**

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

CSE 4553: Machine Learning

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 down the Bayes theorem with explanation. Discuss the use of Naive Bayes classifier in real world applications. 4+3

   b) Consider the dataset given in Table 1 of a credit card promotion database. The credit card company has authorized a new life insurance promotion similar to the existing one. We are interested in building a classification data mining model for deciding whether to send the customer promotional material. 12

Table 1: Dataset of credit promotion

Customer ID	Magazine Promotion	Watch Promotion	Credit Card Insurance	Sex	Life Insurance Promotion
1	Y	N	N	M	N
2	Y	Y	Y	F	Y
3	N	N	N	M	N
4	Y	Y	Y	M	Y
5	Y	N	N	F	Y
6	N	N	N	F	N
7	Y	Y	Y	M	Y
8	N	N	N	M	N
9	Y	Y	Y	M	N
10	N	Y	N	F	Y

Use the Naive Bayes classifier to determine the value of Life Insurance Promotion for the following instance:

Magazine Promotion = Y, Watch Promotion = Y, Credit Card Insurance = N, Sex = F, Life Insurance Promotion = ?

c) You are given a data set of 10,000 students with their sex, height, and hair color. You are trying to build a classifier to predict the sex of a student, so you randomly split the data into a training set and a testing set. Here are the specifications of the data set: 3+3

- sex ϵ { male, female}
- height ϵ [0,300] centimeters
- hair ϵ {brown, black, blond, red, green}

Under the assumptions necessary for Naive Bayes answer each question with T (True) or F (False) and provide a justification of your answer:

i. As height is a continuous valued variable, Naive Bayes is not appropriate since it cannot handle continuous valued variables.

ii. P(height, hair|sex) = P(height|sex) P(hair|sex).

2. a) Suppose you want to build a decision tree for a problem. In the dataset, there are two classes, with 150 examples in the '+' class and 50 examples in the '−' class.

   i. What is the entropy of the class variable? 2

   ii. For this data, suppose the Color attribute takes on one of 3 values (red, green, and blue), and the split into the two classes across red/green/blue is '+' : (120/10/20) and '−': (0/10/40). Write down an expression for the class entropy in the subset containing all green examples. Is this entropy greater or less than the entropy in the previous question? 4

   iii. Is Color a good attribute to add to the tree? Explain your answer 2

   iv. What is the information gain for a particular attribute if every value of the attribute has the same ratio between the number of + examples and the total number of examples? 4

   b) Imagine you grow a very large, complex decision tree from a training set which contains many features (attributes). 2×4

   i. You find that the training set accuracy for your tree is very high, but the test set accuracy (as measured on held out data) is very low. Explain why the accuracy on the training data could be so much higher than on the test data.

   ii. You decide to use pruning to create a series of successively smaller subtrees from your full tree (e.g. χ-squared pruning, or truncating the tree at smaller depths). As you prune more and more of the tree, the test accuracy goes up at first, but then starts to drop again after extensive pruning. Explain the rise and then fall of test accuracy

   c) Discuss the advantages and disadvantages of using Decision Tree classifier. 5

3. a) Explain the principle of the gradient descent. Consider a linear regression problem $y = w_1x + w_0$, with a training set having m examples $(x_1, y_1), \ldots, (x_m, y_m)$. Suppose that we wish to minimize squared error (loss function) given by: 5+5

$$Loss = \frac{1}{2m}\sum_{i=1}^{m}(y_i - w_1x - w_0)^2$$

Derive a batch gradient descent algorithm that minimizes the loss function.

   b) i. What is the difference between Linear and Logistic regression? 4×2

   ii. Suppose you are given a dataset of cellular images from patients with and without cancer. If you are required to train a classifier that predicts the probability that the patient has cancer, would you prefer to use Decision trees over logistic regression? If not why?

   iii. Consider a logistic regression model with weights, $\beta = (-ln(4), ln(2), -ln(3))$. A given document has feature vector $X = (1, 1, 1)$. What is the probability that the document is about sports?

   iv. Suppose you train a logistic classifier where the hypothesis is

$$h_\theta(x) = g(\theta_0 + \theta_1x_1 + \theta_2x_2)$$

If $\theta_0 = 6$, $\theta_1 = -1, \theta_2 = 0$, draw the figure of the decision boundary found by this classifier?

   c) Consider a (binary) linear classifier model: y= g(w^Tx), where input x is a d-vector and w is the parameters to learn. Suppose we want to use such binary classifier models to classify k classes. Explain in detail how this can be done. 3

   d) Is it possible to get multiple local optimum solutions if we solve a linear regression problem by minimizing the sum of squared errors using gradient descent? Give proper explanation. 4

4. a) Determine which is the best approach for each problem (i-v) and why? 5

- Supervised learning – classification
- Supervised learning – regression
- Unsupervised learning - clustering

i. A robot is learning to sort garbage using visual identification. It sits all day picking out recyclable items from garbage as it passes on a conveyor belt. It places items such as glass, plastic and metal into 12 bins. Each item is labeled with an identification number on a sticker

ii. A friend invites you to his party where you meet totally strangers. Now you will classify them in the basis of gender, age group, dressing, educational qualification or whatever way you would like.

iii. Suppose you have never seen a Cricket match before and by chance watch a video on internet, now you can classify players on the basis of different criterion: Players wearing same sort of kits are in one class, Players of one style are in one class (batsmen, bowler, fielders), or on the basis of playing hand (RH vs LH)

iv. Consider the problem of predicting the marks of a student based on the number of hours he/she put for the preparation

v. Determine whether a credit card transaction is valid or fraudulent.

b) Consider a 2-class classification problem where the number of data points (we also call them examples) in class 0 is 990 and number of data points in class 1 is 10. Suppose the classification model (or algorithm) predicts everything to be class 0. Which of the following metrics correctly measures the performance of the model: Accuracy, Precision, Recall, False positive rate, False negative rate? Justify your answer. 5

c) What are the benefit of feature scaling? Suppose students have taken some class, and the class had a midterm exam and a final exam. You have collected a dataset of their scores on the two exams, which is as follows: 3+6

Mid I (X1)	Mid II (X2)	Final
89	7921	96
72	5184	74
94	8836	87
69	4761	78

You would like to use polynomial regression to predict a student's final exam score from their midterm exam score. Before that you plan to use feature scaling so that each feature in the data have zero-mean and unit-variance. Which scaling technique you should apply and how? What will be the normalized value of feature X_2 ?

d) Write down the differences among hold out, k-fold cross-validation and leave-one-out cross-validation? 6

B.Sc. Engg. SWE 5th Semester | 27 February 2020 (Morning)

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

MID SEMESTER EXAMINATION | **WINTER SEMESTER, 2019-2020**

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

CSE 4559: Introduction to Cloud 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 the characteristics of Cloud Computing given in NIST's definition, which one do you think is most important? Which core technologies can help to achieve the characteristic? and which issues would damage it? (if any). 10

b) What is Virtualization? Differentiate between full virtualization and para virtualization. 6

c) Suppose you have a host machine that has 64 GB RAM and you are trying to create VMs that requests 4 GB RAM but only uses 2.5 GB RAM. Calculate the amount of memory that will be saved if the concept of memory overcommit is used. 4

d) Describe the different Cloud Service Models. 5

2. a) What is Cloud Computing? What are the benefits of Cloud Computing? 7

b) Write short notes on the followings: 4+5

i. Transparent Page Sharing
ii. Cloud Deployment Models
iii. Issues of Cloud Computing

c) Explain the risk from multi-tenancy with respect to various cloud environment. 4

d) What is Fault tolerance? What are the techniques to enhance fault tolerance in Cloud Computing? 5

3. a) What is the difference between scalability and elasticity? 5

b) Define Service Oriented Architecture SOA. Depict a SOA communication between the service provide and service consumer using a SOAP Architecture. 8

c) Elaborate on the following quote from Larry Ellison, Oracle Corporation CEO; 4
"We've redefined Cloud Computing to include everything that we already do. I don't understand what we would do differently other than change the wording of some of our ads."

d) Differentiate between Grid Computing, Distributed Computing, Cluster Computing and Cloud Computing. Also draw the relationship between them. 8

4. a) What is Load Balancing? What is the importance of Load Balancing? With the help of an architectural diagram, explain how Load Balancing is achieved by the cloud controller. 10

b) Explain how the different emulation methods (Interpretation, Static and Dynamic translation) of instructions works in a virtual environment. 6

c) Elaborate on the following type of VM migration. Discuss their downtime and migration duration. 9

i. Stop-and-copy (S-C)
ii. Demand-migration (D-M)
iii. Iterative precopy (I-P)

BBA TM 5th Semester

27 February 2020 (Morning)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

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

CSE 4561: Computer Science and Technology-III

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 4

Figures in the right margin indicate marks.

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1. a) Explain the characteristics of an Information System. 5
   b) What are the different categories of an Information system? Show the hierarchy of an organization with different operational levels and functional areas. 7
   c) What are the differences between Decision Support System and Executive Information System? 8
   d) What is an ERP? List the features of an ERP. 5

2. a) What is class and object in object-oriented programming? What is the relation between class and object? Give an example. 4
   b) What is the difference between object-oriented programming and procedure-oriented programming? 3
   c) Write a C++ program to read and print the details of a student. Create a class called Student and an object of this class. This class contains four data members (Name, Roll No, Total marks, Percentage) with *private access* and two member functions with public access, one for getting the details and another for showing the details. 6
   d) Every vehicle has a speed, color, and it can turn left and right. A bike is a vehicle which has a gear and rings bell for warning other vehicles in the road. Motor vehicles are special type of vehicles which runs on engine. The motor vehicles have different size of engines (usually measured in CC), license plates and beep horn for giving warning in the road. Among the motor vehicles, motor bike and car are of two types. All motor bikes have a model and cars have specific number of seats. Write C++ program for it. 12

3. a) What is a constructor and how does a constructor work? Can there be more than one constructor for a class? 5
   b) What is the difference between function overriding and function overloading? 4
   c) The following table is supposed to define the access to a field of a class permitted by each modifier in java. Fill in the blanks of the following table with "Yes" if the field is accessible from the Class/Package/Subclass/World or "No" if it is not accessible: 6

Table 1: Access Level

	Private	No Modifier	Protected	Public
Same class				
Subclass in same package				
Subclass in different package				
Non subclass in same package				

B.Sc. TE (2-Yr) 1st Semester

27 February 2020 (Morning)

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

CSE 4573: Microprocessors and Assembly Language 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) Derive the contents of the `Flag (CF, PF, ZF, SF, AF)` register of `8086` microprocessor upon executing the following instructions: 10

   i. `CMP AL, ABh` ; Assume `AL` initially contains `ABh`.
   ii. `ADD AX, 8000h` ; Assume `AX` initially contains `8000h`.

   b) Write appropriate assembly language codes for 8086 to accomplish the following tasks: 8

   i. 0Fh × (225 - 200) + 127
   ii. 0FFFh × 10h + 10101010b

   c) What is an assembler? Using an appropriate example, briefly explain the concept for fetching of an instruction/data from the memory. 2+5

2. a) Considering following memory addresses and instructions, mention the output (i.e., values) of register A, B and Stack Pointer (SP) after execution of all the instructions. Assume, initially the stack is empty. 10

Memory Address	Assembly Language
0100h	**MVI** A, 250
0102h	**MVI** B, 10
0104h	**ADD** B
0106h	**PUSH** A
0108h	**POP** B

   b) Briefly explain about the stack operation of 8086 microprocessor. 8

   c) Write an assembly language code to take a single-character as an *input* and show the same character as an *output* with new line and carriage return. 7

3. a) Derive the machine codes of the following `MOV` instructions using its coding template and also show how the machine codes of the instructions are to be stored in memory: 10

   i. `MOV AL, 255`
   ii. `MOV SS:[SI], DH`

   b) How do `8085` and `8088` microprocessors differ with each other in terms of flag register? 8

   c) Write an assembly language program structure to allocate exactly 64 Kbytes of memory for *code segment and data segment*, and also 1024 Bytes for *stack segment*. 7

4. a) Write an assembly language program equivalent of *if-else* using conditional jump instructions for accessing following conditional levels L1, L2 and L3; where, take two values at AL and BL, respectively. 10

Condition	Operations for Levels
`If AL>BL`	`L1: Add AL with BL`
`If AL<BL`	`L2: Subtract BL from AL`
`If AL=BL`	`L3: X-or between AL and BL`

b) Write short notes on Addressing Codes from memory 8

c) Explain the procedure to perform `SUB` and `CMP` operation in assembly language. 7

B.Sc. Engg./ HD EEE 5th Semester 25 February 2020 (Morning)

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

CSE 4575: 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) How are data structures classified? Describe them in brief. 10

   b) Write the algorithm to delete any specified element from an array. 5

   c) What is the prerequisite of binary search? What are the best, average and worst case time complexities of binary search? Search for "8" among the following values using binary search and tabulate the values of low, mid and high. 10

   1, 4, 5, 9, 8, 16, 22, 32, 35, 54

2. a) Write down the following functions for a doubly linked list : 15

   i. Inserting an element after a specified element

   ii. Deleting a specified element

   The specified element will be mentioned by the user. Be sure to consider all possibilities of user input.

   b) Place the following complexities in ascending order: 2

   O(n!), O(logn), O(n), $O(n^2)$, O(nlogn), $O(2^n)$

   c) What will be the time complexity of the following code fragment: 2

```
for(i=0; i<m ; i++){
      for(j=0;j<(n*n);j++)
      {
            printf("%d",i*j);
      }
}
```

   d) What is a proper binary tree? What are the properties of a proper binary tree? 6

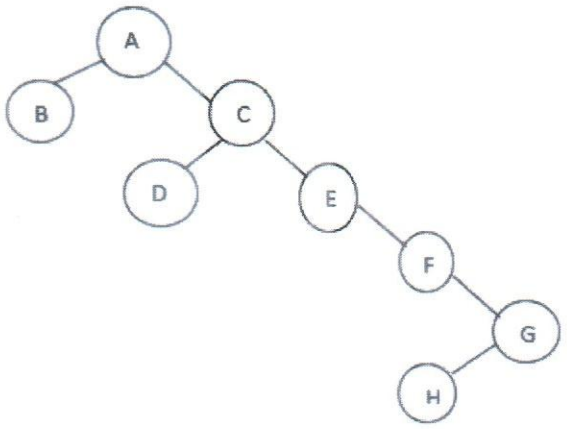
3. a) Write down the algorithm for insertion sort. For the following array, simulate how the insertion sort will work in each iteration of the outer loop. 15

5	2	1	3	19	18	2	4	8	15

   b) Distinguish between array and linked list. 5

   c) What is your preferred data structure to store *any* tree? Why? 5

4. a) Write down the algorithm of preorder, postorder and inorder traversal of a binary tree. For the given tree below, write down the output of the three mentioned traversals.



12

b) How can you modify the code for bubble sort so that the best case time complexity becomes O(n)? How does it improve the time complexity? Write the code in order to demonstrate the modification. 7

c) What is the best way to store a complete binary tree and why? Draw a complete binary tree and illustrate the organization of the elements in your chosen data structure (based on the first part of the question). How can you access the children and parent from a given node? 6

B.Sc. Engg. / HD EEE 5th Semester

28 February 2020 (Morning)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

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

CSE 4591: Discrete Mathematics

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) Let,
L(x):= x is a large bird.
H(x):= x lives on honey.
F(x):= x is female.
P(x):= x is a parent.
M(x, y):= x is the mother of y.
D(x):= x is diamond.
R(x):= x is Ruby.
B(x):= x is beautiful gem.
A(x):= x attends the class.
F(x, y):= x and y are friends.
Z(x, y): = y gives proxy for x.

Translate the following English sentences into logical expressions: 8

i. No large birds live on honey.
ii. If a person is female and is a parent, then this person is someone's mother.
iii. Diamonds and Rubies are beautiful gems.
iv. Every student either attends the class or has a friend who gives his proxy.

b) Using rules of inference and proper quantifiers, show that the premises "Somebody in this class loves football", and "Someone who loves football, watches football whenever he/she gets some free time" imply the conclusion "There is at least one person in this class who watches football whenever he/she gets some free time." 9

c) Inhabitants of a remote island can be of two types- knights and knaves, where knights always tell the truth and knaves always lie. You encounter two people, *A* and *B*. Determine, what *A* and *B* are if they address you in the ways described. If you cannot determine what these two people are, can you draw any conclusion? 8

i. A says "at least one of us is a knave" and B says nothing.
ii. A says "The two of us are both knights" and B says "A is a knave".
iii. A says "I am a knave or B is a knight" and B says nothing.
iv. Both A and B say "I am a knight".

2. a) Let $\boldsymbol{m}$ be a positive integer. If $\boldsymbol{a \equiv b \ (mod\ m)}$ and $\boldsymbol{c \equiv d \ (mod\ m)}$, then prove that $\boldsymbol{a + c \equiv b + d \ (mod\ m)}$ and $\boldsymbol{ac \equiv bd \ (mod\ m)}$ 6+3

Now, Suppose x and y are integers , $x \equiv 4 \ (mod\ 13)$ and, $y \equiv 9 \ (mod\ 13)$, Find integer z with $0 \leq z \leq 12$ such that

i. $z \equiv (2x + 3y) \ (mod\ 13)$.
ii. $z \equiv 9x \ (mod\ 13)$.
iii. $z \equiv (x^2 + y^2) \ (mod\ 13)$.

b) Prove that, there are infinitely many primes. 8

c) Find the greatest common divisor of 637 and 133 using the Euclidean algorithm and express the greatest common divisor as a linear combination of 637 and 133 . 8

3. a) A computer network consists of six computers. Each computer is directly connected to zero or more of the other computers. Show that there are at least two computers in the network that are directly connected to the same number of other computers. 10

b) How many solutions are there to the equation, 9

$$x_1 + x_2 + x_3 + x_4 + x_5 = 21$$

Where, x_1, x_2, x_3, x_4, x_5 are nonnegative integers such that

i. $x_1 > 2$

ii. $x_1 \geq 2, x_2 \geq 3$

iii. $0 \leq x_1 \leq 10$

c) Programmers of IUT has created a new social media called IUTgram. Each user on IUTgram must have a unique username. Each username is six to nine characters long, where each character is an uppercase letter or a digit. Also each username must contain at least one digit if the length of the username is less than eight. 6

What is the maximum number of users IUTgram can possibly have?

4. a) Each inhabitant of a remote village always tells the truth or always lies. A villager will give only a "Yes" or a "No" response to a question a tourist asks. Suppose you are a tourist visiting this area and come to a fork in the road. One branch leads to the ruins you want to visit, the other branch leads deep into the jungle. A villager is standing at the fork in the road. What one question can you ask the villager to determine which branch to take? 5

b) Use the bubble sort to sort $6, 2, 3, 17, 9$, showing the list obtained at each step. 10

c) What is the time complexity of *linear search algorithm* and *binary search algorithm*? Which one is better? Justify your answer. 5

d) Give a Big-O estimate for $f(x) = 3x^2 + (x + 1)\log(x^2 + 1)$. 5

B.Sc. Engg. CSE 7rd Semester — 28 February 2020 (Morning)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

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

CSE 4703: Theory of Computing

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 Finite Automata. What are the differences between a DFA and an NFA? 2+3

   b) Give the formal description of the finite automata pictured in Figure 1. What is the language of the automata? 6+2

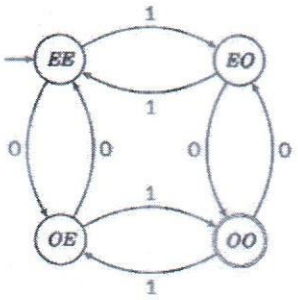

Figure 1: State diagram of a finite automaton for Question 1.b

   c) A vending machine is an automated machine that provides items such as snacks, beverages, lottery tickets to consumers after money, a credit card or specially designed card is inserted into the machine. Consider a very simple vending machine which provides pen at a cost of 10tk each. The machine takes 2tk, 5tk and 10tk only, and does not return changes even if you pay more than the price of a pen. It accepts payment only if you pay at least or more than the rate for a pen otherwise rejects. There is a reset button in the machine which someone can press anytime to start a new purchase. Now design a DFA (state diagram) for the vending machine. 12

2. a) i. Define Alphabet and String 2+3

   ii. Explain the differences among Σ, Σ^0 and Σ^1.

   b) Design an NFA to accept the set of strings over alphabet $\{0, 1\}$ such that there are two 0's separated by a number of positions that is a multiple of 4. Note that 0 is an allowable multiple of 4. 8

   c) Consider the following ϵ-NFA. 12

Table 1: Transition table of an ϵ-NFA for Question 2.c

	ϵ	a	b	c
$\rightarrow p$	$\{q, r\}$	$\emptyset$	$\{q\}$	$\{r\}$
q	$\emptyset$	$\{p\}$	$\{r\}$	$\{p, q\}$
$*r$	$\emptyset$	$\emptyset$	$\emptyset$	$\emptyset$

   i. Compute the ϵ-closure of each state

   ii. Give all the strings of length three or less accepted by the automaton

   iii. Convert this automata to DFA

3. a) Write regular expressions for the following languages: 2×4

   i. The set of strings of 0's and 1's whose number of 0's is divisible by five.

   ii. The set of strings of 0's and 1's with at most one pair of consecutive 1's.

b) Describe the languages of the following regular expressions: 2×4

i. $(1+\varepsilon)(00^*1)^*0^*$

ii. $(0^*1^*)^*000(0+1)^*$

c) Convert the following DFA to a regular expression, using the state-elimination technique. 6

Table 2: Transition table of a DFA for question 3.c

	0	1
→*p	s	p
q	p	s
r	r	q
s	q	r

d) Convert the regular expression (0+1)01 to an NFA 3

B.Sc. Engg. CSE 7th Semester — 24 February 2020 (Morning)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

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

CSE 4709: Machine Learning

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) Suppose you want to analyze the sentiment of a popular media content and classify that sentiment as positive or negative. Answer the following:
   i. Is the problem a machine learning problem? Explain your answer by comparing machine learning approach with traditional programming approach. 6
   ii. Write the machine learning steps for this problem in brief. 10

   b) What is reinforcement learning? Explain the basic elements of a reinforcement learning with a real-life example. 9

2. a) Consider a linear regression problem $y = \theta_1 x + \theta_0$, with a training set having m examples $(x_1, y_1), (x_2, y_2), \ldots, (x_m, y_m)$. Suppose that we wish to minimize the mean of *fourth* degree error (loss function) given by:

$$Loss = \frac{1}{m}\sum_{i=1}^{m}(y_i - \theta_1 x_i - \theta_0)^4$$

   i. Derive the equation to calculate the gradient with respect to the parameters θ_1 and θ_0. 6
   ii. Write the pseudo-code of the gradient descent algorithm for this problem. 6
   iii. Write the interpretations of empirical risk in the form of noise that incur in the loss function. 3

   b) What is feature engineering? Explain the following feature engineering tasks with example: 1+9
   i. One-Hot Encoding
   ii. Standardization
   iii. Data imputation

3. a) What are overfitting and underfitting problems in machine learning? Explain how the lasso and the ridge regularizations work to solve the overfitting problem with necessary equations. 6+8

   b) What is odds ratio? How does the logistic regression solve two-class problem using odds-ratio? Derive the cost function of logistic regression to maximize the likelihood of the training set. 11

4. a) Consider the set of training examples given in Table 1.

Table 1: Dataset for decision tree

SN	Major	Experience	Tie	Hired
1	CSE	Programming	Pretty	No
2	CSE	UI/UX	Pretty	No
3	SWE	Programming	Ugly	Yes
4	CSE	UI/HX	Ugly	Yes

Do the followings:
   i. Determine the entropy of **Hired.** 4
   ii. Which attribute should be selected as a root of the decision tree using ID3? 3
   iii. Construct the decision tree for this dataset based on information gain. 6

   b) How does the clustering technique help in solving machine learning problems? Consider the following sample points, $A\,(1,1), B\,(2,-2), C\,(3,4), D\,(4,5)$. Perform k-means clustering, show the calculation of distance matrix and group assignment matrix for two epochs only. [Assume k=2.] 2+10

B.Sc. Engg. CSE 7th Semester
B.Sc. Engg. SWE 5th Semester

27 February 2020 (Morning)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

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

CSE 4733 / CSE 4561: Digital Image 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) What are the illumination and reflectance components of an image formation model? How is the intensity level defined from this model? 2+5

   b) When and how do you use *bicubic interpolation* in digital image processing? 10

   c) What is false contouring? Suppose that a flat area with center at (x_0, y_0) is illuminated by a light source with intensity distribution $i(x, y) = Ke^{-[(x-x_0)^2+(y-y_0)^2]}$. Assume for simplicity that the reflectance of the area is constant and equal to 1.0, and let K=255. If the resulting image is digitized with k bits of intensity resolution, and the eye can detect an abrupt change of eight shades of intensity between adjacent pixels, what value of k will cause visible false contouring? 2+6

2. a) Develop an algorithm for converting a one-pixel-thick *8*-path to a *4*-path. 7

   b) Suppose your monitor has a gamma error when displaying an image on it. How can you correct this gamma error? Mathematically explain it for color images. 8

   c) An image has the gray level histogram $p_r(r)$ shown in Figure 1. It is desired to transform the gray levels of this image so that it will have the specified histogram $p_z(z)$ provided by equation (1.2). Assume continuous quantities and find the transformation function (in terms of r and z) that will accomplish this. 10

$$p_r(r) = 2 - 2r \qquad (1.1)$$

$$p_z(z) = 2z \qquad (1.2)$$

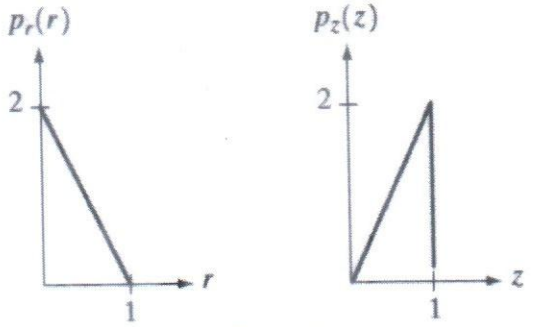

Figure. 1

3. a) Show that 2-D filtering with separable, symmetric filters can be computed by first computing 1-D convolution along the individual rows (columns) of the input, followed by computing 1-D convolution along the columns (rows) of the result from the first step. 8

   b) "Gradient mask is not an isotropic mask but gradient magnitude is" – Briefly explain why. 5

   c) Explain the working principle of *unsharp masking*. Design a single mask with which if you perform spatial filtering, the output will be sharpening with *unsharp mask* including a weight factor k. 6+6

4. a) Draw the general shape of the transformation functions used to correct excessive contrast in the RGB color space. Explain how that transformation function will reduce excessive contrast. 5

b) Suppose the color values of an image have been modified using the transformation functions as shown in Figure 2 in its RGB color space. How can you obtain the same effect using the 3+3

i. HSI color space

ii. CMY color space

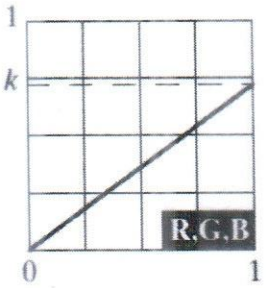

Figure 2: Color Transformation Function.

c) If a smoothing filter is applied directly on a color image, what difference will it make in contrast to the output where the filter is applied separately on each RGB color channel? 5

d) In an automated assembly application, three classes of parts are to be color coded in order to simplify detection. However, only a monochrome TV camera is available to acquire digital images. Propose a technique for using this camera to detect the three different colors. 9

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

HUM 4741: Business Communication and Law

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) Business is an economic and social system. To produce and sell goods and services any business has to coordinate the activities of many groups of people such as employees, suppliers, customers, legal advisors, community representatives and government agency through communication. As an IT professional, state the importance of communication in business and identify the four interrelated trends which can influence your work and communication in business. 10

   b) "No one knows exactly what occurs inside the minds of communicators when they undertake to create a message, but researchers generally agree that the communication process includes some specific steps". Identify and discuss the steps of communication process. 6.67

2. a) Assume you are the Head of Marketing Department in Nestle Ltd. If you need to persuade your boss, you have to implement some kind of cross-cultural training in the company. What kind of evidence might help you make a convincing case? Discuss with relevant examples. 6.67

   b) Suppose you have made a recent transaction with a person from India. How did the contexts of communication (larger contexts, relationship between communicators, and particular context) influence the outcome of your transaction? Describe with examples. 5

   c) Apply the "Pareto principles" in the communication pyramid. 5

3. a) Researchers found that executives typically have a default style of decision making process that lands them in one of five categories. Explain those five categories of decision making style along with their persuasion strategy. 10

   b) Leadership, at any level, certainly is not easy — but unclear, vague, roller-coaster pronouncements make many top managers' jobs infinitely more difficult than they need to be. Why do many organizations sink into chaos? Mention the reasons. 6.67

4. a) Imagine you are the manager of a good-sized unit within your organization. Your work frequently brings you into contact with another manager call him Yan to whom you have come to dislike. No matter how much you do for him, it's not enough. Worse, he never seems to believe that you're doing the best you can for him. Resenting his attitude and his obvious lack of trust in your abilities and in your good faith, you don't spend as much time with him as you know you should; in consequence the performance of both his unit and yours is deteriorating. How do you overcome this disliking and improve your performance? 5

   b) Dr. Robert wrote a book on persuasion, it has been widely hailed as a seminal book. The most significant aspect of this book was the highlighting of Cialdini's six principles of persuasion. Explain these principles with business applications. 8

   c) It is possible to communicate with another person without using any words. Nonverbal communication may be expressed through body languages, distance, time, tone, frankness and even through your handshakes. These languages carry important impact on business relationship. Discuss the impact of nonverbal communication on business relationship. 3.67

B.Sc. Engg. CSE 7th Semester | 27 February 2020 (Morning)

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

MID SEMESTER EXAMINATION | **WINTER SEMESTER, 2019-2020**

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

CSE 4749: Introduction to Cloud 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 the characteristics of Cloud Computing given in NIST's definition, which one do you think is most important? Which core technologies can help to achieve the characteristic? and which issues would damage it? (if any). 10

b) What is Virtualization? Differentiate between full virtualization and para virtualization. 6

c) Suppose you have a host machine that has 64 GB RAM and you are trying to create VMs that requests 8 GB RAM but only uses 6 GB RAM. Calculate the amount of memory that will be saved if the concept of memory overcommit is used. 4

d) Describe the different Cloud Service Models. 5

2. a) What is Cloud Computing? What are the benefits of Cloud Computing? 7

b) Write short notes on the followings: 4+5

i. Transparent Page Sharing
ii. Cloud Deployment Models
iii. Issues of Cloud Computing

c) Explain the risk from multi-tenancy with respect to various cloud environment. 4

d) What is Fault tolerance? What are the techniques to enhance fault tolerance in Cloud Computing? 5

3. a) What is the difference between scalability and elasticity? 5

b) Define Service Oriented Architecture SOA. Depict a SOA communication between the service provide and service consumer using a SOAP Architecture. 8

c) Elaborate on the following quote from Larry Ellison, Oracle Corporation CEO; 4
"We've redefined Cloud Computing to include everything that we already do. I don't understand what we would do differently other than change the wording of some of our ads."

d) Differentiate between Grid Computing, Distributed Computing, Cluster Computing and Cloud Computing. Also draw the relationship between them. 8

4. a) What is Load Balancing? What is the importance of Load Balancing? With the help of an architectural diagram, explain how Load Balancing is achieved by the cloud controller. 10

b) Explain how the different emulation methods (Interpretation, Static and Dynamic translation) of instructions works in a virtual environment. 6

c) Elaborate on the following type of VM migration. Discuss their downtime and migration duration. 9

i. Stop-and-copy (S-C)
ii. Demand-migration (D-M)
iii. Iterative precopy (I-P)

B.Sc. Engg. (CSE) 7th Semester — 27 February 2020 (Morning)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

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

CSE 4753: Bioinformatics

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 gene expression? Discuss how gene expression can be measured. 2+4
   b) Discuss transcription and post-transcription operations. 10
   c) Why gene expression raw data are needed to be normalized? Explain various types of bias which are needed to be considered during normalization. 9

2. a) Write short notes on the followings:
      i. GC-content 3
      ii. Poly-A tail 3
      iii. pseudogenes 4
      iv. overlapping genes 5
   b) What would happen during translation process if a start codon re-appeared within mRNA? 2
   c) What is *consensus sequence*? Four sequences are given below. Build a *consensus sequence* for them. 8

      ACTGA
      ACGCA
      ATTC
      TCCA

3. a) Describe various regulatory sites and transcription factor which control transcription process. 10
   b) Write down your understanding about the content and structure of human genome. 10
   c) Discuss how scoring matrix can be design for sequence alignment purpose. 5

4. a) Discuss on RNA editing in cephalopods. 10
   b) Distance matric D for Five sequences a, b, c, d and e are given below. You need to align them using clustalW algorithm. Step by step build the guided tree using UPGMA approach. 12

	a	b	c	d
b	5			
c	9	10		
d	9	10	8	
e	8	9	7	3

   c) What are the differences between Prokaryotic and Eukaryotic cells? 3

B.Sc.TE. 1-Yr 1st Semester
B.Sc.TE. 2-Yr 3rd Semester

02 March 2020 (Afternoon)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

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

CSE 4773: 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 do you mean by Access Network? Briefly explain the Networking Infrastructure for Distributed Applications. 2+5

   b) Write short notes on any two of the following Access Networks with diagrams. 5×2
      i. Digital Subscriber Line
      ii. Cable Connection
      iii. Fiber to the Home (FTTH)

   c) What analogy is followed to best understand the difference between packet transmission and propagation delay? Explain the analogy briefly. 8

2. a) Briefly explain the different types of classful IPv4 addresses? Why is classless IP addressing is needed? 5+2

   b) An IP address 200.11.8.45 is given and its subnet mask is 255.255.255.224/27 is given. Determine the following. 15
      i. How many subnets can be formed from it?
      ii. What are the subnet IPs?
      iii. What are the broadcast address of each subnet?
      iv. What are the valid hosts for each subnet?

   c) What type of IPV4 addressing is used for Multicast Routing Protocols? 3

3. a) What type of IP addressing is used in Islamic University of Technology (IUT)? Describe how an end device from IUT communicates with the outside world. 1+3

   b) How does a newly arriving host get an IP address in an unknown network? Explain with diagram. 7

   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 4+6
      i) Assuming no other traffic in the network, what is the throughput for the file transfer
      ii) Suppose the file is 4 million bytes. How long will it take to transfer the file from A to B?

   d) Though Network Address Translation (NAT) has enjoyed widespread deployment, yet some purists loudly object to it. Explain the reasons behind it. 4

4. a) Assume that the acknowledgment packet label from destination B is the last two digits of your student ID; hence complete the routing tables and briefly explain the setup phase. 9

   b) Demonstrate the delay for the network in Figure 1 with appropriate diagrams. 6

   c) What are the different types of network layer services? Briefly explain the services provided by the network layer at the destination computer with diagram. 10

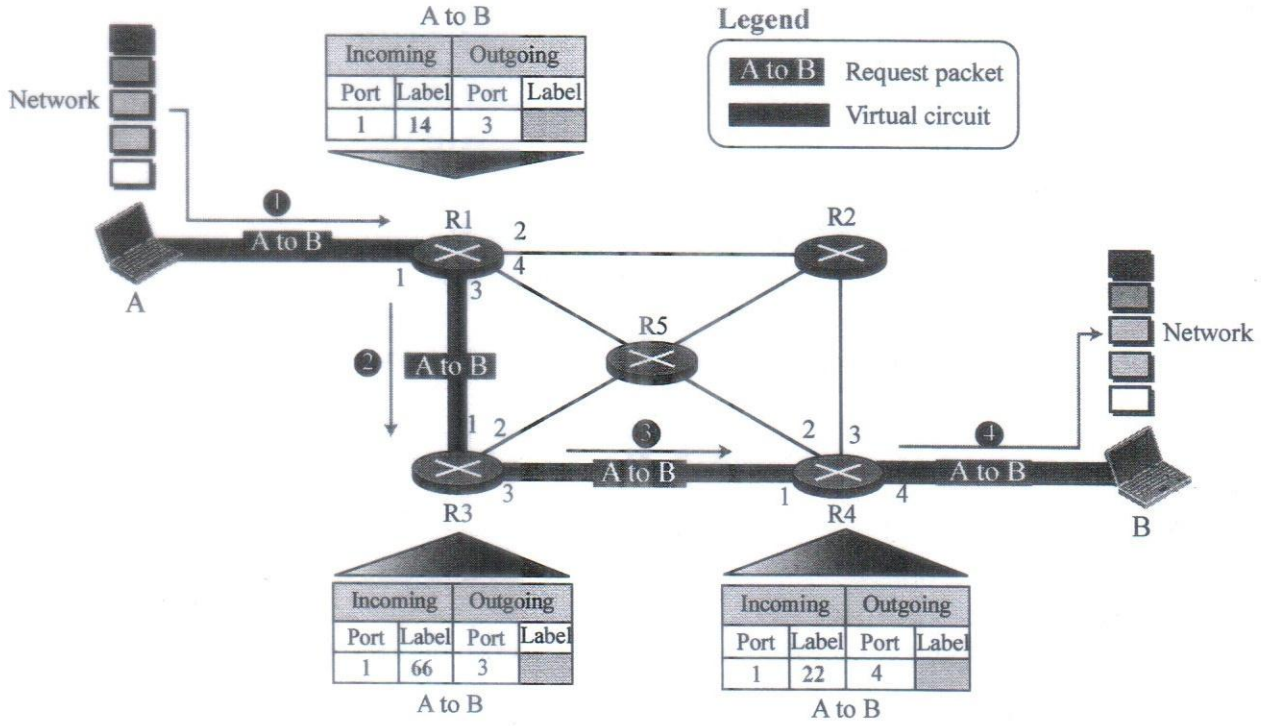

Figure1: Flow of Packet in Connection Oriented Packet Switching

M.Sc. TE 1st Semester | 27 February 2019 (Afternoon)

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

MID SEMESTER EXAMINATION | **WINTER SEMESTER, 2019-2020**

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

CSE 6191: Web Based Instruction and E-Learning

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)	What is an ice breaker? How can it be used during course startup?	2+12
	b)	What is learning? Discuss four stages of learning through OCTR model.	2+9
2.	a)	What is learning style? Classify learning styles and discuss each of them.	2+10
	b)	Discuss implementation of different types of learning styles in an online environment.	6
	c)	Compare traditional learning and e-learning.	7
3.	a)	Before presenting the lecture material which steps may be taken in a class to enhance the learning environment? Explain in detail.	12
	b)	After presenting the lecture material which steps may be taken preserve the learning?	13
4.	a)	What is learning contract? What are the benefits of learning contract?	10
	b)	What is collaborative learning? Discuss its importance in e-learning.	10
	c)	Discuss of self-directed learning.	5

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

CSE 6197: Distributed and Parallel 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.

1.	a)	What is parallel computing? Based on Flynn's taxonomy classify *programs and computers* and discuss on them in brief.	2+8
	b)	Discuss on various types of parallelism.	10
	c)	Write short note on *cluster computing*.	5
2.	a)	What is task parallelism? Discuss with an example.	12
	b)	Discuss how Instruction-level parallelism works.	13
3.	a)	Give a description of Uniform Memory Access (UMA) architecture.	10
	b)	Provide a basic concept of Non-uniform Memory Access (NUMA) architecture used in multiprocessing.	15
4.	a)	What is Symmetric multiprocessing? Explain its brief architecture with a diagram.	10
	b)	Compare parallel and distributed system.	10
	c)	List some applications of distributed system.	5

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

CSE 6257: Advanced Pattern Recognition

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) Why is the issue of generalization important while learning the classification model? Explain with necessary figures. 5

   b) In the multi-category case, a set of samples is said to be linearly separable if there exists a linear machine that can classify them all correctly. If any samples labelled ω_i can be separated from all others by a single hyperplane, we shall say the samples are totally linearly separable. Show that totally linearly separable samples must be linearly separable, but that the converse need not be true. 10
   Note: Use example classes in the 2D feature space.

   c) Consider the three-category linear machine with discriminant functions, where i represents class: $g_i(x) = w_i^t x + b_i, i = 1,2,3.$ 5+5

   i. For the special case where x is two-dimensional vector and the bias weights b_i are zero, sketch the weight vectors with their tails at the origin, the three lines joining their heads, and the decision boundaries.

   ii. Do the decision boundaries change when a constant vector c is added to each of the three weight vectors? Justify your answer.

2. a) Suppose the training data in a 2D feature space in a two-class problem is given as shown in Table 1: 20

Table 1

Class	$[x_1\ x_2]^T$
ω_1	[1 1] [2 0] [-1 1]
ω_2	[1 0] [0 0] [-1 0]

   Derive the equation of the decision boundary to linearly separate them. Show all necessary calculations along with the choice of your cost function.

   b) In a neural network, why do you need a nonlinear activation function? 5

3. a) Define the log-loss function L and cost function J for binary classification problem with m examples. Derive the derivatives of the cost function J with respect to z (total input) and w (weight vector) for a logistic regression unit. 8
   Note: Use vectorization notation. Assume standard notations and symbols.

   b) In case of a multi-layer neural network, what happens if all weights are initialized to zero? 5

   c) For a deep neural network, show all necessary calculations to find the final derivative of the loss function L with respect to a (output) for the $(l\text{-}1)^{th}$ layer. 12

M.Sc. Engg. CSE 28 February 2020 (Afternoon)

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

CSE 6275: Advanced Human Computer Interaction

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 experiential and reflective cognitions? Explain with examples. 8

   b) Suppose you want to design a two-way communication tool between deaf/mute and normal people. Your goal is to design communication dialogues using noun-verb combinations for this communication aid. Nouns are the context information where the interaction takes place and verbs are the operations or actions the user wants/allowed to perform.

      i. Identify the technologies required to support this assistive communication aid and describe in brief. 9

      ii. Design the dialogue (containing nouns and verbs) for the conversations between deaf/mute and normal person. 8

2. a) Monocular cues allow people to see visual depth in the absence of binocular vision. List the monocular depth cues with one example of each cue. 8

   b) Consider the arrangement of image files in the 2D interface as given in Figure 1.

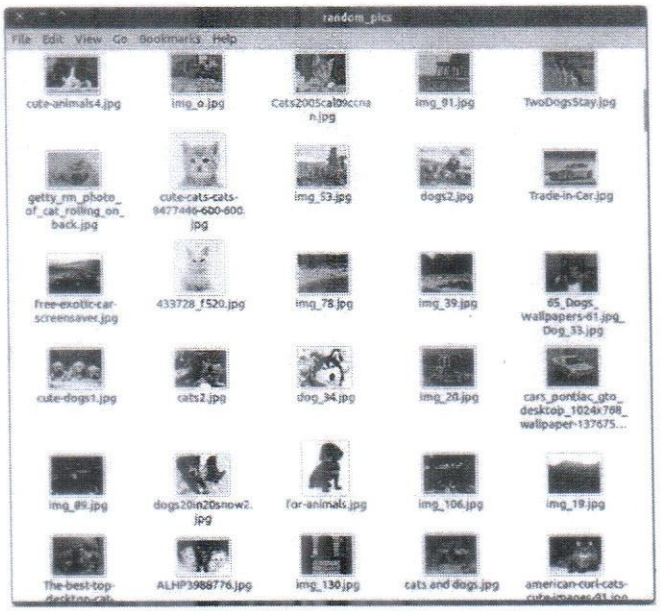

Figure 1: File manager in 2D

Answer the followings: 7

   i. Can visual depth affect the target detection task (selecting a particular image file) in the 2D interface? Explain. 10

   ii. Redesign the interface of Figure 1 by introducing monocular depth cues those are suitable to improve visual attention. You have to keep in mind the issues related to cognitive load while designing.

3. a) Interaction design can be considered as a translation problem between task language and system language. During these translations the gulfs that can be analyzed are Articulation, Performance, Presentation, and Observations. Categorize the following poor translations into these four type of gulfs with one sentence justification. 8

   i. Adjacent keys causing opposite state changes
   ii. To shutdown windows, the user must click on START
   iii. Applications performing the commands wrong
   iv. Lack of indentation, no visual change in the UI
   v. User cannot find important Windows OS commands
   vi. Pressing keys simultaneously
   vii. Cannot read fonts inside the image printed.
   viii. There is no indication that the file has been saved already by pressing `Ctrl+S` command.

   b) Suppose you are designing a Force Touch UI. Force Touch is a feature that was developed by Apple to sense the level of force exerted on a touchpad or trackpad and respond accordingly. People exert forces differently, based on gender, age, and physique.

      i. How would you develop a general scale to measure force touch input that could then be reliably used to trigger system responses? 7

      ii. Suggest some interactions that can be designed with this technology for a real-life scenario. 10

M.Sc. TE 3rd Semester 28 February 2020 (Afternoon)

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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

CSE 6391: Advanced Human Computer Interaction

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 experiential and reflective cognitions? Explain with examples. 8

   b) Suppose you want to design a two-way communication tool between deaf/mute and normal people. Your goal is to design communication dialogues using noun-verb combinations for this communication aid. Nouns are the context information where the interaction takes place and verbs are the operations or actions the user wants/allowed to perform.

      i. Identify the technologies required to support this assistive communication aid and describe in brief. 9

      ii. Design the dialogue (containing nouns and verbs) for the conversations between deaf/mute and normal person. 8

2. a) Monocular cues allow people to see visual depth in the absence of binocular vision. List the monocular depth cues with one example of each cue. 8

   b) Consider the arrangement of image files in the 2D interface as given in Figure 1.

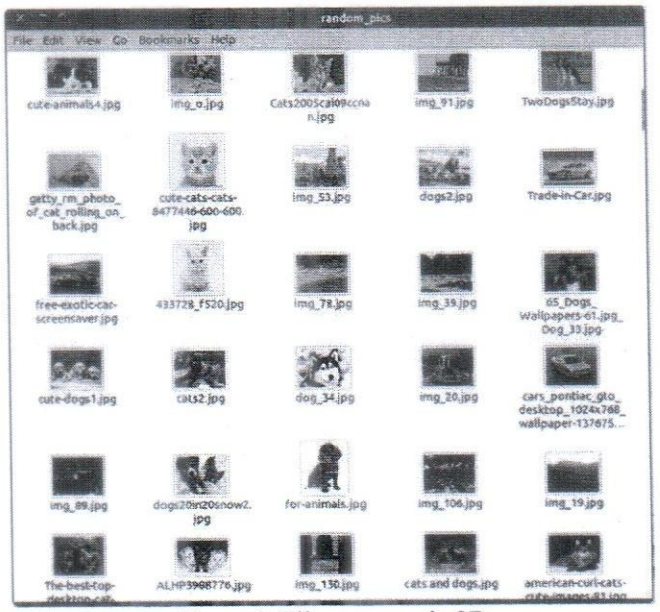

Figure 1: File manager in 2D

Answer the followings: 7

   i. Can visual depth affect the target detection task (selecting a particular image file) in the 2D interface? Explain. 10

   ii. Redesign the interface of Figure 1 by introducing monocular depth cues those are suitable to improve visual attention. You have to keep in mind the issues related to cognitive load while designing.

3. a) Interaction design can be considered as a translation problem between task language and system language. During these translations the gulfs that can be analyzed are Articulation, Performance, Presentation, and Observations. Categorize the following poor translations into these four type of gulfs with one sentence justification. 8

   i. Adjacent keys causing opposite state changes → Performance
   ii. To shutdown windows, the user must click on START → Articulation
   iii. Applications performing the commands wrong → Performance
   iv. Lack of indentation, no visual change in the UI → Presentation
   v. User cannot find important Windows OS commands → Articulation
   vi. Pressing keys simultaneously → Articulation
   vii. Cannot read fonts inside the image printed. → observation
   viii. There is no indication that the file has been saved already by pressing `Ctrl+S` command. Presentation

   b) Suppose you are designing a Force Touch UI. Force Touch is a feature that was developed by Apple to sense the level of force exerted on a touchpad or trackpad and respond accordingly. People exert forces differently, based on gender, age, and physique.

      i. How would you develop a general scale to measure force touch input that could then be reliably used to trigger system responses? 7

      ii. Suggest some interactions that can be designed with this technology for a real-life scenario. 10