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

MID SEMESTER EXAMINATION   WINTER SEMESTER, 2018-2019
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. 4.**
Figures in the right margin indicate marks.

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1. a) A software is written as a program or a set of programs, as a module or a set of modules. A   9
        team of software engineers work collaboratively to accomplish the task of developing a
        software. What does the term *'Man-Month'* indicate about a software? How does the
        'understanding the customer', *'technological know-how'* and *'team formation'* influence the
        estimated man-month for a software project?
    b) Mention the components of a computer system.   4
    c) Differentiate between Parallel and Distributed Computing.   4
    d) Write your perception about Open Source Community and Open Source Software.   4
    e) What do you understand by Von-Neumann and Harvard architecture?   4

2. a) What is a firmware? What is its relation and difference with software? Mention 3 computer   5
        devices that use firmware and also mention the purpose of using the firmware.
    b) Write the algorithm (in pseudo-code format) for calculating the summation of the all the odd   5
        numbers from *Number1* to *Number2*. Consider *Number1* and *Number2* are two input
        variables.
    c) Mention the relations between data, information and knowledge.   5
    d) How does a ball mouse work using an optical-mechanical technology? Describe the   5
        technology to detect the forward and backward movement of the mouse.
    e) Modern computer systems has a view as shown in figure 1:   5

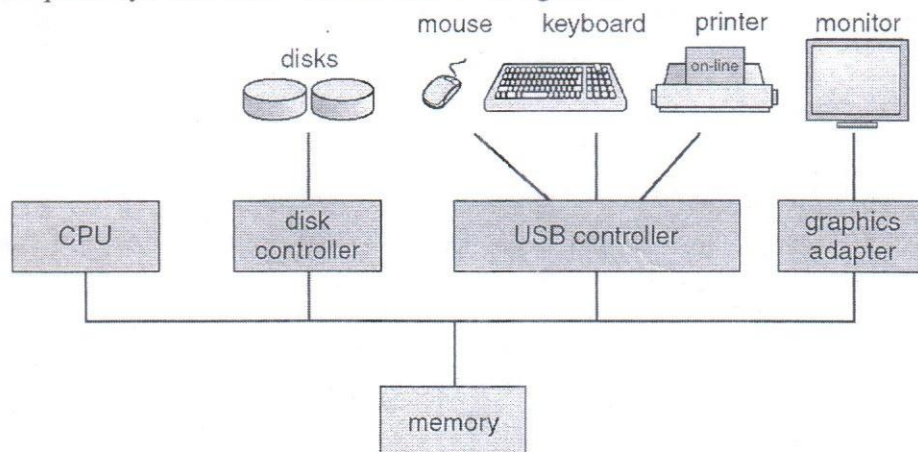

Figure 1: Figure for question 2(e)

Interpreting the above figure briefly answer to the following questions:
    i.   How does the CPU control multiple peripheral or I/O devices in parallel?
    ii. How multiple devices use the *bus* (the horizontal line in the figure)?

3. a) Define a number system. Why do we convert any number into decimal number?   4
   b) Convert $(1234)_{10}$ to a   9
      i. Base-4 number.
      ii. Base-16 number.
      iii. Base-7 number.
   c) What are the decimal values for the numbers $(2114)_5$ and $(775)_8$?   6
   d) Suppose you have a 4-bit binary number system in your computer. You want to do the   6
      arithmetic (**-5-3**). How will your computer perform the math? How will your computer
      decide the correctness of the arithmetic performed?

4.   **(Mandatory to Answer)**
   a) A novice user used the commands *ls* and *cd* as shown in the following figure and got a   6
      message: 'Error: not a directory'.

```
#  ls
user           bin            etc            home           dev
var        myfileDirDev
# cd myfileDirDev
 Error: not a directory
```
Figure 2: Commands for question 4(a)

      What mistake has s/he done? What actions does the user need to perform if s/he wants to
      investigate the contents of *myfileDirDev*.
   b) Suppose a hypothetical micro-processor has the following instructions with their instruction   7
      codes:

Instruction	Instruction Code (in Hexadecimal)
COC	55
DIB	9F
BAB	43

      The instructions use some registers **AX - FX** which have codes 00-05H. The instructions can
      also use one numeral.
      What will be the machine code for the following micro-processor commands:

```
COC    AX,   FX
DIB    FX,   89H
BAB    BX,   DX
```

   c) What is virtualization? How does virtualization enable **Infrastructure as a Service (IaaS)**?   6
   d) Quote a simple example how Digital Logic Design (DLD) can be used as software of a   6
      Computer System.

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

MID SEMESTER EXAMINATION   **WINTER SEMESTER, 2018-2019**
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. 4.**
Figures in the right margin indicate marks.

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1. a) Computer system has a memory hierarchy from registers to main memory and to secondary   7
        storage. Write or Draw the details of the memory hierarchy. Why is the memory hierarchy
        needed?
    b) Binary systems start with *bit* and then to *byte* and *kilobyte* and so on. Write all the quantities   6
        of the binary number systems and show their equivalence in decimal numbers.
    c) What are *Virus*, *Worm* and *Trojan Horse*. How can you be protected from those?   6
    d) A file has a permission 0755 (111 101 101 in binary) set by its owner. What does it imply?   6
        Which types of files have this sort or permission?

2. a) What is a firmware? What is its relation and difference with software? Mention 3 computer   4
        devices that use firmware and also mention the purpose of using the firmware.
    b) How does a keyboard work?   5+2
        Is it possible to have a personalized keyboard layout just by configuring it?
        Is it possible to extend the capability of a keyboard as an output device also?
        If you write yes for the two questions just above, justify your answers.
    c) You may feel that Operating System (*OS*) occupies the CPU all the time. Yet OS executes   5
        several programs simultaneously in a time shared system.
        How does the OS control the CPU for executing multiple programs in a time shared system?
    d) How does a laser printer work?   5
    e) Differentiate between Parallel and Distributed Computing. Categorize peer to peer   4
        computing and cloud computing as one of parallel or distributed system.

3. a) Define a number system. Why is binary number system studied widely for developing digital   4
        systems?
    b) Convert $(55)_{10}$ to a   6
        i. Base-4 number.
        ii. Base-5 number.
    c) What are the decimal values for the numbers $(2112)_3$ and $(775)_9$?   6
    d) Perform the following 2's complement arithmetic assuming 4-bit computer system: 9
        i.   5 - 2
        ii. -4 -3
        iii. 1-8

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4. a) **Block** is the logical primitive for any *file system*. How is a **block** defined in *Hard Disk* and in   6
   Flash Memory Devices?
   Compare a logical *file system* with the cataloging system of a library. Quote appropriate
   technical terms related to file systems during the comparison.

   b) Write an algorithm to convert a decimal number D to a base B number system.   7

   c) Many students have a misconception that an Integrated Development Environment (IDE)   6
   generates the *.exe* and runs the file. Define the tasks of an IDE for developing a
   program/code.

   d) How is a c program converted to a *.exe* binary executable file. Write the use of assembler,   6
   linker and compiler in achieving this conversion.

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Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION

WINTER SEMESTER, 2018-2019

DURATION: 1 Hour 30 Minutes

FULL MARKS: 75

CSE 4107: Structured Programming 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.
Figures in the right margin indicate marks.

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1. a) What is the difference between a **while** loop and a **do while** loop? Explain.   6

    b) Write the output of the following program: 11

```c
#include <stdio.h>
int main()
{
    int i, j, k;
    for(i=0, j=0; i<5, j<5; i++, ++j){
        printf("Inside for loop %d %d\n", i, j);
    }
    while(++i<12 && j++<12){
        printf("Inside while loop %d %d\n", i, j);
        for(k=0; k<3; ++k, i++, ++j){
            printf("Inside nested for loop %d %d %d\n", i, j, k);
        }
    }
    return 0;
}
```

Figure 1: Program from Question no. 1(b)

   c) Write a C program which prints the number table of **n** numbers upto **m** multiples. There will   8
   be 6 (3×2) lines of output for a pair of input (**n** and **m**). In a general case, the output will contain
   m×n lines in total. The sample input and output is given below:

Table 1: Number table sample for Question no. 1(c)

Sample Input	Sample Output
3 2	1 * 1 = 1 1 * 2 = 2 2 * 1 = 2 2 * 2 = 4 3 * 1 = 3 3 * 2 = 6

2. a) Sadaf likes to throw balls into the air with all his might. He becomes happy if the ball reaches   8
    greater height. 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. [**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) What are header files? Why do we need header files? Which header files do the following functions belong to?   8
   i.   strcat()
   ii. sqrt()
   iii. printf()
   iv. cos()

c) A function-tree is a visualization of function calls. A Fibonacci series is a sequential list of numbers, where each number is the sum of the previous two numbers. Therefore, a Fibonacci series of 8 numbers will be as follows: 0, 1, 1, 2, 3, 5, 8, 13.   9

```
int fib(int a)
{
    if(a==1) return 0;
    if(a==2) return 1;
    return fib(a-1)+fib(a-2);

}
```
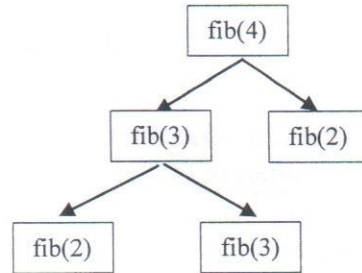
Figure 2(a): Code for Question 2(c).

Figure 2(b): Function-tree for Question 2(c).

The function code to find the ath Fibonacci number is given in figure 2(a). If the function-tree for a=4 is given in figure 2(b), draw the function-tree for **a**=3. Mention the return values of the functions in each step of the figure.

3. a) Answer the followings: 9
   i.   Write a program that will read a string of characters from the console and print the number of vowels in that string. All the characters will be lower-case English alphabets and digits with no space.
   ii. Modify the previous program to count the number of digits.

b) Will the following sections of codes in Figures 3(a) and 3(b) execute/run properly? Write the errors (if any) and make the necessary amends so that the program executes properly.   12

```
int ar[100], i=1, j=1, idx=-1;
for( ; i<=10; i++, j+=10){
    puts(i);
    arr[i] = i;

}
if(ar[idx]==idx)
    puts("value = index");
else  printf("not same");
```

```
void func(int a, int b){
    int ar[][]={1,7,9,4,6};
    int str[5][5];
    strcpy(str,ar);
    a=strcmp(str,ar);
    printf("%d", a)
    return str[5][5];

}
```

Figure 3(a): Sample Code 1 for Question 3(b).   Figure 3(b): Sample Code 2 for Question 3(b).

c) Fill up the following Table: 4

Table 2: Built-in C Functions

Function	Input	Output/Return
strcmp()	"stipend", "stupid"	
strcmp()	"base", "1case"	
scanf("%d", &a)	5	
scanf("%d", &a)	c	

4. a) What are the two different types of functions? What are the main attributes of prototypes? 5

b) Google is an extra-ordinary search engine as it uses highly optimized algorithms to find a 20
webpage. Each webpage has some keywords which can be used to find it. Whenever a user
types one of those keywords in the search bar, Google finds the pages by mapping the words
to the pages. You are an engineer of Google and you have to organize the data to make it easier
to find. Use any sorting algorithm within your knowledge to organize the webpages so that
they are easier to find. You have to sort the keywords under each webpage and also sort the
webpages according to their name. There can be **N** number of webpages and for each webpage
there can be **M** number of words. The input will begin with the value of **N**, followed by **N**
integers. Each of the **N** integers will be followed by the name of the webpage and **M** keywords.
See the given sample input and output in Table 3 for reference:

Table 3: Sample input and output for Question no. 4(b)

Sample Input	Sample Output
3 2 google search engine 3 microsoft hardware software product 2 alibaba sale buy	alibaba - buy sale google – engine search Microsoft - hardware product software

B.Sc. Engg. SWE 1ˢᵗ Semester   **7 March 2019 (Afternoon)**

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

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

CSE 4107: Structured Programming 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.
Figures in the right margin indicate marks.

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1. a) You have been assigned the task of developing a grading software to calculate the grades of   12
   the students. The software will take the mark $m, (0 \leq m \leq 100)$ obtained by a student as
   input and then print the grade of the student according to the following table. You have also
   been instructed to only use switch cases in the program. The use of *if* condition will not be
   accepted by the clients.

   Table 1: Table for Question 1(a)

Grade	Marks
A	70-100
B	50-69
C	40-49
F	0-39

   b) A **narcissistic number** is a number that is the sum of its own digits each raised to the power   13
   of the number of digits. The definition of a narcissistic number relies on the decimal
   representation

   $$n = d_k d_{k-1} \ldots d_1 \text{ of a natural number n,}$$

   i.e.,

   $$n = d_k * 10^{k-1} + d_{k-1} * 10^{k-2} + \cdots + d_1 * 10^0$$

   With k digits d_i satisfying $0 \leq d_i \leq 9$. Such a number n is called narcissistic if it satisfies the
   condition

   $$n = d_k^k + d_{k-1}^k + d_{k-2}^k + \cdots + d_1^k$$

   For example, the 3-digit decimal number 153 is a narcissistic number because
   $$153 = 1^3 + 5^3 + 3^3.$$

   **Write a program which will take two input m, n where 0<m<n<100000 and display all
   narcissistic number in the range [m,n] inclusive in the output.**

2. a) Write a program to sort the array named list in descending order and display.   10

   ```
   int list [10] = {5,4,1,2,8,3,7,9,6,10};
   ```

   b) A Pythagorean triple is a set of three integer a, b, c where the sum of the square of two of the   10
   numbers is equal to the square of the third number. Write a program that will take three
   integers as input from the user and print whether the numbers form a Pythagorean triple or
   not. The program will continue taking input until the user enters a Pythagorean triple as input.

   c) Differentiate between global variable and local variable with the help of suitable examples.   5

3. a) Determine the output for the following block of code.   12

```c
#include<stdio.h>
void fun1(int x, int y);
double fun2(double b);
int a = 5;
double b = 10;

int main(){
    int a = 15;

    printf("In main: a = %+.21f,", (double)a);
    printf(" b = %+.21f\n", (double)b);
    fun1(a, b);
    printf("Leaving main: a = %+.21f,", (double)a);
    printf(" b = %+.21f\n", (double)b);
    return 0;

}
void fun1(int x, int y){

    printf("In F1: a = %+.21f,", (double)a);
    printf(" b = %+.21f\n", (double)b);
    b = fun2(x + y);
    printf("Leaving F1: a = %+.21f,", (double)a);
    printf(" b = %+.21f\n", (double)b);

}
double fun2(double b){

    printf("In F2: a = %+.21f,", (double)a);
    printf(" b = %+.21f\n", (double)b);
    b = a + b;
    printf("Leaving F2: a = %+.21f,", (double)a);
    printf(" b = %+.21f\n", (double)b);
    return b + a;

}
```

Figure 1: Code for Question 3(a)

b) Write a program that will take a number n, as input from the user and draw a pattern similar   8
to the following figure. The output shown here is for n = 5.

```
            1
          1 *
        1 * 3
      1 * 3 *
    1 * 3 * 5
```

Figure 2: Figure for Question 3(b)

c) What are the limitations and disadvantages of using *switch* instead of *if* statement? Explain   5
using a suitable example.

4. a) Alphabetical characters include 'A'-'Z' and 'a'-'z'. Following program should take input   12
from the user until it finds a non-alphabetical character. It will show the number of
consonants and vowels present in the input as output.

Find out the logical and syntax error in the following code.

```
#include<stdio.h>

int main(){
    int ch, count_cons, count_vow , total=0;

    while(ch>= 'A' || ch<= 'Z' && ch>= 'a' || ch<= 'z')
    {
        scanf("%c ",ch)
        switch(ch)
        {
            case 'a':
            case 'A':
            case 'e':
            case 'E':
            case 'i':
            case 'I':
            case 'o':
            case 'O':
            case 'u':
            case 'U':
                    count_vow++;
            default :
                    count_cons++;
        }
    }
    total = count_vow+count_cons
    printf("Total:%d\n ",total);
    printf("Consonants:%d, Vowels:%d",count_cons,count_vow);

    return 0;
}
```

Figure 3: Code for Question 4(a)

b) Write a program where the main function will take a character variable *c*, as input and print whether the input is an upper-case letter, lower-case letter or a number. **You must write three separate functions to perform the three different checks.** You cannot check the type of the character in the main function.   8

c) Explain the differences between **i++** and **++i** operations with necessary examples.   5

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Department of Computer Science and Engineering (CSE)

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

Phy 4141: Physics I

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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 Coulombs law in electrostatics. With the help of a suitable example show that charge is conserved — 7

   b) 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. — 10

   c) The electric field between the plates of a cathode-ray oscilloscope is 1.2×10^4 nt/coul. What deflection will an electron experience if it enters at right angles to the field with a kinetic energy of 2000 ev ($= 3.2 \times 10^{-16}$ joul)? The deflecting assembly is 1.5 cm long. — 8

2. a) Discuss electric potential V. How is electric potential V related to the electric field E? — 7

   b) Derive an expression for the electric potential V at any point of space due to an electric dipole provided only that the point is not too close to the dipole. Describe how V changes for different values of θ (from $\theta = 0$,90, 180) — 10

   c) Calculate the dipole moment of a water molecule under the assumption that all ten electrons in the molecule circulate symmetrically about the oxygen atom, that the OH distance is 0.96×10^{-8} cm, and that the angle between the two OH bonds is 104^0. — 8

3. a) Discuss Einstein's photo-electric effect. Draw a schematic diagram of the photo-electric experiment and explain the working of this device — 7

   b) Define interaction of radiation with matter. Discuss Compton effect. How does Compton effect differ from the Einstein's photo-electric effect? — 10

   c) Write short notes on: — 8
      i. Photo-current
      ii. Stopping potential
      iii. Threshold frequency
      iv. AND work function

4. a) Discuss Special theory of relativity. Write down the postulates of Special theory of relativity. What are inertial and non-inertial frame of reference? Give example for each — 8

   b) Derive Lorentz transformation equations. Also write down their inverse form. What are time dilation and length contraction? — 10

   c) A certain particle has a lifetime of 1.00×10^{-7} s when measured at rest. How far does it go before decaying if its speed is 0.99c when it's created? — 7

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

MID SEMESTER EXAMINATION   WINTER SEMESTER, 2018-2019
DURATION: 1 Hours 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.

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1. a) Find the change in the coordinates of a point when the direction of axes is turned through an   15
       angle θ without changing the origin. Transform the equation $2x^2+4xy+4y^2-2x-4y-2=0$ to
       rectangular axes through the point (2,-1) and inclined at angle 45^0.

    b) Find the value of K, so that the conic $12x^2+36xy+ky^2+6x+6y+3=0$ represent a pair of   8.33
       straight lines.

    c) Write the different conditions need to be fulfilled so that the general equation of second   10
       degree represents a conic. Discuss the nature of the conic $x^2+6xy+9y^2+4x+12y-5=0$.

2. a) Define direction ratios and cosines of a line. Suppose OP be any line, where O be the origin   10
       and P (2, 1,-1) be any point, find the direction angles of the line.

    b) Find the Projection of a line AB on a line CD by using two different methods, where the   10
       points A, B, C, and D are respectively (1, 1,-1), (2, 1, 0), (-1, 0, 1) and (1, 2, 3).

    c) If the edges of a rectangular parallelepiped are L, H and W then show that the angles   13.33
       between the four diagonals are given by $cos^{-1}\left(\frac{\pm L^2 \pm H^2 \pm W^2}{L^2+H^2+W^2}\right)$.

3. a) Classify the following function as even, odd or neither.   8

       i. $f(x)=\dfrac{-3x^2}{x^3+1}$ ii. $g(x)=\cos x+1$ iii. $F(x)=\dfrac{x-3}{|x-3|}$ iv) $h(x)=x^4+1$

    b) If $f(x)=\begin{cases}-x-4 & -4\le x\le -1\\ 3x & -1\le x\le 1 \\ -x+4 & 1<x\le 4\end{cases}$ then graph $f(x)$ and $|f(x)|$.   8

    c) i.   Graph the function $f(x)=-(x-2)^2(x-1)^2(x+3)$ by showing necessary steps.   17.33
       ii. Find the inverse of the function $f(x)=2e^{x+2}-1$ and graph the f and f^{-1} in the
            same plane.

4. a) Define Limit of a function. If $f(x)=\dfrac{3x+|x|}{7x-5|x|}$, does the limit $\lim\limits_{x\to 0} f(x)$ exist?   8

    b) Find the Limit of the following functions   9

       i. $\lim\limits_{x\to 2}\dfrac{1}{(x-2)^4}$ ii. $\lim\limits_{x\to\infty}\dfrac{x^2+2x-x^3}{3x^4-7}$ iii. $\lim\limits_{x\to 2}\ln|x-2|$

c) If $f(x) = \begin{cases} x^2 - 1 & -1 \le x < 0 \\ 2x & 0 < x < 1 \\ 1 & x = 1 \\ -2x + 4 & 1 < x < 2 \\ 0 & 2 < x < 3 \end{cases}$, then graph the function. Answer the following questions: 9

    i.   Does $f(-1)$ and $f(-1)$ exist?   ii. Does Limit $\lim_{x \to 0} f(x)$, $\lim_{x \to 1} f(x)$ and $\lim_{x \to 2} f(x)$ exist? If so what is it? If not, explain why?

d) A raindrop forms in the atmosphere and begins to fall to earth. If we assume air resistance   7.33 is proportional to the speed of the raindrop, then the drop's velocity as a function of time is given by $v(t) = \dfrac{mg}{k}(1 - e^{-kt/m})$ where m is the mass of the raindrop, g is acceleration of gravity and k is a positive constant. Find $\lim_{t \to \infty} v(t)$ and draw the graph of $v(t)$.

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

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

CSE 4173: Introduction to Database Management System
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) Describe the purposes of Database Management System.   10

   b) What are the differences among **Cartesian Product**, **Join** and **Natural Join** operation? Explain   10
      with necessary examples.

   c) What is the **Atomic** property of an attribute? Explain with necessary examples.   5

2. a) What is **Data Abstraction**? Describe the three levels of **data abstraction** which simplify the   10
      users' interactions with the system.

   b) Explain the distinctions among **Super Key**, **Candidate Key** and **Primary Key** with suitable   10
      examples.

   c) What does a **Null** value indicates? Point out some complications in database operation on a **null**   5
      value.

3.   *employee* (<u>employee name</u>, street, city)
      works (<u>employee name</u>, company name, salary)
      company (<u>company name</u>, city)
      manages (<u>employee name</u>, manager name)

   a) Write down the **sql queries** as well as the **relational algebra** for the following queries.   20

      i.   Find the **name**s and **cities** of residence of all employees who work for "First Bank
           Corporation".
      ii. Find the **names**, **street addresses**, and **cities** of residence of all employees who work for
           "First Bank Corporation" and earn more than $10,000.
      iii. Find all employees (**name**) in the database who do not work for "First Bank Corporation".
      iv. Find all employees (**name**) in the database who earn more than each employee of "Small
           Bank Corporation"
      v.   Find the number of employees in each company in the database.

   b) List and explain the common data types available in SQL.   5

4.   *department(*dept_name, building, budget*)*
*course (*course_id, title, dept_name, credits*)*
*instructor (*ID, name, dept_name, Salary*)*
*section (*course_id, sec_id, semester, year, building, room_number*)*
*teaches (*ID, course_id, sec_id, semester, year*)*

a)   Write down the necessary DDL to create above tables. Include necessary foreign key constraints   10
where necessary.

b)   Nowadays, most users of a database system are not present at the site of the database, but   15
connect to it through a network. We can therefore differentiate between client machines, on
which remote database users work, and server machines, on which the database system runs.
Now, describe the database architecture with diagram.

CSE 4175: Computer 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.

1. a) What is typecasting? Why is typecasting required? Explain with proper example.   2+5
   b) Write a program, which will take 10000 integers as input and print the average of those   10
      integers.
   c) Write down the output for the following code: 8

```c
#include<stdio.h>
int z=5;
int main(void)
{
    int x=998785,y=2;
    printf("%d\n", x%y);
    x=x%y;
    printf("%d\n", ++x);
    printf("%d\n", x++);
    printf("%d\n", --y);
    for( ; y<2;++y) z*=y;
    printf("%d\n", y);
    printf("%d\n", x*y);
    x*=100;
    printf("%d\n", x/y);
    printf("%d\n", z);
    return 0;
}
```

2. a) What are ASCII Values and ASCII Characters? Write a program to print the ASCII values of   2+8
      characters starting from 'A' up to 'Z' and 'a' up to 'z'.
   b) Write a program that will take an integer as input and check whether it is an Armstrong   15
      number or not.

3. a) Explain the topics below: 2+4+2
      i.   Block of code
      ii. Local & Global Scope
      iii. Function Prototype
   b) 1 foot = 30.48 centimeters. Write a program that converts centimeters to foot. Write a function   7
      named **c_to_f** to perform the conversion. Call c_to_f from the main function with the number
      of centimeters as argument. Let **c_to_f** return the value of foot to the main function.

c) Write a program, which will take three sides of a triangle as input and print whether the triangle is valid or invalid. Hints: Any side of a triangle cannot have value zero or less than that and any two side should be greater than the third one for a triangle to valid.   10

Sample Input	Sample Output
0 -5 7	Invalid
3 4 5	Valid
10 2110	Invalid

4. a) Write down a program which will take an integer as input and check if it is prime or not.   15

   b) Using nested for loop print the following shape (blank positions represent spaces):   10

```
    5
   45
  345
 2345
12345
```

B.Sc. Engg. CSE 3rd Semester   08 March 2019 (Afternoon)

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

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

CSE 4301: Object Oriented 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.

---

1. Create a class called **StudentInfo** where the details of a student's academic records are stored.   25
    In the above mentioned class, the private properties will include the name and ID of the student.
    Moreover, a student can take any number of courses and the results of the courses are to be
    kept in an integer array inside **StudentInfo** class. All these properties need to be private and
    can only be accessed outside of **StudentInfo** class by **CalculateAvgResult** method from
    ResultService class and through the parameterized constructor of the **StudentInfo** class. It
    should be noted that the properties of the **StudentInfo** class can only be set once through this
    its constructor as parameters and the values should be immutable. **CalculateAvgResult**
    method calculates the average result of a given student. Moreover, ResultService include
    another method called **SortStudents** which takes an array of students as parameter and sorts
    them according to their average results in ascending order. Finally, **SortStudents** prints the
    names of the students according to the sorted list.
    Note: The **interface** and **implementation** for both the classes should be in separate files with
    each file marked elaborately along with their names. Moreover, you should include a main
    function in a separate file to demonstrate your implementation. Each file should refer to all
    required header and library files according to necessity.

2. a) How Structured programming is different from Object Oriented Programming?   5
    b) Write short notes on   4x2
        i.   Function Overloading
        ii.   Encapsulation
        iii. Polymorphism
        iv.   Inheritance
    c) What are the purposes of Destructors in C++ classes? With proper example describe the   12
        problems associated with Destructors while assigning objects, passing objects as parameters
        to a function and returning object from a function. Also provide worked out solution to such
        problems.

3. Check out the code snippet in Figure 1. Complete the classes according to the instruction given   25
    as comments. Given two character-arrays, use the first array to build your *dictionary*. Each
    'element' object holds unique characters from the first array as *key,* and the number of times
    they appear in the first array is stored in *count.* The second array is used to decrease counts of
    corresponding *element keys*. You cannot use any library other than *iostream.*
    For example, if you were given two character-arrays: **ABACB** and **BCCGG,** you should at
    first build your dictionary which should be like **(A: 2), (B: 2), (C: 1)**. In the second array B
    and C occurs once and twice respectively. You should decrease the count of B and C from
    your dictionary. The final status of the dictionary should be like this: **(A: 2), (B: 1)**. Notice
    that as C appears twice, the *key 'C'* is removes from dictionary. Also there was no *key 'G'* in
    the initial *dictionary* and thus has no impact on the *dictionary*.
    Demonstrate your code by writing a *main function* that takes two character-arrays of arbitrary
    length from user and prints the final status of the *dictionary*.

```
#include<iostream>
Using namespace std;

class element {
    char key;
    int count;
public:
    /*Implement appropriate constructors, getters and setters*/
};

class dictionary {
    /*Declare an object pointer of 'element' class and other properties
as necessary. */
public:
    /*Create necessary constructors. */
    /*Check if element with the given key exists. */
    bool hasElement(char key);
    /*Add a new element to the array of 'element' objects. Return false
if element already exists. Else return true. */
    bool addElement(element elm);
    /*Add a new element to the array of 'element' objects. Return false
if element already exists. Else return true. */
    bool addElement(char key, int count);
    /*remove element from array of 'element' objects. Return false if no
such element exists. Else return true. */
    bool removeElement(element elm);
    /*remove element from array of 'element' objects by matching the
key. Return false if no such element exists. Else return true. */
    bool removeElement(char key);
    /*Increase count of the element that matches the key. Return false
if no such element exists. Else return true. */
    bool increaseCount(char key);
    /*Decrease count of the element that matches the key. Return false
if no such element exists. Else return true. If element's count
decreases to zero, remove that particular element. */
    bool decreaseCount(char key);
    /*Print all existing elements along with their count. */
    void printElements();
};
```

Figure 1

4. a) Check the code snippet given in Figure 2. Complete the code according to the comments provided.   10

```
class classA {
    int i;
    float f;
public:
    /*Write exactly THREE constructors. No other methods are allowed*/
};

int main() {
    int count = 4;
    /*In ONE executable C++ statement create and initialize an array of
classA objects with 'count' number of elements (in this case [count=4]).
    The first object should have {i=0, f=0.0}
    The second object should have {i=1, f=0.0}
    The third object should have {i=0, f=2.0}
    The fourth object should have {i=3, f=4.5}*/
    return 0;
}
```

Figure 2

b) Figure 3 is a complete program. What would be the output of the program? If you think there will be any possible anomalies in the output, mention them with proper explanations.   10

```cpp
class test {
    int count;
    int *p;
public:
    test() {
        this->count = 5;
        this->p = new int[this->count]{ 0,0,0,0,0 };
    }
    test(int count, int* p) { this->set_p(count, p); }
    void set_p(int count, int* p) {
        this->count = count;
        this->p = new int[this->count];
        for (int i = 0; i < count; i++)
            this->p[i] = p[i];
    }
    int* get_p() {return this->p;}
    test* getTest() {return this;}
};
int set(test* obp) {
    int count = 5;
    int* p = new int[count] {10, 20, 30, 40, 50};
    obp->set_p(count, p);
    return count;
}
int set(test obp) {
    int count = 6;
    int* p = new int[count] {1, 2, 3, 4, 5, 6};
    obp.set_p(count, p);
    return count;
}
void print(test* p, int count) {
    int i = 0;
    while (true) {
        cout << *(p->get_p() + i) << ' ';
        i++;
        if (i >= count) break;
    }
    cout << endl;
}
int main() {
    int count = 4;
    int* p = new int[count] {100, 200, 300, 400};
    test* obP = new test(count, p);
    print(obP, count);
    count = set(obP);
    print(obP, count);
    count = set(*obP);
    print(obP, count);
    test ob = *obP->getTest();
    print(&ob, count);
    return 0;
}
```

Figure 3

c) Revisit the program in Figure 3 of Question 4(b). What impact would there be if the class *test* included a destructor with the following code in Figure 4? Would there be any run-time exception? If yes, then why?   5

```cpp
~Test(){delete[] p;}
```

Figure 4

B.Sc. Engg. SWE 3rd Semester   8 March 2019 (Afternoon)

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

MID SEMESTER EXAMINATION   WINTER SEMESTER, 2018-2019

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 **4 (four)** questions. Answer **3 (three)** of them **including question 1**.
Figures in the right margin indicate marks.

Question 1 is mandatory to answer

1.   You recently got a messy project to work with and the Ride class in Figure 1 is part of it.

```
1.   class Ride {
2.       String vt;
3.       int distance;
4.       int nop;
5.
6.       int getFare() {
7.           int f;
8.           if (vt == "sedun") {
9.               f = (50 + distance * 30) / nop;
10.          } else if (vt == "motorbike") {
11.              f = Math.max(25, distance * 20) / nop;
12.          } else {
13.              if (distance < 10)
14.                  f = 300 / nop;
15.              else
16.                  f = distance * 30 / nop;
17.          }
18.
19.          return f - (f % 5);
20.      }
21.
22.      boolean isRideValid() {
23.          if (vt == "sedun") {
24.              return nop <= 4 && distance <= 25;
25.          } else if (vt == "sevenseater") {
26.              return nop <= 7 && distance >= 10;
27.          } else {
28.              return nop == 1 && distance <= 10;
29.          }
30.      }
31.  }
```

Figure 1

a)   i.   Detect at least 5 unique code smells and find at least 10 lines of code with smells.   12+3
Mention the line number where a particular code smell is found.

      ii.   Two of the code smells are worse than others, which are those?

b)   The code in Figure 1 needs refactoring. Draw a class diagram or write a code with empty   10
methods that represents the expected code after refactoring.

2.   a)   One of your friends is complaining that the `Ride` class in Figure 1 is not open for extension.   3+2+4

      i.   Give an example of an extension that your friend might be referring to.

      ii.   Find the locations of the code that requires modification to implement the extension
you mentioned in answer 2a(i).

      iii.   What are the benefits of the design you suggested in answer 1(b) has over the
original design, in terms of the extension? Note that there is a lot more code in the
project, the `Ride` class is only a part of it.

b)   State the fundamental concept of the following design principles. Use maximum 3   3x3
sentences for each.

      i.   Open Closed Principle (OCP)

      ii.   Liskov Substitution Principle (LSP)

      iii.   Dependency Inversion Principle (DIP)

c)   Graph in Figure 2 represents a program. The nodes represent type/class, the filled edges   7
represent program flow direction and the dashed edges represent source code dependency
direction. This program does not follow DIP. How would the graph look like if the program
did follow DIP? Note that you might require to add new nodes.
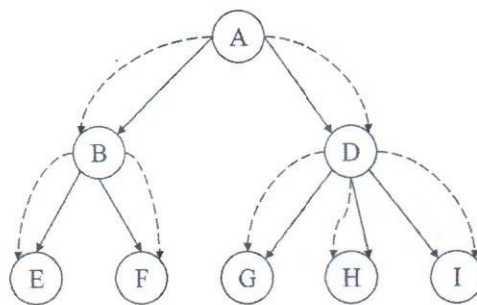

Figure 2: Dependency graph of a program

3.   a)   You heard your friend saying, "That critical bug was fixed as a result of refactoring".   2+5+5

      i.   Define refactoring.

      ii.   Explain why the statement above incorrectly uses the term refactoring.

      iii.   Based on the definition of refactoring, explain how unit testing is related to it.

b)   Unit testing is difficult without dependency inversion. Explain with an example.   6

c)   Give a simple code example where LSP is violated.   7

4.   a)   There is a popular phrase saying "prefer composition over inheritance".   2+5

      i.   Inheritance gives two benefits, one of which can also be achieved by composition.
What is this common benefit of composition and inheritance?

      ii.   What is your opinion regarding this phrase? Defend your opinion.

b)

```
class A {
    B b;
    A() {
        b = new B();
    }
}
```

Figure 3: Program for Question 4(b)

4+3

    i.   Rewrite the code in Figure 3 so that it uses dependency injection.

    ii.   Between classes A and B, which one is dependent and which one is dependee?

c)   The `SimpleList` class in Figure 4: 4 only supports `String` type. Write a generic version of this class so that any type can be supported.

7

```
class SimpleList {
    String[] allItems;

    SimpleList(int capacity) {
        allItems = new String[capacity];
    }

    void set(int index, String item) {
        allItems[index] = item;
        lastIndex++;
    }

    String get(int index) {
        return allItems[index];
    }
}
```

Figure 4: Program for Question 4(c)

d)   Explain class variable and instance variable with code examples.

4

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B.Sc. Engg. CSE 3rd Semester   12 March 2019 (Morning)

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

MID SEMESTER EXAMINATION   WINTER SEMESTER, 2018-2019
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. Answer any **3 (three)** of them.
Figures in the right margin indicate marks.

---

1. a) Consider the *List* class with the following *private* members: 10

```
class List{
private:
    struct Node{
    int item;          // the data of the node
    Node* next;        // points to the next node of the list
    };
Node* head;            // point to first node in the list
};
```

Consider the linked list of *integers* represented by the following diagram:

   i.   Draw a diagram of the above list after the following lines of code have been executed:

```
Node* prev = head->next;
Node* nodeToInsert = new Node;
nodeToInsert->item = 4;
nodeToInsert->next = prev->next;
prev->next = nodeToInsert;
```

   ii. Assume that the code represented above in part (i) has executed. What is the value of *prev->item*?

   iii. In addition to the code above, assume the following code executes. Draw a diagram of the list after this code executes as well.

```
prev = prev->next;
prev = prev->next;
Node* curr = prev->next;
prev->next = curr->next;
delete curr;
curr = NULL;
```

   b) Bob writes down a number between 1 and 1,000. Mary must identify that number by asking   7
   "yes/no" questions to Bob. Mary knows that Bob always tells the truth. If Mary uses an optimal
   strategy, then she will determine the answer at the end of exactly how many questions in the
   worst case.

   c) Discuss different types of memory allocation techniques with appropriate example.   8

2. a) Define Complexity. Translate Q into its equivalent postfix expression P using stack.   9
$$Q = A * (B + D) / E - F - (G + H / K)$$

b) Assume you have a stack with operations: *push()*, *pop()*, *top()*, *isEmpty()*. How would you use these stack operations to simulate a queue, in particular, the operations: *enqueue()* and *dequeue()*? 8

c) On each iteration of its outer loop, insertion sort finds the correct place to insert the next item, relative to the ones that are already in sorted order. It does this by searching back through those items, one at a time. 4+4

    i. Would insertion sort be speeded up by using binary search to find the correct place to insert the next item? Justify your answer.

    ii. What is the running time for insertion sort when the array is already sorted in ascending order and descending order?

3. a) Analyze the complexity of bucket sort and radix sort. Briefly mention the limitations of these two sorting algorithms. 8

b) What is the best asymptotic ("big-O") characterization of the following functions: 10

    i. $f(n) = 2^5 + 5n^3 \log(n) + 2^6 n^2 + 100\, n^4$

    ii. $f(n) = 1000n^2 + 16n + 2^n$

    iii. $f(n) = n + (n-1) + (n-2) + \cdots + 3 + 2 + 1$

    iv. $f(n) = 2^{10} + 3^5$

    v. $f(n) = 37n + n \log(n^2) + 5000 \log(n)$

c) Consider the following numbers to construct a binary heap tree. 3+4

$$18\,,\, 16\,,\, 14\,,\, 12\,,\, 10\,,\, 8\,,\, 6\,,\, 4\,,\, 2$$

    i. After inserting all the numbers sequentially, insert a new item *15*. Now perform *heapify* (if necessary). Show step by step.

    ii. Use the binary heap tree you created in (i). Now delete the item *18* and balance the tree by following the conditions of a binary heap tree.

4. a) Consider the following list of numbers: 4+4

$$62\,,\, 31\,,\, 70\,,\, 91\,,\, 25\,,\, 11\,,\, 9\,,\, 61\,,\, 73\,,\, 6$$

    i. Show the resulting tree after inserting the numbers in the same order specified above into an initially empty binary search tree.

    ii. Use the binary search tree you created in (i). What are the two possible binary search trees after 62 is deleted.

b) Discuss three different ways of improving the performance of the basic Bubble sort algorithm with suitable example. 9

c) Explain Time-Space Tradeoff with a suitable example. Analyze the code of Fig. 2 and find out the complexity in terms of Big-O notation step by step. (try to make the upper bound tighter) 8

```
void complexity(){
    int n, val;
    for ( int j = 4; j < n; j = j+2 ){
        val = 0;
        for ( int i = 0; i < j; ++i){
            val = val + i * j;
            for ( int k = 0; k < n; ++k){
                val++;
            }
        }
    }
}
```

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

B.Sc. Engg. SWE 3ʳᵈ Semester

12 March 2019 (Afternoon)

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

MID SEMESTER EXAMINATION

WINTER SEMESTER, 2018-2019

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.

---

1. a) Define Throughput and Response Time. How are they affected by: 8
    i.   Replacing the old processor with a new one.
    ii.   Adding more processors.

    b) What is Power Wall and how has it led to the inception of Multiprocessors? What are the 9
    hurdles of parallel programming for multiprocessors?

    c) Consider three different processors P1, P2 and P3 executing the same instruction set with the 8
    clock rates and CPIs given in the following table:

Table 1: Table for question 1 (c)

Processor	Clock Rate	CPI
P1	3 Ghz	1.5
P2	1.5 Ghz	3.0
P3	2 Ghz	2.5

Answer the following questions:
    i.   Which processor has the highest performance?
    ii.   If each processor executes a program in 20 seconds, find the number of cycles
            and the number of instructions.

2. a) What are the different instruction formats in MIPS architecture? Give appropriate examples 10
    for each. Also mention the name and size of the fields of each of the instruction formats.

    b) Convert the following assembly language into its corresponding machine code and mention 5
    the value of each field of the R-format instruction.

    add $s6, $t0, $s1

    c) Convert the C code given in Figure 1 into Assembly code. The arguments are to be stored in 10
    registers $a0 to $a2, variable i in register $s0$, base register of 'save' array in $s6$ and result in
    register $v0$. You can also use other registers other than these if required. Make sure to add
    comments for each line of the assembly language:

```
int Mid (int j, k, p){
      int i = p;
      while (save[i]< k) j++;
}
```

Figure 1.

3. a) Explain briefly the functions of a linker and loader.   5
   b) Describe the followings with appropriate example: 10
      i.   PC-Relative Addressing
      ii.   Base Addressing
   c) The following problems deal with translating from MIPS to C. Assume that the   10
      variables f, g, h, i, and j are assigned to registers $s0, $s1, $s2, $s3, and $s4,
      respectively. Assume that the base address of the arrays A and B are in registers $s6
      and $s7, respectively. For the MIPS assembly instructions below, what is the corresponding C
      statement?

      a. sll $s2, $s4, 1
          add $s0, $s2, $s3
          add $s0, $s0, $s1

      b. sll $t0, $s0, 2   # $t0 = f * 4
          add $t0, $s6, $t0   # $t0 = &A[f]
          sll $t1, $s1, 2   # $t1 = g *4
          add $t1, $s7, $t1   # $t1 = &B[g]
          lw $s0, 0($t0)   # f = A[f]
          addi $t2, $t0, 4
          lw $t0, 0($t2)
          add $t0, $t0, $s0
          sw $t0, 0($t1)

4. a) Define pipelining and its advantages. Use appropriate examples.   6
   b) Consider the MIPS datapath shown in Figure 2. Suppose the latencies (time needed to do their   9
      work) for the logic blocks are given in Table 2:

Table 2: Latencies for the logic blocks

I-Mem	Add	Mux	ALU	Regs	D-Mem	Sign-extend	Shift-left
400ps	120ps	40ps	120ps	150ps	350ps	20ps	0ps

   Answer the following questions:
      i.   What is the clock cycle time if the only type of instructions supported are the
             ALU instructions (add, sub etc.)?
      ii.   What is the clock cycle time if only sw instruction were to be supported?
      iii.   What is the clock cycle time if you must support add, beq, lw and sw
             instruction

   c) Consider the following sequence of MIPS instructions: 5+5

      lw $t1, 0($t0)
      lw $t2, 4($t0)
      add $t3, $t1, $t2
      sw $t3, 12($t0)
      lw $t4, 8($t0)
      add $t5, $t1, $t4
      sw $t5, 16($t0)

Answer the followings:
  i.   What are data hazards and how can we overcome them?
  ii.   Identify the hazard(s) in this instruction sequence and rearrange them so that it
          will execute without any stalls on a 5-stage pipelined processor.
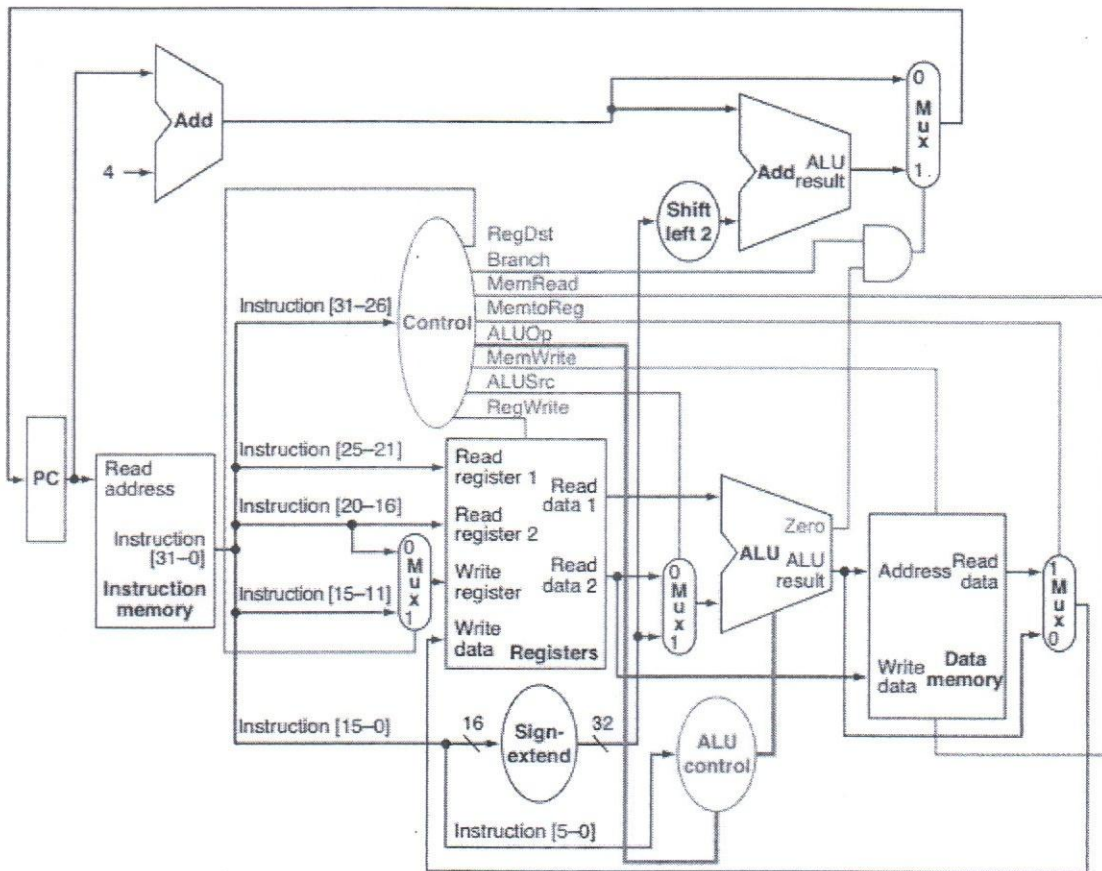

Figure 2.

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

MID SEMESTER EXAMINATION   WINTER SEMESTER, 2018-2019
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.

---

1. a) What are the key distinguishing features of a microprocessor comparing with microcontroller? 7

   b) Draw a typical multicore configuration that supports PCIe and also mention different kinds of components those can be attached with PCIe. 8

   c) There are a few basic design elements that serve to classify and differentiate cache architectures. Among those key elements "Replacement Policy" and "Write Policy" are crucial as they are involved in writing on cache and main memory respectively. Briefly describe them mentioning their different techniques to implement. 10

2. a) Consider a system with three I/O devices: a printer, a disk, and a communications line, with increasing priorities of 2, 4, and 5, respectively. A user program begins at $t = 0$ taking 20 units time in total for completion. At $t = 10$, a printer interrupt occurs requiring total 10 units of time to be completed; at $t = 15$, another communication interrupt raises and also takes 10 units of time; a disk interrupt occurs at $t = 20$ taking same amount of time. How will a processor manage this multiple interrupts situation through a single interrupt pin serving all ISRs belonging to their respective interrupts? Suggest a solution with the help of a timing diagram how and when the interrupts will be enabled or disabled. 7

   b) Briefly characterize Amdahl's law and Little's Law with appropriate examples. Why are they necessary in measurement of computer performance? 6

   c) Write short notes on the following: 12
      i. Cache Coherency and its approaches
      ii. Comparison between RAM and ROM
      iii. An individual cell structure of SRAM and DRAM

3. a) The concept of a family of compatible computers was both novel and extremely successful. A customer with modest requirements and a budget to match could start with the relatively inexpensive model and later, if the customer's needs grew, he could upgrade to a faster machine with more memory without sacrificing the investment in already developed software. Which characteristics do you think that a family should follow to accomplish the preceding? 7

   b) Given the 11-bit data word 00100101010, generate the corresponding composite word for the Hamming code that corrects single errors and detects double errors. Show the steps of calculation. 6

c) Four benchmark programs are executed on three computers with the following results in Table 1: 12

Table 1: Execution time in second for Computer A, B, and C

	Computer A	Computer B	Computer C
Program 1	1	10	20
Program 2	1000	100	20
Program 3	500	1000	50
Program 4	100	800	100

The Table shows the execution time in seconds, with 100,000,000 instructions executed in each of the four programs. Calculate the MIPS values for each computer for each program. Then calculate the arithmetic and harmonic means of the MIPS values assuming equal weights for the four programs, and rank the computers based on arithmetic mean and harmonic mean.

4. a) A program consisting of a total of 300 instructions contains a 50-instruction loop that is executed 10 15 times. The processor contains a cache. Fetching and executing an instruction that is in the main memory requires 20 time units. If the instruction is found in the cache, fetching and executing it requires only 2 time units. Ignore operand data accesses. Assume that the cache is initially empty, that it is large enough to hold the loop, and that the program starts with all instructions in the main memory.

   i. Calculate the ratio of program execution time without the cache to execution time with the cache. This ratio is called the speedup due to the use of the cache.
   ii. Generalize part (i) by replacing the constants 300, 50, 15, 20, and 2 with the variables w, x, y, m, and c. Develop an expression for speedup.
   iii. For the values w = 300, x = 50, m = 20, and c = 2 what value of y results in a speedup of 5?

   b) For the hexadecimal main memory addresses 111111, 666666, BBBBBB, find out the following 10 information, in hexadecimal format considering 64KB cache and 16MB main memory where line size and block size is 4 bytes each:
   i. Tag, Line, and Word values for a direct-mapped cache
   ii. Tag and Word values for an associative cache
   iii. Tag, Set, and Word values for a two-way set-associative cache
   c) Define the following terms: 5
   i. Hard Failure
   ii. EPROM
   iii. Flash Memory
   iv. Hamming Distance
   v. Syndrome

Islamic University of Technology

Organisation of Islamic Cooperation (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION   WINTER SEMESTER, 2018-2019

Duration: 1 Hour 30 Minutes   Full Marks: 75

CSE 4307: Database Management Systems

Programmable calculators are not allowed. Do not write anything on the question paper. There are 4(four) questions. **Question No. 1 is compulsory to answer**. Answer any 2 from the remaining questions. Figures in the right margin indicate marks.

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1. (**Compulsory**) Government of Bangladesh plans to digitalize its different sectors. Each of the following questions are based on a description of the desired system of a particular component and a number of tasks are identified. The components are logically connected. *You may add additional attribute only if it is needed.*

   (a) A national database should be maintained to store the basic information of each citizen such as `Name`, `Date of Birth (DOB)`, `Blood Group`, `Address`, `Profession`. There are two positions of conflicts of entity Vs. attribute choice for `Blood Group` and `Profession` as given bellow: [6]

   Position A: Both Blood Group and Profession should be attributes.
   Position B: Both Blood Group and Profession should be entities.

   Tasks: Justify your position. Make Entity Relationship Diagram (ERD) specifying the cardinality explicitly. Finally make the DDL statements corresponding the ERD.

   (b) We want to store and maintain citizens' driving license information such as `Name of Citizen`, `Address`, `Date of Birth`, `License No`, `License Issue Date`, `License Expire Date`. Each Citizen may have at most one driving license. [6]

   Tasks: Design the ERD without any data redundancy, mention the cardinality. Comment on if the participations are *total* or *partial*. Make the equivalent DDL statements.

   (c) Now medical sector should be connected to this system. To achieve this the information of each hospital should be maintained including `Name of Hospital`, `Location`, `Year of Establishment`, `Total Capacity` Citizens may be admitted to any of these hospitals but his time and reason for admission must be stored. [6]

   Tasks: Draw the ERD explaining the cardinality involved here. Write the DDL statements to reflect the ERD.

   (d) Based on the above design write the SQL statements for the followings: [2+2+3=7]

   i. Find out the list of citizens ID, name, date of birth, age in years (not given as entity attribute), whose names begin with 'a' and end with 'n' (in both cases letters are not case-sensitive).

   ii. Find the citizen ID, Name and Name of the profession.

   iii. Find a list of top 10 professions along with its total number of people (based on total number of people involved in the profession). A profession must have at least 1000 people involved to be considered primarily.

2. (a) *Atomicity problems* and *concurrent-access anomalies* are considered as the major drawbacks of traditional file processing system compared with relational database management systems. Briefly explain with examples. [8]

   (b) i. Define super key, candidate key, primary key and foreign key. Support the definitions using suitable example data. [6]

ii. What guideline will you follow in constructing a primary key of an Employee Management [3]
System?

(c) *Primary key ensures two important purposes.* Mention them. *Foreign key, on the other hand,* [8]
prevents the insertion of erroneous data as well as it removes redundancy. Explain with example.

3. (a) Consider the following description:
A library stores books information such as book title, author name, publisher name, area of
study. Area of study can be organized in 2 levels (e.g. Level 1: Computer Science, Level 2:
Algorithm, Database etc.). Publishers are well-known along with some additional information
such as Name, Established Year, Country of origin, reputation. Multiple copies of a book
must be stored efficiently. Now students can borrow and return books. Assume students basic
information such as ID, Name, Department.

  i. Draw the ERD for the above scenario. [5]
  ii. Write the DDL statements for the above ERD. [5]

(b) What is the basic difference between inner join and outer join? Explain with example. [5]

(c) Is there any difference between a table and a view? Explain briefly. Mention the conditions [5]
that allow data insertion into a view.

(d) Mention the major integrity constraints on a single relation. Issue one DDL statement involving [5]
the integrity constraints you have mentioned.

4. (a) Define Cartesian Product and Natural Join. *Cartesian Product many produce many meaningless* [8]
records while Natural Join removes them and retains only meaningful records - Justify with
example data.

(b) Mr. Db Hall is a database designer of a very large company comprising 50000 employees. As [8]
part of the total system design he has done the following in regard to employees information:

The total salary of each employee is calculated as follows:
`Total Salary= Basic + 30% of Basic (as house rent)`
Mr. X designed emp entity as follows:
`emp(ID,Name, Date of Birth, Join Date, Age, Basic Salary, House Rent, Total Salary)`
In order to make employee ID more informative he designed the ID as follows:
`ID: X-NNN    where X is either L1 or L2 or L3, NNN is a 3-digit number.`
Here L3, L2 and L1 stand for Senior, Medium and Junior employees. An employee has L3
status if he/she worked more than 10 years, L2 status if he/she worked more than 5 years and
less than 10 years, others are with L1 status.

Tasks: This design has some benefits. Briefly mention them. But at the same time Mr. Db
Hall has made some design problems in this context. Your task is to explain the major design
problems and at the same time propose an ideal solution to eliminate those problems.

(c) Classify the constraints on generalization or specialization based on: i)Attribute of higher-level [9]
entity determines lower-level entity membership ii)The number of branching in its lower-level
entity and iii)Completeness

B.Sc. Engg. SWE 3rd Semester   11 March 2019 (Afternoon)

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

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

CSE 4307: Database Management 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) Consider the following Library Database Schema: 6
   Book (ISBN, title, authorName, Price, yearPublished)
   BookCopy (copyNo, status, loanPeriod, ISBN)
   BookLoan (loanNo, dateOut, dateReturned, copyNo, borrowerNo)
   Borrower (borrowerNo, name, address)
   Book table stores different information about the books. Each book must have a *title*.
   authorName can be either in English or Chinese. *BookCopy* table keeps track of individual
   copies of books. Here *status* can be from the set {'Available', 'Loaned'}. If one book is
   deleted from the *Book* table, all copies of it must be removed. *BookLoan* table keeps track of
   the books that is loaned by the borrowers. *Borrower* table stores information about different
   borrowers.
   Write DDL statements to create the tables. Make sure to include proper integrity constraints
   and references.

   b) Write SQL statements to perform the following operations based on the schema in Question   3×5
   1(a).
      i. Count the number of books that have names starting with a consonant.
      ii. Show all the information about the most expensive book.
      iii. Count the number of available books (not book copies).
      iv. List the name of the people who borrowed at least one book from January 01, 2019 to
         January 31, 2019 (inclusive).
      v. List the name and the number of copies of that book in the library. Remember to
         include the books which have no copies currently.

   c) Assume that there are *m* tuples in a relation *r(A, B)* and *n* tuples in another relation *s(C, D)*   2×2
   where *C* and *D* are compatible with attributes *A* and *B*, respectively. Determine the minimum
   possible number of tuples in the resulting relation after executing each of the following SQL
   statements:
      i. `SELECT * FROM r UNION ALL SELECT * FROM s;`
      ii. `SELECT * FROM s NATURAL JOIN r;`

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

   b) Write Relational Algebra expressions to answer the following queries based on the schema   1.5×4
   shown in Question 1 (a):
      i. Find the *title* and *author* of the books published in 1999.
      ii. Find the *ISBN*, *copyNo* and *dateReturned* of the books that were loaned by people
         living in 'Chittagong'.
      iii. Find the *name* of the borrowers that borrowed a book written by 'Silberschatz'.
      iv. Rewrite the query from (iii) using natural join.

   c) Write an SQL statement to create a view *BorrowerList* containing the name of the borrowers   2+3
   and the number of books they borrowed. Is the view updateable? Justify your answer.

d) Write appropriate SQL statements to create the authorization graph shown in Figure 1. For each statement, identify which user will execute the command. Assume that you are only granting the SELECT privilege on *Book* table based on the database schema in Question 1(a). Explain what happens in the context of Oracle Database when DBA revokes privilege from U1. 6+2
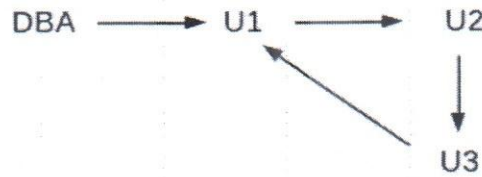

Figure 1: Authorization Graph

3. a) Assume that as a part of an international conference organized by the Dept. of CSE, IUT, the organizers need to keep track of many workshops (day-long training) associated with the main event. Initial requirements analysis brings out the following information about what needs to be recorded: 8

   - Each workshop has a unique identifier, a name, and happens on a particular date or dates, as some workshops last more than one day.
   - A workshop may have many participants. Each participant is described by a unique identifier, a name and an address. A participant may sign up to one or more workshops. It is important to record the date when a participant signs up for a workshop.
   - A workshop may be divided into sessions. Each session is identified by an identifier, time of the day when the session takes place (e.g. morning, afternoon or evening) and a speaker of the session who is also a participant.
   - There are number of meeting rooms at the conference venue, each of a fixed capacity. Meeting rooms are identified by a floor and a room number. Every workshop needs an allocated meeting room where all sessions of the workshop takes place. If a workshop lasts for more than one day, it will use the same room on both days.
   - Each workshop is supervised by a faculty member of the department. Each faculty has a unique identifier, name and rank (Lecturer, Assistant Professor and so on). A faculty can supervise many workshops, possibly zero.

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

   b) Reduce the ER model that you have designed in Question 3(a) into a set of relations with proper justification. Identify the appropriate primary key for each relation. 6

   c) Describe appropriate scenarios where you can demonstrate the application of the following cardinalities: 2×3
      i. one-to-one
      ii. one-to-many
      iii. many-to-many

   d) Explain the necessity of identifying entity sets in Entity-Relationship model. Provide necessary examples. 5

4. a) With proper examples, explain the bad designs that normalization aims to eradicate. 12
   b) Define data dictionary. Explain atomicity, consistency and durability in transaction management. 1+6
   c) List the components of a query processor and describe their functionalities. 6

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) Explain the terms in one sentence: 2
        i.   Decidability
        ii. Intractability

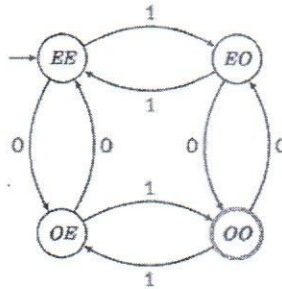   b) Give the formal description of the finite automata pictured in Figure 1. What is the language   6+2
        of the automata?

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,   15
        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 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.

2. a) What are the differences between a DFA and an NFA?   4
    b) Design an NFA to accept the set of strings over alphabet $\{0, 1\}$ such that there are two 0's   9
        separated by a number of positions that is a multiple of 4. Note that 0 is a multiple of 4.
    c) Convert the NFA represented by Table 1 to its equivalent DFA.   12

Table 1: Transition table of a DFA for question 2.c.

	0	1
→ p	{p, q}	{p}
q	{r, s}	{t}
r	{p, r}	{t}
* s	∅	∅
* t	∅	∅

3. a) Figure 2 is the state diagram of an ε-NFA. Describe the language it accepts. Also describe   2+8
        (with diagram) the states the automata will transit through during the processing of input
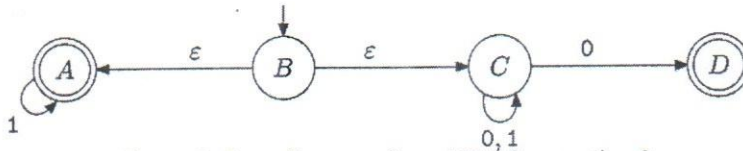
string 0010.

Figure 2: State diagram of an ε-NFA for question 3.a

c) Compute the ε-closure of each state and convert the ε-NFA of Table 2 to its equivalent DFA.   15

Table 2: Transition table of an ε-NFA for question 3.c

	ε	a	b	c
→ p	∅	{p}	{q}	{r}
q	{p}	{q}	{r}	∅
* r	{q}	{r}	∅	{p}

4. a) What are the operators of regular expression? Mention the order of precedence followed by the operators.   2+1

b) Let A and B are two regular languages and their alphabet is the standard 26 letters $\{a, b, .., z\}$. $A = \{good, bad\}$ and $B = \{boy, girl\}$. Now what will be the sets of $B \cup A$ and $B \circ A$?   4

c) Describe the languages of the following regular expressions: 2x3
   i. $\Sigma^*011\Sigma^*$
   ii. $(1^*01^*0)^*1^*$

d) Write regular expressions for the following languages: 2x6
   iii. The set of all strings over alphabet {0, 1} whose tenth symbol from the right end is 1.
   iv.   The set of strings over alphabet {a, b} consisting of even number of a's followed by odd number of b's.

B.Sc. Engg. / HD CSE 5th Semester   12 March 2019 (Afternoon)

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

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

CSE 4539: Web 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) What are the differences between "Internet" and "World Wide Web"?   4
    b) Explain the stages in Name Resolution Process in DNS.   8
    c) With the help of a diagram describe the HTTP Request and HTTP Response components.   8
    d) What will be the output of the following code in Figure 1?   5

```html
<!DOCTYPE html>
<html>
<head>
    <script type="text/javascript">
        var y, i;
        function printMessage() {
            y=1;
            for( i=3; i<=11; i++){
                y += i;
            }
          document.getElementById('ar').innerHTML = "Output: " + y;
        }
    </script>
</head>
<body>
    <form name="f" action="">
       <input type="button" value="Sum!" onclick="printMessage()">
    </form>
    <div id="ar">
    </div>
</body>
</html>
```

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

2. a) What are the different possible values for the CSS property *position?* Explain the behavior of an element when its position is set to each of these values and mention the differences between them.   10

b) Design the webpage layout given in Figure 2 below. Use different gray colors (#666, #CCC, #DDD, #777) to represent the colors in the background of different sections. You can also assume the dimensions. (**Note: writing the full paragraph texts is NOT necessary**).   12
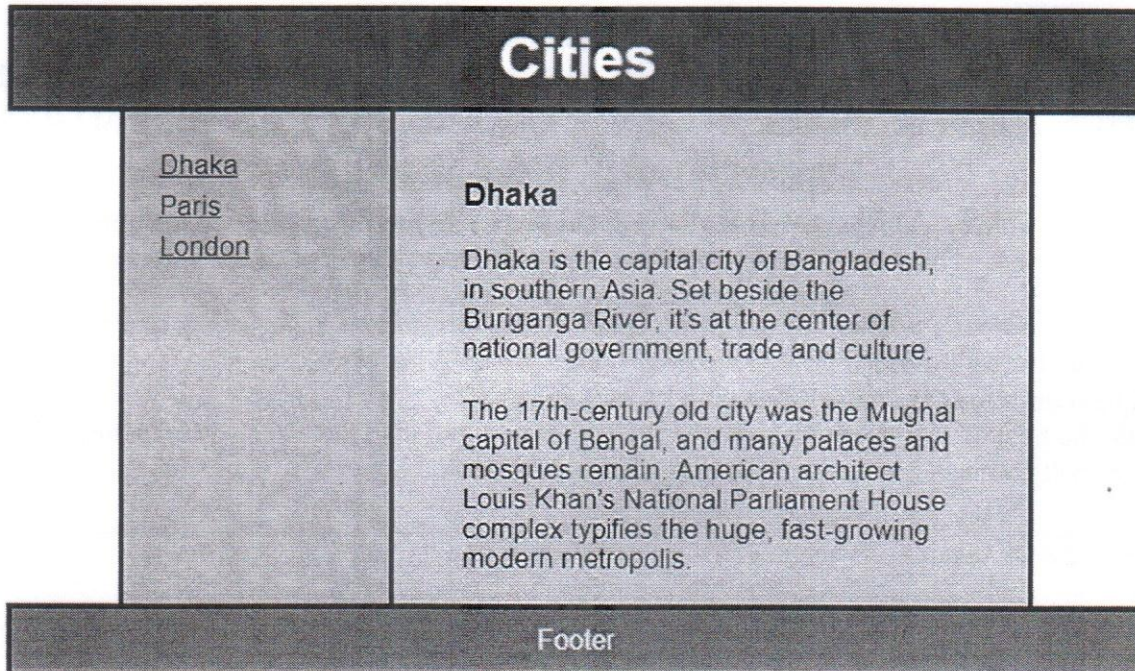

Figure 2: Cities website, for question no. 2 (a).

c) What are considered Web Safe Colors in web development? Give an example of such colors.   3

3. a) Explain the concept of vertical margin collapse in HTML/CSS.   4

b) The following table, Figure 3, shows some students information. Write the HTML code to generate the table in a webpage having the following properties.   11
Table Caption: Students Information, **Table Border:** 1, **Cell Padding:** 10

Figure 3: Students Information, for question no. 3 (b).

c) Given the following unordered list,   6
   - Home
   - About
   - Services
   - Contact

   Write CSS code required to transform the above list into a navigation bar list as follows,
   Assume the normal tags where used to create the list

   Home   About   Services   Contact

d) What are the three possible ways to apply CSS styles to a web page?   4

4. a) Write the HTML code to generate the Sign-up form given in Figure 4 below.   13

Sign Up

Personal Information
Name: Name
Password: Password
Gender: ○ Male   ○ Female
Email: example@mail.com
DOB: mm / dd / yyyy

Other Information
Country: Select a Country   ▼
Message: [   ]
               ☑ Receive Updates
                                    Sign up

Figure 4: Sign up form, for question no 4 (a).

b) Define and state the differences between the following.   4×2
   i.   Inline Elements and Block Elements
   visibility: hidden and display: none CSS properties
c) What is the use of the *map* tag in HTML? Give an example.   4

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

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

Math 4341: Linear Algebra

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 two systems of equations. Solve both systems simultaneously by applying Gauss-Jordan reduction to an appropriate 3×5 matrix.   12

$$
\begin{aligned}
x + y + z &= 7 \\
x + 2y + 2z &= 10 \\
2x + 3y - 4z &= 3
\end{aligned}
\qquad
\begin{aligned}
x + y + z &= 6 \\
x + 2y + 2z &= 11 \\
2x + 3y - 4z &= 3
\end{aligned}
$$

   b) Which three elimination matrices E_{21}, E_{31}, E_{32} put A into its upper triangular form $E_{32}E_{31}E_{21}A = U$? Multiply E_{32}^{-1}, E_{31}^{-1} and E_{21}^{-1} to factor A into LU format.   13

$$
A = \begin{bmatrix} 1 & 0 & 1 \\ 2 & 2 & 2 \\ 3 & 4 & 5 \end{bmatrix}
\qquad
L = E_{32}^{-1}\, E_{31}^{-1}\, E_{21}^{-1}
$$

2. a) For the given matrix B, show by elimination that (b_1, b_2, b_3) is in the column space if $b_3 - 2b_2 + 4b_1 = 0$. Also find out what combination of the rows of B gives the zero row?   8

$$
B = \begin{bmatrix} 1 & 3 & 1 \\ 3 & 8 & 2 \\ 2 & 4 & 0 \end{bmatrix}
$$

   b) Define vector space and subspaces with appropriate examples. Mention the vector subspaces of $\mathbf{R^2}$ and $\mathbf{R^3}$ space.   7

   c) Generally when we multiply two matrices by hand (satisfying dimensions), we multiply rows with column. How can we get the same result by multiplying in the other way around i.e. column times row? Mention the special property of the sub-matrix that you get by multiplying a single column with a single row.   10

3. a) For a matrix of dimension $(m \times n)$ if rank $\Gamma = m = n$. Mention four important properties of this matrix. Also comment on the solution space of such matrix.   6

   b) Suppose that A is the matrix below. Explain in words how knowing all solutions to Ax = b decides, if a given vector b is in the column space of A.   6

$$
A = \begin{bmatrix} 2 & 1 \\ 6 & 5 \\ 2 & 4 \end{bmatrix}
$$

   Is the vector $b = \begin{bmatrix} 8 \\ 28 \\ 14 \end{bmatrix}$ in the column space of A?

c) Find out the complete solution to the following linear system. Your solution should contain   13
both particular solution and special solution in null space.

$$x + 3y + 3z = 1$$
$$2x + 6y + 9z = 5$$
$$-x - 3y + 3z = 5$$

4. a) Invert the following matrix M by the Gauss-Jordan method starting with $[A \quad I]$ 5

$$\begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 3 \\ 0 & 0 & 1 \end{bmatrix}$$

b) For which right sides (find a condition on $b_1, b_2,$ and b_3) are these systems solvable? Also find   12
out the rank of the linear systems given.

i. $$\begin{bmatrix} 1 & 4 & 2 \\ 2 & 8 & 4 \\ -1 & -4 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}$$

ii. $$\begin{bmatrix} 1 & 4 \\ 2 & 9 \\ -1 & -4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}$$

c) Reduce the following matrix to its ordinary echelon form and then identify its free variables   8
and pivot variables.

$$\begin{bmatrix} 1 & 2 & 2 & 4 & 6 \\ 1 & 2 & 3 & 6 & 9 \\ 0 & 0 & 1 & 2 & 3 \end{bmatrix}$$

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B.Sc. Engg. SWE 3rd Semester   **04 March 2019 (Afternoon)**

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

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

Math 4341: Linear Algebra

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.

1. a) The matrices shown below represent a system of linear equations $Ax=b$:

$$A = \begin{bmatrix} 1 & 1 & 0 \\ 4 & 6 & 1 \\ -2 & 2 & 0 \end{bmatrix} x = \begin{bmatrix} x \\ y \\ z \end{bmatrix} b = \begin{bmatrix} 1 \\ 3 \\ -1 \end{bmatrix}$$

   i. Write the equations representing the system and draw Column Picture for the equations.   3
   ii. Solve this system of linear equation using Gaussian Elimination.   6
   iii. Perform 'EA=U' and 'A=LU' factorization on A.   5
   iv. Compare the two factorizations mentioned above and determine which one gives better insight about the elimination process.   2
   v. Finally show the factorizations 'PA=LU' and 'PA=LDU' for matrix A.   4

   b) Prove that, Inverse of A^T can be found by taking the Transpose of A^{-1}.   5

2. a) Invert these matrices A by the Gauss-Jordan method starting with [A I]:   10

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 3 \\ 0 & 0 & 1 \end{bmatrix} \ and \ A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 2 \\ 1 & 2 & 3 \end{bmatrix}$$

   b) Consider the matrices E and F.   9

$$E = \begin{bmatrix} 1 & 0 & -2 \\ 2 & -1 & 5 \\ 4 & 1 & 0 \end{bmatrix} \qquad F = \begin{bmatrix} 4 & 3 & 0 \\ 1 & 2 & 7 \\ 0 & 0 & 7 \end{bmatrix}$$

   Multiply the matrices in the following ways to determine EF:
   i. Linear combination of the Columns
   ii. Linear combination of the Rows
   iii. Columns of E times Rows of F.

   c) Do the vectors lying on the line $2x+y=7$ form a subspace? Justify your answer.   3
   d) $S = \{x, y \in R: x>0, y>0 \ or \ x<0, y<0\}$ Does this set of vectors form a valid subspace? Justify your answer.   3

3. a) Define 'Column Space' of a matrix. What is the significance this space? 5
   b)   i.   If A is any 5 by 5 invertible matrix, then its column space is __. why? 8
        ii.   If the 9 by 12 system Ax = b is solvable for every b, then C (A) = __. Why?
        iii.   The column space of 2A equals the column space of A. (True or False? Why?)
        iv.   A square matrix will always have free variables. (True or False? Why?)
   c) Suppose four matrices A,B, C and D are defined as $[\vec{V_1}]$, $[\vec{V_3}\ \vec{V_1}]$, $[\vec{V_1}\ \vec{V_2}\ \vec{V_3}\ ]$, $[\vec{V_1}\ \vec{V_2}\ \vec{V_3}\ \vec{V_4}]$,   4×3
   where,

$$\vec{V_1} = \begin{bmatrix} -1 \\ 3 \\ 2 \end{bmatrix},\ \vec{V_2} = \begin{bmatrix} 4 \\ 3 \\ 7 \end{bmatrix},\ \vec{V_3} = \begin{bmatrix} 2 \\ 9 \\ 0 \end{bmatrix},\ \vec{V_4} = 2\vec{V_1}$$

Answer the followings:
   i.   What is the column space of each matrices?
   ii.   Modify the matrix D so that B & D have the same column space.
   iii.   How many vectors will be in the Null Space of A, B, C and D?

[Mandatory]
4. a) Consider the matrices below:

$$A = \begin{bmatrix} 1 & 0 & 2 & 3 \\ 1 & 3 & 2 & 0 \\ -1 & 3 & -2 & -6 \end{bmatrix}\ x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} b = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}$$

Answer the followings:
   i.   Find out the Null Space of A. 8
   ii.   What is the rank of the matrix? What are the pivot variables and free variables? What 3
        is the largest possible rank of a matrix with same dimension as A?
   iii.   What is the condition on 'b' for Ax=b to have solution? 4
   iv.   What will be the solution of the system $Ax = \begin{bmatrix} 1 \\ 2 \\ 7 \end{bmatrix}$. 3
   v.   Find out the complete solution of $Ax = \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$ 4
   vi.   What is the shape of N(A) and C(A)? 1.5
   vii.   What will be the dimension of each vectors in N(A) and C(A)? 1.5

BBA TM 3rd Semester

07 March 2019 (Morning)

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

MID SEMESTER EXAMINATION

WINTER SEMESTER, 2018-2019

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 (**You must answer question no. 4**)
Figures in the right margin indicate marks.

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1. a) What is the basic definition of a computer? Describe six different types of computers for individual users. 8

   b) What is the difference between a desktop computer and a workstation? 3

   c) Perform the following operations: 9
      i.   26B.C12 (Convert from Hexadecimal to Decimal)
      ii.   101001.010011101 (Convert from Binary to Decimal)
      iii. 1100,1001 (Perform Binary Subtraction)

   d) What would be the output of the following program? 5

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

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

2. a) What is cache? What is cache Hit and Miss? Why the size of cache memory is very small in most computers? 8

   b) What was the significant improvement seen in the fourth generation computers? Mention the kind of computer you would use for performing the following tasks – 6
      i.   Weather forecasting
      ii.   Maintaining transaction of an air-ticket booking website
      iii. Rendering animations

   c) Describe the working principle of barcode readers. 5

   d) Find out the number of bugs in the following program. Briefly explain about each bug in one or two sentences. 6

```c
#include <stdio.h>
int main()
{
        int celsius, farenhite;
        celsius =((farenhite-32)*9/5);
        kelvin =celsius+273;
        printf("%f", celsius);
        return 0;
}
```

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

3. a) Write short notes on the steps of Programming Development Life Cycle (PDLC). Why the documentation of programs is so important? **7**

   b) Perform binary subtraction on the following numbers: **7**
   $$(-24)-(-10)$$

   c) Write a C program that takes input of an integer and check if the number is odd or even. Print 'Odd' in case of odd numbers and 'Even' in case of even numbers. **5**

   d) Briefly explain about the tracks and sectors of a hard disk and how the access time is measured for finding any data. **6**

Mandatory

4. a) BTM House has a capacity of 30 people to stay. There are mostly non-residential students in the house, but some residential students have seats there too. Non-residential students have a basic monthly expense of 4000 taka to live there, whereas the residential students have the monthly expense of 2500 taka. The manager of the BTM House must calculate the expenses of the house. Being a smart programmer yourself, you have been given the task to write a program that would do this particular task. Your program will take the number of residential students who have seats in BTM House as input. Then it would print the total monthly expense of BTM House as output. It would also print the total monthly expenses of residential and non-residential students. **10**

   Sample execution of your program:

   ```
   Input:
   Enter the number of residential students who have seats in BTM
   House: 12
   Output:
   Total monthly expenses of residential students: 30000
   Total monthly expenses of non-residential students: 72000
   Total monthly expenses of BTM House: 102000
   ```
   Figure 3: Example execution for question no. 4(a)

   b) Write an algorithm for finding out the sum of all the even integers from 1 through 100, both 1 and 100 inclusive. **7**
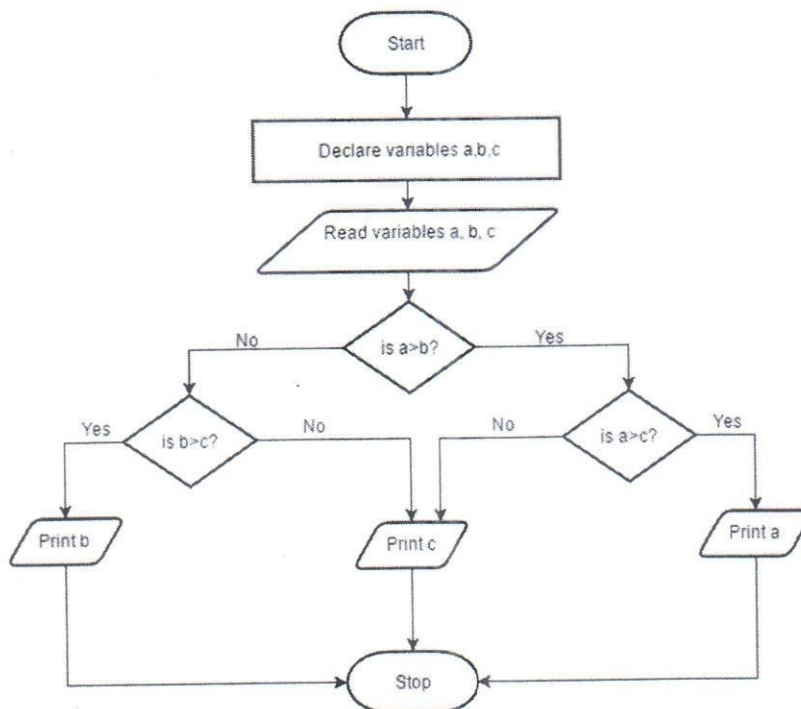
   c) Write the C code for the flowchart given below: **8**

Figure 4: Flowchart for question no. 4(d)

B.Sc. Engg. CSE/ HD CSE 5th Semester   11 March 2019 (Afternoon)

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

MID SEMESTER EXAMINATION   WINTER SEMESTER, 2018-2019
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 is an operating system? Write down the services provided by the operating systems.   5
    b) Explain with example how UNIX creates a new process using system calls *fork* and *exec*.   7
    c) What could happen if applications were allowed to jump into kernel mode at any location in the kernel? Explain how the operating system control the entry of application to kernel at specific location.   7
    d) Explain how can the base and bound registers prevent users from accessing other users' programs data.   6

2. a) Explain the necessity of using two stacks for each process.   5
    b) Explain the steps that an operating system goes through when the CPU receives an interrupt.   8
    c) When a user process is interrupted or causes a processor exception, the x86 hardware switches the stack pointer to a kernel stack, before saving the current process state. Explain why.   6
    d) When the CPU receives an interrupt, how does it determine what instruction to execute next?   6

3. Consider the following set of tasks to be scheduled for execution on a single CPU system. Note that a lower number represents a higher priority.

Task	Arrival Time	Service Time(ms)	Priority
T_1	0	10	2
T_2	2	8	1
T_3	3	3	3
T_4	10	4	2
T_5	12	1	3
T_6	15	4	1

    a) Draw a Gantt chart showing FCFS scheduling for these tasks.   5
    b) Draw a Gantt chart showing SJF (non-preemptive) scheduling.   5
    c) Draw a Gantt chart showing preemptive priority scheduling.   5
    d) Draw a Gantt chart showing round robin scheduling with time quantum 2 ms.   5
    e) Find the scheduling policy with the minimum average waiting time. Also, mention the average waiting time of that scheduler.   5

4. a) Differentiate process and thread. Explain, with specific example(s), the advantages of using threads. 8

   b) Explain the steps involved in creating a thread. 5

   c) Define the state of a thread and the set of data used to represent the state of a thread (i.e., the per-thread state). 4

   d) When a process cycles through different states in its life time, the TCB and the values associated with its states change location. For example, when a process is just created, its TCB is attached to the "New List" and the TCB contains the values associated with its state. Write down the location of the TCB and the state of a thread when it is in the RUNNING, WAITING and READY states. 8

B.Sc. Engg. / HD CSE 5th Semester   05 March 2019 (Afternoon)

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

MID SEMESTER EXAMINATION   WINTER SEMESTER, 2018-2019
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.

---

1. a) Differentiate between Assembly language and Machine Language. How are these related?   10

   b) Derive the contents of the Flag (CF, PF, ZF, SF) register of 8086 microprocessor   8
      upon executing the following instructions:
      i.   AND AL, FFh   ; Assume AL initially contains FFh.
      ii. SUB AX, 8000h ; Assume AX initially contains 8000h.

   c) Write appropriate assembly language codes to accomplish the following tasks: 7
      i.   0Fh × (225 - 200) + 127
      ii. 0FFFh × 10h + 10101010b

2. a) Considering following memory segments, offsets and instructions, write the sequence of   10
      PUSH/POP operations on stack segment mentioning different Stack Pointer (SP) values.
      Assume, initially the stack segment is empty.

Segment	Offset	Assembly Language
1000h	0100h	IN AL, 27h
1000h	0102h	MOV DL, AL
1000h	0104h	MOV AH, 1
1000h	0106h	**INT 21h**
1000h	0108h	ADD AL, DL

   b) How do 8085 and 8086 microprocessors differ with each other in terms of flag register?   8

   c) *"Number of address locations and memory size have a close relation with the Address Bus*   7
      length" – How? Explain with example.

3. a) Write a short note on the registers set of 8085 microprocessor.   10
   b) Briefly explain the concept of stack memory and pointer of 8085 and 8086 microprocessors.   8
   c) Write an assembly language program structure to allocate exactly 64 Kbytes of memory for   7
      code segment, 512 Bytes for *stack segment* and also consider that the size for *data segment*
      may exceed 64 Kbytes.

4. a) Write a short note on *polling* and *interrupt* concepts. Which one is preferable and why?   10
   b) Write short notes on: 8

      i.   Implied Addressing
      ii. Even and Odd memory bank.

   c) Explain the procedure to perform NOT and NEG operation in assembly language.   7

---

1. a) Neatly sketch the *IEEE 802.3* MAC frame. An Ethernet destination address is 05:01:02:03:04:05, what is the type of the address? How does the address appear on the line in binary?   3+2+2

   b) Suppose that you would like to increase the link speed of your Ethernet cable, how would this upgrade affect the minimum required packet sizes? If you upgrade your cable to a higher speed and realize that you cannot change packet size, what else can you do to maintain correct operation?   3+5

   c) Draw the send and receive window for *'Go-Back-N ARQ'* protocol. With necessary example, prove that the send window size for *'Selective Repeat ARQ'* protocol can be at best 2^{m-1}, where m is the size of sequence number.   4+6

2. a) Derive the maximum achievable throughput of a slotted ALOHA network. A slotted ALOHA network transmits 1000-bit frames using a shared channel with a 1000-kbps bandwidth. Find the throughput if the system produces 1000 frames per second.   6+2

   b) Draw the flowchart of the medium access procedure of a pure ALOHA network. Determine the average transfer delay of a pure ALOHA network.   4+8

   c) Briefly explain the p- Persistent method used in CSMA protocol.   5

3. a) How does the Distributed Coordination Function (DCF) differ from the Point Coordination Function (PCF) as a MAC sublayer for *IEEE 802.11*?   5

   b) What is CDMA? With an example, show how data can be encoded and decoded between a sender and a receiver in a three-station environment. Generate the chip codes for 16 stations using the Walsh table.   2+4+4

   c) How does a bridge differ from a repeater? Briefly explain the learning procedure of a transparent bridge with suitable example.   3+7

4. a) Suppose you are working in a reputed ISP. You are given a class C network address 200.0.0.0 and you are asked to create subnets from the given network using the subnet mask 255.255.255.248. Now, answer the following questions: 2+2+3
      i. How many subnets can be there?
      ii. How many hosts per subnets?
      iii. What are the valid subnets?

b) What are the main motivations for *subnetting*? How can we find the sub-network address 3+2+3 if one of the address in that sub-network is given? If the IPv4 address of a host is 10.1.0.65/19 then what is the subnet address and the broadcast address of the subnet?

c) Write short notes on any **two** of the followings: 2×5
    i. Hidden station problem of IEEE 802.11
    ii. Cheapernet
    iii. VLAN

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.

---

1. a) Define Software and Software Engineering. Draw and describe the failure curve of Hardware and Software. — 3+3

   b) What is Legacy Software? Describe how the legacy software can turn into modern reusable software. — 2+3

   c) What is Pareto Principle? Following table shows the number of faults found during testing phase of software. Using pareto principle, identify which errors need to be removed first in order to enhance the software quality. — 3+7

Table 1: Table for question 1(c)

Error Name	Count
Input Field Exception Handling	130
Buffer overflow	60
Array Index Invalid	41
Improper Resource Allocation	39
Improper Branch Handling	19
Infinite Loops	7
Null Pointer Reference	85
Incompatible Types	5
Error initialization	94
Missing return type	2

   d) What are the two major requirements FURPS emphasize on? State the name of the quality attributes covered by FURPS. — 2+2

2. a) Assume one of your software projects and describe the four major practices to follow in order to solve the problem. — 8

   b) Assume, an online library management system. It provides an easy book management platform for the students, teachers and librarians. The librarian can add, delete, upload, issue books, add or remove teacher and student profiles etc. On the other hand, teacher and students can view, search and request for books.
   Given the scenario, identify the data entities of the system. Later, draw the Entity Relationship and Schema Diagram of the scenario. — 10

   c) Describe the main roles and their expectations associated with Software Quality Management. — 2

   d) "XYZ is a known software firm for its high quality software development strategy. The company has set standard rules for companywide project development. Besides, the company ensures high quality software by measuring the quality attributes regularly for enhanced — 5

software performance." - Why and Which CMM level the company has achieved? What are the Key Process Areas (KPA), the company ensured for achieving this level?

3. a) "Consider a hotel management system used by hotel staffs and external users to book hotel rooms online. The system has also features like showing nearby visiting spots and travel details for ease of users". Given the scenario, draw the Architectural Context Diagram of the system. 5

    b) What is SCRUM? How can it help in adaptive software development? 5+2

    c) Identify and explain the Generalization, Aggregation and Composition relationships in the following diagram: 6
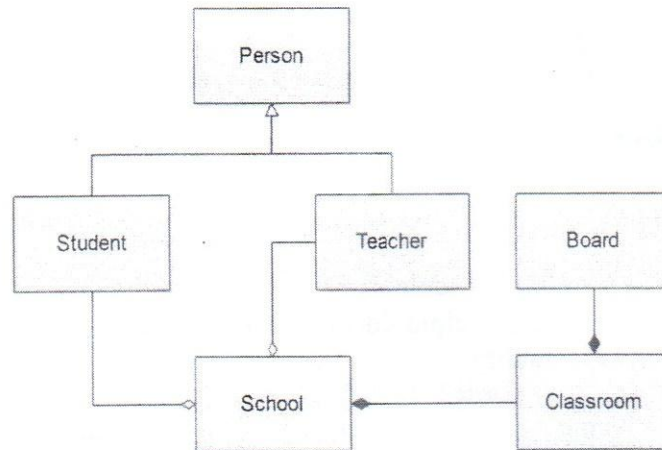

Figure 1: Diagram for question 3(c)

    d) Due to human misconception or information lack, defects get injected into the software system. Using which techniques, those injected defects could be removed? 7

4. a) Write short notes on - Reliability, Dormant Faults, Fishbone Diagram and Extreme programming. 6

    b) Identify and justify which process model will you follow for each of the following software development problems: 6

        i.   An international insurance company wants to offer a huge number of insurance policies to its customers. The company requires a website where the customers can manage the insurance policies. The company also aims to provide multilingual support in future for the worldwide customers.

        ii. The railway organization wants to support online ticket management system with the existing pre-specified functionalities. The organization wants the development team to deliver the software incrementally within some specified number of meetings.

        iii. There is a need of a small app for transaction management offered by a specific bank. The app will be used by that specific bank only. However, the customer wants the app to be tested properly before its delivery.

    c) Demonstrate and draw the relationship among software error, faults and failures. 5

    d) An ATM system has some user accounts where the accounts are protected through account number and pin number. After two failed attempts to insert a pin, the account is locked. If a user enters the right pin number, the user is allowed to perform some transactions like - checking balance, withdrawing and depositing money. A user is allowed to withdraw money if enough money is available in the corresponding user account. 8

        Now, Identify the events and draw a single state diagram considering these events associated to an "ATMAccount" class.

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

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

CSE 4531: E-Commerce and Internet 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. Abid is an entrepreneur and a third-year student of IUT. He noticed that there are many people who want to buy and sell different items in IUT but they do not have a platform. So he created a website called **"iutbuynsell.com"** where IUTians can auction or sell items, browse and buy etc. Mr. Abid wants to make this business profitable so he sketched up a business model. After 6 months of operating, seeing iutbuynsell become popular, Mr. Ahlan, a student of fourth year decided to make a similar website called **"wantsomething.com"**.

    a) What are the unique features of iutbuynsell.com? Describe using examples.   8
    b) Which B2C business model would Mr. Abid take and why? Explain.   5
    c) Describe "Value Proposition", "Revenue Model" and "Competitive Advantage" of iutbuynsell.com.   4×3

2. a) Iutbuynsell.com has some unpopular or obscure items that do not sell as much as popular items. Which E-Marketing strategy would Mr. Abid use to generate substantial revenue and why would this marketing strategy generate revenue?   6
    b) Mr. Ahlan wants to market "wantsomething.com" using search engine marketing but it has created some issues. What are they? Describe in brief.   10
    c) What is the difference between data warehouse and data mining?   3
    d) Write short notes on the following: 3×2
        i.   Lead Generation Marketing
        ii. Beacons

3. Mr. Elon Flusk is an unskilled hacker. He does not have that much experience and relies on tools developed by Mr. Mark Iceberg, a skilled hacker who has done some malicious and destructive activities. Flusk mostly runs different scripts and tools to compromise a system. Flusk is trying to break into IUTs IUSERS system to increase his internet usage limit.

    a) Which hacker classes do Elon Flusk and Mark Iceberg belong to? Which types of penetration testing are they most likely to do?   2+2
    b) Which phases Mr. Flusk has to go through in order to hack IUSERS? Describe using IUSERS scenario.   9
    c) Write short notes on the following: 2×3
        i.   Hacktivist
        ii. Non-Repudiation
        iii. Doxing
    d) Encrypt the sentence **"manchester city best club"** with Rail Fence cipher of depth 3. Use iteration method on the result. Did it make it more secure? If yes, then why?   6

4. a) You have been given the key as: **HILURIOUS.** Draw the Play-Fair table.   3
    b) Encrypt the following text using the play-fair table in 4(a)   9
        "CSE SXTEEN VERY GOOD"
    c) Using the Vigenère Cipher, decrypt the word **"PBVWETLXOZR"** using the key **"leg"**.   6
    d) What are the conditions for Kasiskis method to work? Encrypt the word **"multivariate"** using   7
        the same key in 4(c) with Vigenère autokey system. Write down the Key and Cipher text.

B.Sc. Engg. / HD CSE 5th Semester   12 March 2019 (Afternoon)

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

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

CSE 4539: Web 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) What are the differences between "Internet" and "World Wide Web"?   4
    b) Explain the stages in Name Resolution Process in DNS.   8
    c) With the help of a diagram describe the HTTP Request and HTTP Response components.   8
    d) What will be the output of the following code in Figure 1?   5

```
<!DOCTYPE html>
<html>
<head>
      <script type="text/javascript">
          var y, i;
          function printMessage() {
                  y=1;
                  for( i=3; i<=11; i++){
                      y += i;
                  }
              document.getElementById('ar').innerHTML = "Output: " + y;
          }
      </script>
</head>
<body>
    <form name="f" action="">
        <input type="button" value="Sum!" onclick="printMessage()">
    </form>
    <div id="ar">
    </div>
</body>
</html>
```

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

2. a) What are the different possible values for the CSS property *position?* Explain the behavior of   10
        an element when its position is set to each of these values and mention the differences
        between them.

b) Design the webpage layout given in Figure 2 below. Use different gray colors (#666, #CCC, #DDD, #777) to represent the colors in the background of different sections. You can also assume the dimensions. (**Note: writing the full paragraph texts is NOT necessary**).   12
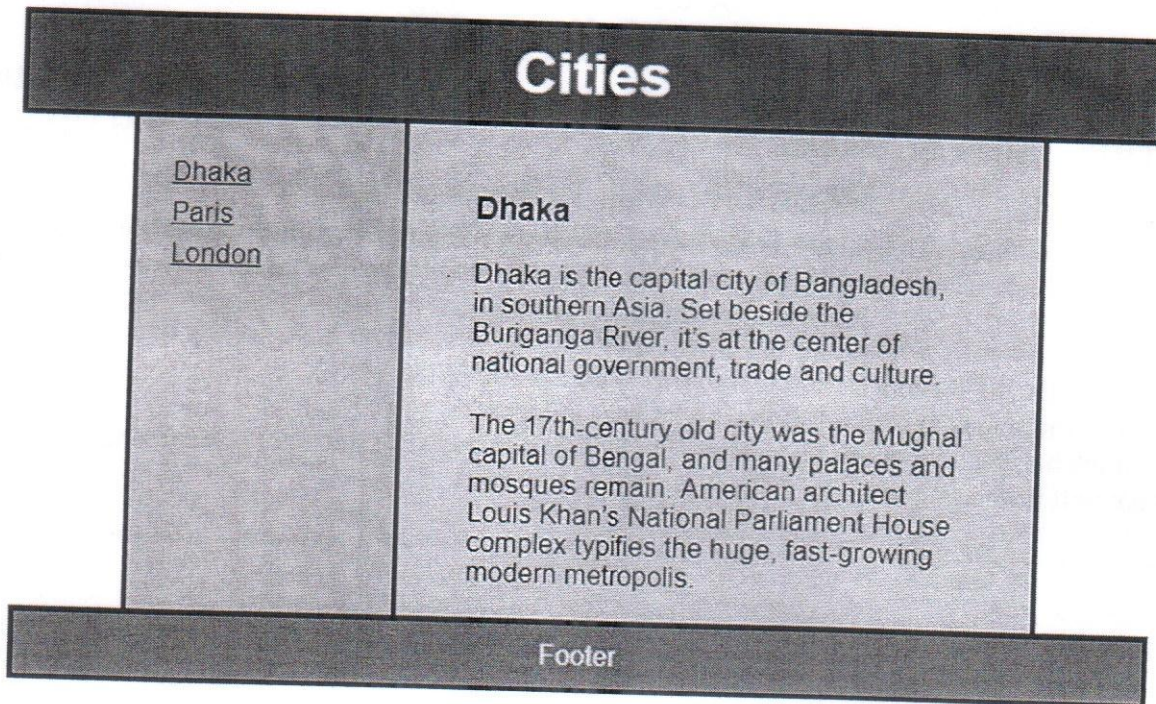

Figure 2: Cities website, for question no. 2 (a).

c)   What are considered Web Safe Colors in web development? Give an example of such colors.   3

3. a) Explain the concept of vertical margin collapse in HTML/CSS.   4

b) The following table, Figure 3, shows some students information. Write the HTML code to generate the table in a webpage having the following properties.   11
Table Caption: Students Information, **Table Border:** 1, **Cell Padding:** 10

Figure 3: Students Information, for question no. 3 (b).

B.Sc. Engg. CSE 5th Semester   12 March 2019 (Afternoon)

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

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

CSE 4551: Computer Graphics and Multimedia

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) Differentiate between vector display hardware and raster displays. What is the main limitation   5
   when displaying an image through raster display?

   b) Discuss geometry-based graphics and sample-based graphics in detail. Write down the benefits   10
   and limitations of a sample-based system.

   c) What is a projection in the context of computer graphics and linear algebra? What does a cross   5
   product between two vectors imply?

   d) Explain linearly independent vectors with the aid of an example. Do two vectors necessarily   5
   have to be perpendicular in order to be linearly independent?

2. a) For an application, a rectangular window with a bottom left co-ordinate of (2,5), and of length   8
   21 units and width 9 units, needs to be transformed to fit a rectangular viewport. The viewport
   has a top-right co-ordinate of (9,7) and a length of 5 units and a width of 4 units. The window
   and viewport are illustrated below. Write down the sequence of matrices, in the correct order,
   for this transformation. Describe what each matrix is performing.
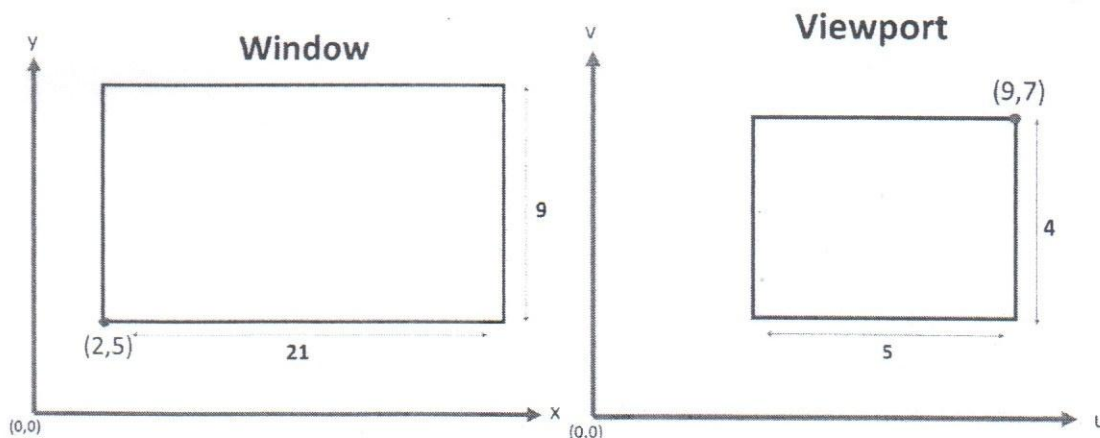
Figure 1: The window and viewport in their
own respective co-ordinate systems

   b) Suppose you want to scale an object about any arbitrary point in 2D. Assume that this arbitrary   5
   point has co-ordinate (X_p, Y_p). Assume also that the scale factors are S_x and S_Y along the x and
   y directions, respectively. Find a single, final matrix that does this, when it is multiplied to the
   object's co-ordinates.

   c) What are splines? Briefly discuss Hermite Curves, with a suitable diagram to show the four   4
   pieces of information that determine these curves.

d) Derive the parameterized equation of a Cubic Hermite curve. For your convenience, the Hermite basis matrix is given below: **8**

$$\begin{vmatrix} 2 & -2 & 1 & 1 \\ -3 & 3 & -2 & -1 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \end{vmatrix}$$

3. a) A cube is to be rotated 90 degrees in 3D, about a vector defined by the endpoints (4, 2, 0) and (6, 6, 2). Write down the correct sequence of matrix transformations to achieve this, including all of the intermediate translations and rotations. Explain, very briefly, the role of each matrix. When performing this rotation, make sure that the vector is transformed such that it coincides with the z-axis via the x-z plane. **20**

    b) Explain the mathematical rules that must be satisfied for a transformation to be classified as linear. Provide evidence as to why translation is not a linear transformation. **5**

4. a) What is scan conversion? What are some of the drawbacks of the basic line drawing algorithm? **5**

    b) Derive, from the very beginning, the generalized values for d_{start}, ΔE, and ΔNE in the midpoint line algorithm. **10**

    c) Using the midpoint line algorithm, draw a line from (20,10) to (30,18). Write down all of the intermediate points that would make up the line, from the given start and end points. **10**

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

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

CSE 4573: 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.

---

1. a) Differentiate between Assembly language and Machine Language. How are these related?   10

   b) Derive the contents of the `Flag` (`CF`, `PF`, `ZF`, `SF`) register of `8086` microprocessor   8
   upon executing the following instructions:
      i.   `AND AL, FFh`   ; Assume `AL` initially contains `FFh`.
      ii. `SUB AX, 8000h` ; Assume `AX` initially contains `8000h`.

   c) Write appropriate assembly language codes to accomplish the following tasks: 7
      i.   0Fh × (225 - 200) + 127
      ii. 0FFFh × 10h + 10101010b

2. a) Considering following memory segments, offsets and instructions, write the sequence of   10
   PUSH/POP operations on stack segment mentioning different Stack Pointer (SP) values.
   Assume, initially the stack segment is empty.

Segment	Offset	Assembly Language
1000h	0100h	IN AL, 27h
1000h	0102h	MOV DL, AL
1000h	0104h	MOV AH, 1
1000h	0106h	**INT 21h**
1000h	0108h	ADD AL, DL

   b) How do `8085` and `8086` microprocessors differ with each other in terms of flag register?   8

   c) *"Number of address locations and memory size have a close relation with the Address Bus   7
   length"* – How? Explain with example.

3. a) Write a short note on the registers set of 8085 microprocessor.   10

   b) Briefly explain the concept of stack memory and pointer of 8085 and 8086 microprocessors.   8

   c) Write an assembly language program structure to allocate exactly 64 Kbytes of memory for   7
   code segment, 512 Bytes for *stack segment* and also consider that the size for *data segment*
   may exceed 64 Kbytes.

4. a) Write a short note on *polling* and *interrupt* concepts. Which one is preferable and why?   10

   b) Write short notes on: 8

      i.   Implied Addressing
      ii. Even and Odd memory bank.

   c) Explain the procedure to perform `NOT` and `NEG` operation in assembly language.   7

1. a) What are the differences between "Internet" and "World Wide Web"?   4
    b) Explain the stages in Name Resolution Process in DNS.   8
    c) With the help of a diagram describe the HTTP Request and HTTP Response components.   8
    d) What will be the output of the following code in Figure 1?   5

```
<!DOCTYPE html>
<html>
<head>
      <script type="text/javascript">
          var y, i;
          function printMessage() {
                  y=1;
                  for( i=3; i<=11; i++){
                      y += i;
                  }
              document.getElementById('ar').innerHTML = "Output: " + y;
          }
      </script>
</head>
<body>
      <form name="f" action="">
          <input type="button" value="Sum!" onclick="printMessage()">
      </form>
      <div id="ar">
      </div>
</body>
</html>
```

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

2. a) What are the different possible values for the CSS property *position?* Explain the behavior of   10
    an element when its position is set to each of these values and mention the differences
    between them.

b) Design the webpage layout given in Figure 2 below. Use different gray colors (#666, #CCC, #DDD, #777) to represent the colors in the background of different sections. You can also assume the dimensions. (**Note: writing the full paragraph texts is NOT necessary**). **12**

Figure 2: Cities website, for question no. 2 (a).

c) What are considered Web Safe Colors in web development? Give an example of such colors. **3**

3. a) Explain the concept of vertical margin collapse in HTML/CSS. **4**

b) The following table, Figure 3, shows some students information. Write the HTML code to generate the table in a webpage having the following properties. **11**
Table Caption: Students Information, **Table Border: 1, Cell Padding: 10**

Figure 3: Students Information, for question no. 3 (b).

c) Given the following unordered list,   6

- Home
- About
- Services
- Contact

Write CSS code required to transform the above list into a navigation bar list as follows, Assume the normal tags where used to create the list

Home	About	Services	Contact

d) What are the three possible ways to apply CSS styles to a web page?   4

4. a) Write the HTML code to generate the Sign-up form given in Figure 4 below.   13

Sign Up

Personal Information

Name: `Name`

Password: `Password`

Gender: ⊙ Male ⊙ Female

Email: `example@mail.com`

DOB: `mm / dd / yyyy`

Other Information

Country: `Select a Country ▼`

Message: [ ]

☑ Receive Updates

[Sign up]

Figure 4: Sign up form, for question no 4 (a).

b) Define and state the differences between the following.   4×2
  i.   Inline Elements and Block Elements
  visibility: hidden and display: none CSS properties

c) What is the use of the *map* tag in HTML? Give an example.   4

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

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

CSE 4585: 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) Neatly sketch the *IEEE 802.3* MAC frame. An Ethernet destination address is 05:01:02:03:04:05, what is the type of the address? How does the address appear on the line in binary?   **3+2+2**

   b) Suppose that you would like to increase the link speed of your Ethernet cable, how would this upgrade affect the minimum required packet sizes? If you upgrade your cable to a higher speed and realize that you cannot change packet size, what else can you do to maintain correct operation?   **3+5**

   c) Draw the send and receive window for *'Go-Back-N ARQ'* protocol. With necessary example, prove that the send window size for *'Selective Repeat ARQ'* protocol can be at best 2^{m-1}, where m is the size of sequence number.   **4+6**

2. a) Derive the maximum achievable throughput of a slotted ALOHA network. A slotted ALOHA network transmits 1000-bit frames using a shared channel with a 1000-kbps bandwidth. Find the throughput if the system produces 1000 frames per second.   **6+2**

   b) Draw the flowchart of the medium access procedure of a pure ALOHA network. Determine the average transfer delay of a pure ALOHA network.   **4+8**

   c) Briefly explain the p- Persistent method used in CSMA protocol.   **5**

3. a) How does the Distributed Coordination Function (DCF) differ from the Point Coordination Function (PCF) as a MAC sublayer for *IEEE 802.11*?   **5**

   b) What is CDMA? With an example, show how data can be encoded and decoded between a sender and a receiver in a three-station environment. Generate the chip codes for 16 stations using the Walsh table.   **2+4+4**

   c) How does a bridge differ from a repeater? Briefly explain the learning procedure of a transparent bridge with suitable example.   **3+7**

4. a) Suppose you are working in a reputed ISP. You are given a class C network address 200.0.0.0 and you are asked to create subnets from the given network using the subnet mask 255.255.255.248. Now, answer the following questions: **2+2+3**

   i.   How many subnets can be there?
   ii. How many hosts per subnets?
   iii. What are the valid subnets?

b) What are the main motivations for *subnetting*? How can we find the sub-network address   3+2+3
if one of the address in that sub-network is given? If the IPv4 address of a host is
10.1.0.65/19 then what is the subnet address and the broadcast address of the subnet?

c) Write short notes on any **two** of the followings: 2×5
     i.   Hidden station problem of IEEE 802.11
     ii.   Cheapernet
     iii. VLAN

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

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

CSE 4703: Theory of Computation

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) In ancient Japan, there was a game called Janken which had the three symbols, Snake, Slug   3
   and Frog. In this game, hand gestures were made to represent the three symbols. In a two player
   setting, Snake would beat Frog, Frog would beat Slug and Slug in turns would beat Snake.
   Show this relationship as a directed graph.

   b) Prove that, "For each even number n greater than 2, there exists a 3-regular graph with n   7
   nodes".

   c) Draw the state diagram for the DFAs that accept the following languages [in all of the   3x5
   problems, $\Sigma = \{a, b\}$]:

       i. $\{w|$ w is any string that does NOT contain exactly two a's$\}$
       ii. $\{w|$ w begins with an 'a' and ends with 'ab'$\}$
       iii. $\{w|$ w does NOT contain the substring aab$\}$

2. a) Prove by construction that "the class of regular languages are closed under the union   15
   operation". Your proof should construct a DFA as part of the proof. Also, show what needs to
   be changed if we wanted to proof that the "the class of regular languages are closed under the
   intersection operation".

   b) Using the proof above, draw the state diagram for the DFAs that accept the following   2x5
   languages [in all of the problems, $\Sigma = \{a, b\}$]:

       i. $\{w|$ w has exactly two a's and at least two b's$\}$
       ii. $\{w|$ w has an even number of a's and each a is followed by at least one b$\}$

   Hint: Each of these languages are the combination of two simpler regular languages.

3. a) Draw NFAs for the following regular expressions [in all of the problems, $\Sigma = \{a, b\}$:   2x9

       i. $(a \cup b^+)a^+b^+$
       ii. $a^+ \cup (ab)^+$

   b) Why can't we prove "the class of regular languages is closed under the concatenation   7
   operation" using DFAs? How does non-determinism help us in proving this theorem?

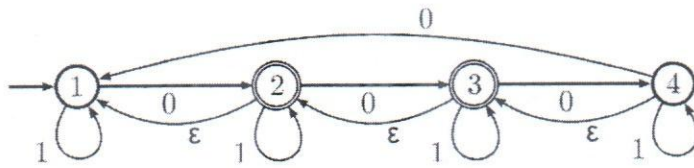4   a)   Draw the equivalent DFA for the following NFA. Make sure to get rid of extraneous states: 16

Figure 1: NFA for question 4 (a)

b)   Prove that "If a language is described by a regular expression, then it is regular."   9

B.Sc. Engg. CSE 7th Semester   04 March 2019 (Afternoon)

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

MID SEMESTER EXAMINATION   WINTER SEMESTER, 2018-2019
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) According to Tom Mitchel (1998), a computer program is said to learn from experience E with respect to some task T and some performance measure P, if its performance on T, as measured by P, improves with experience E. Identify T, P, and E for the following problems:

    i.   A program that will tell which tweets will get retweets.   3

    ii. A program that will predict the traffic pattern at a busy intersection.   3

    b) Briefly explain the steps of developing a machine learning application with a real life example.   14

    c) What do you mean by feature vector? Suppose in a two class problem the feature vectors are normally distributed with a covariance matrix, $\Sigma = \begin{bmatrix} 1.2 & 0.4 \\ 0.4 & 1.8 \end{bmatrix}$. The mean vectors of the classes are, $\mu_1 = [0.5, 0.5]^T$ and $\mu_2 = [1.1, 1.5]^T$. The Mahalanobis distance from a vector x to the class mean is given by the equation, $d_i^2 = (x - \mu_i)^T \Sigma^{-1}(x - \mu_i)$. Classify the test point, $x = [1, 1]^T$ using Mahalanobis distance. $[\Sigma^{-1} = \begin{bmatrix} 0.9 & -0.2 \\ -0.2 & 0.6 \end{bmatrix}$ is given for your convenience.]   1+4

2. a) Consider a linear regression problem $y = w_1 x + w_0$, with a training set having m examples $(x_1, y_1), (x_2, y_2), \dots, (x_m, y_m)$. Suppose that we wish to minimize the mean *fifth* degree error (loss function) given by:

    $$Loss = \frac{1}{m} \sum_{i=1}^{m} (y_i - w_1 x_i - w_0)^5$$

    i.   Derive the equation to calculate the gradient with respect to the parameters w_1 and w_0.   6

    ii. Write the pseudo-code of the gradient descent algorithm for this problem.   6

    b) Consider the following set of points: $\{(-2, -1), (1, 1), (3, 2)\}$

    i.   Find the least square regression line for the given data points.   4

    ii. Plot the given points and the regression line in the same rectangular system of axes.   4

    c) What is the use of basis function in linear regression?   5

3. a) What is overfitting problem? How does regularization solve the overfitting problem? Explain with example. [Hint: Ridge regression]   3+5

    b) What is logistic function? Why do you need to use logistic function in linear regression? Explain with example.   2+5

    c) Explain the concept of bias-variance trade-off. What will be the effect on bias and variance if we regularize the weights in linear/logistic regression model? Explain in brief.   5+5

4. a) Consider the dataset in Table 1. *Grade*, *Bumpiness* and *Speed-limit* are the features and *Speed* is label.

Table 1: Dataset for decision tree

SN	Grade	Bumpiness	Speed-limit	Speed
1	steep	bumpiness	yes	slow
2	steep	smooth	yes	slow
3	flat	bumpiness	no	fast
4	steep	smooth	no	fast

Answer the followings:

   i.   Determine the entropy of **Speed.**   4

   ii.   Which attribute should be selected as a root of the decision tree?   3

   iii. Construct the decision tree for this dataset based on information gain.   6

b) What do you mean by clustering? Consider the following sample points, $A\ (1,1), B\ (2,-2), C\ (2,3), D\ (3,3)$. Perform k-means clustering, show the calculation of distance matrix and group assignment matrix for two epochs only. [Assume k=2.]   2+10

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

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

CSE 4733: 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) Define the following terms: 2×5
   - i.   24-bit Color Image
   - ii.   Chromatic Light
   - iii. Spatial Resolution
   - iv.   Image Interpolation
   - v.   Photon

   b) Explain the main steps involved in image digitization and how they affect the image quality.   10

   c) The median, ζ, of a set of numbers is such that half the values in the set are below ζ and the   5
   other half are above it. For example, the median of the set of values {2, 3, 8, 20, 21, 25, 31} is
   20. Show that an operator that computes the median of a sub-image area, S, is nonlinear.

2. a) What is a contrast stretching transformation? Show how such transformation function can   1+6
   expand a narrow range of intensity levels of an image to a much higher range of intensity.
   Justify your answer with the help of an intensity mapping function.

   b) Propose a set of intensity-slicing transformations capable of producing all the individual bit   8
   planes of an 8-bit monochrome image.

   c) Provide the final intensity mapping table for performing histogram equalization (HE) on the   10
   data given in Table 1.

Table 1

r_k	n_k	$p_r(r_k) = n_k/MN$
$r_0 = 0$	790	0.19
$r_1 = 1$	1023	0.25
$r_2 = 2$	850	0.21
$r_3 = 3$	656	0.16
$r_4 = 4$	329	0.08
$r_5 = 5$	245	0.06
$r_6 = 6$	122	0.03
$r_7 = 7$	81	0.02

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

   b) Give the mathematical equation representing the correlation of a filter $w(x,y)$ with an image   3×4
   $f(x,y)$. Show the results of applying a 3×3 Weighted Average filter on a gray-scale image of
   size 5×5 pixels. Assume all intensity values for the image are 0, except for two positions {at
   pixel location (2,2), (3,3)}, where intensity value is 255. Explain any three different
   correlation responses in the neighborhood of that position obtained with that filter.

   c) "Median filtering is sharpening filter" – Do you agree or disagree with this statement. Justify   5
   your choice.

4. a) Describe the working principle of the following morphological operations: 4+4
      i.   Hit-or-Miss Transformation
      ii.   Closing for Gray-scale image
   b) Opening or Closing with circular structuring element (SE) produces round corners which were 7
      sharp beforehand. Describe when and why these inward and outward sharp corners are
      rounded. Draw necessary illustrations.
   c) In the application of microscopy, one issue that frequently arises is to count particles of 10
      different sizes. One example image is shown in Figure 1 (assume the particles do not overlap).
      Assume the image has binary pixel values, i.e., particles have value 1 and background has
      value 0. Assume there are three different sizes. Propose a morphological algorithm to compute
      the number of particles of each size. Please sketch a flowchart or schematic diagram of your
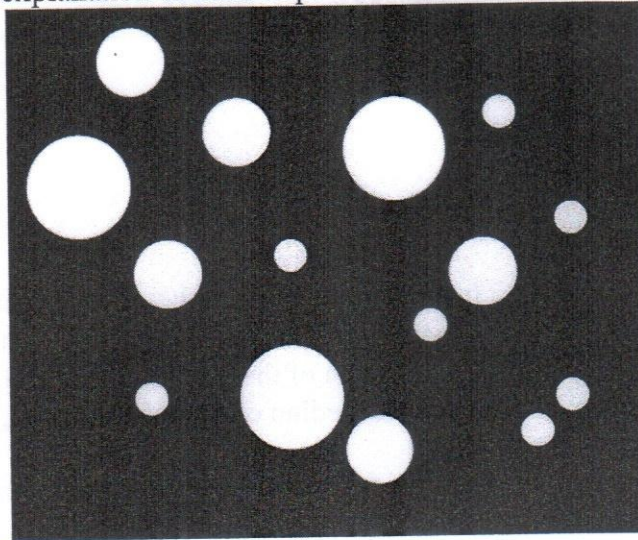   algorithm, plus some explanation of each step.

Figure 1.

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8 March 2019 (Afternoon)

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

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

CSE 4739: Data Mining

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

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1. a) Bioinformatics is one of the most impactful area of Data Mining. It is the science of storing,   15
        analyzing, and utilizing information from biological data such as sequences, molecules, gene
        expressions, and pathways. Though it is one of the promising areas, it comes with a lot of
        challenges. Outline the major research challenges of data mining in Bioinformatics.
    b) Outliers are often discarded as noise. However, one person's garbage could be another's   10
        treasure. For example, exceptions in credit card transactions can help us detect the fraudulent
        use of credit cards. Give two more examples where outlier information can be useful.

2. a) Use these methods to normalize the following group of data: 3x4
                            235, 319, 400, 600,1000
        i.   min-max normalization by setting min = -1 and max = 7.
        ii.   z-score normalization
        iii. z-score normalization using the mean absolute deviation instead of standard deviation
        iv.   normalization by decimal scaling
    b) What are the Data reduction strategies? Explain with appropriate examples.   9
    c) Differentiate *Interval-scaled attributes* from *Ratio-scaled attributes*.   4

3. a) Data quality can be assessed in terms of several issues, including accuracy, completeness, and   10
        consistency. For each of the above three issues, discuss how data quality assessment can depend
        on the intended use of the data, giving examples. Propose two other dimensions of data quality.
    b) Suppose that the data for analysis includes the attribute age. The age values for the data tuples   3x3
        are (in increasing order):
        13, 15, 16, 16, 19, 20, 20, 21, 22, 22, 25, 25, 25, 25, 25, 30, 33, 33, 35, 35, 35, 35, 36, 40, 45,
        46, 52, 70, 82, 86.
        i.   Give the five-number summary of the data.
        ii.   Is there any outlier here? What are those?
        iii. Show a boxplot of the data.
    c) "Manhattan distance and Euclidean distance are variations of Minkowski distance." – Justify   6
        this statement.

4. The following data in Table 1 are from a survey on some IUTians:

Table 1: Survey Data

ID	Name	Age	Gender	Residential status	Income	Dept.	Behavior
1	X1X1	20	F	Yes	3400	CSE	Moderate
2	X2X2	23	M	No	5800		Poor
3	X3X3	21	M	Yes	6000	CSE	Good
4	X1X1	25	M	No	2500	CSE	Very Good

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Here, the attributes types are-
- Age and Income are Numeric,
- Name is Nominal,
- Dept. is Nominal with 6 possible options,
- Gender is asymmetric binary with "M" having higher weight,
- Residential status is symmetric binary,
- Behavior is ordinal with 5 options. (Ve 1ry poor < Poor< Moderate< Good < Very Good)

a) Differentiate *Data Matrix* from *Dissimilarity Matrix*. Show the data matrix for the data of Table   5
1.
b) Find the dissimilarity matrix of the data in Table 1.   20

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B.Sc. Engg (CSE) 7th Semester   05 March 2019 (Afternoon)

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

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

Math 4741: Mathematical Analysis

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) In a sequence of independent flips of a biased coin(probability of a head is .6), let N denote the   6+4
   number of flips until there is a run of three consecutive heads. Find
       i. $P(N \leq 8)$
       ii. $P(N = 8)$

   b) Define the following terms: 1.5x4
       i.   Accessible
       ii.   Communicate
       iii.   Transient State
       iv.   Recurrent State

   c) Let the Markov chain consisting of the states 0, 1, 2, 3 have the transition probability matrix: 4

   $$P = \begin{Vmatrix} 0 & 0 & \frac{1}{2} & \frac{1}{2} \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{Vmatrix}$$

   Determine which states are transient and which are recurrent.

   d) Let the Markov chain consisting of the states 0, 1, 2, 3, 4 have the transition probability matrix: 5

   $$P = \begin{Vmatrix} \frac{1}{2} & \frac{1}{2} & 0 & 0 & 0 \\ \frac{1}{2} & \frac{1}{2} & 0 & 0 & 0 \\ 0 & 0 & \frac{1}{2} & \frac{1}{2} & 0 \\ 0 & 0 & \frac{1}{2} & \frac{1}{2} & 0 \\ \frac{1}{4} & \frac{1}{4} & 0 & 0 & \frac{1}{2} \end{Vmatrix}$$

   Determine which states are transient and which are recurrent.

2. For a given Bonus Malus system, let $s_i(k)$ denote the next state of a policyholder who was in
   state i in the previous year and who made a total of k claims in that year. If we suppose that the
   number of yearly claims made by a particular policyholder is a Poisson random variable with
   parameter λ, then the successive states of this policyholder will constitute a Markov chain with
   transition probabilities

   $$P_{i,j} = \sum_{k:s_i(k)=j} e^{-\lambda} \frac{\lambda^k}{k!}, \quad j \geq 0$$

Consider Table 1, which specifies a hypothetical Bonus Malus system having four states.

Table 1

State	Annual Premium	0 claim	1 claim	2 claims	≥ 3 claims
			Next state if		
1	200	1	2	3	4
2	250	1	3	4	4
3	400	2	4	4	4
4	600	3	4	4	4

Thus, for instance, the table indicates that $s_2(0) = 1$; $s_2(1) = 3$; $s_2(k) = 4$, $k \geq 2$. Consider a policyholder whose annual number of claims is a Poisson random variable with parameter λ. If a_k is the probability that such a policyholder makes k claims in a year, then

$$a_k = e^{-\lambda}\frac{\lambda^k}{k!}, \quad k \geqslant 0$$

Considering $\lambda = .5$ determine the following:
a) Determine the transition matrix.   10
b) Draw the transition diagram.   5
c) If the process runs for a long time, determine the long term proportions of all of the states.   10

3.   Assume a football game of penalty shootout where goals are scored with $\lambda = .6$/min. You will play the game for at least two minutes and if there is a goal scored within this interval, you will stop playing after two minutes. Otherwise, you will continue until there is at least a goal scored (no matter how long it takes past the first two minutes). Answer the following based on this scenario:
a) P(play for more than two minutes)   5
b) P(play for more than two minutes and less than five minutes)   5
c) P(scoring at least two goals)   5
d) E[number of fish]   5
e) E[total fishing time]   5

4. a) State the differences between Bernoulli process and Poisson process.   5
b) There are four light bulbs burning with Poisson rate λ_1, λ_2, λ_3, λ_4. What is the expected time until the last light bulb burns out? Show necessary calculation with proper explanation.   8
c) Consider, two different color light bulbs are blinking with Poisson rate λ_1 and λ_2 respectively. A colorblind person observes the experiment and tells you that the blink came from the bulb with λ_1 rate. What is the probability that he is right? Show justification for your answer.   7
d) "An average family size is four and an average person comes from a family size of six" – is the quote contradictory? Show justification for your answer.   5

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

MID SEMESTER EXAMINATION   WINTER SEMESTER, 2018-2019
DURATION: 1 Hour 30 Minutes   FULL MARKS: 50

Hum 4741: Business Communication & 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 including Question No. 4.**
Figures in the right margin indicate marks.

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1. a) How does business communication serve as a problem-solving tool? If you want to launch a   7
      new software in the market, what kinds of communication challenges will you face?
   b) Think of English words that probably do not have precise equivalent in some other culture.   5
      How would you attempt to explain each of these words to a person from that culture?
   c) Is conversational style of communication appropriate to write for non-native readers?   5
      Discuss.

2. a) Evaluate the comment: "It is hard to argue against courtesy, but business people do not have   6
      time to spend extra effort on it. Anyway, they want their documents to go to the point
      without wasting time and without sugar coating."
   b) Identify and explain the various steps in the writing process with appropriate figure.   6
   c) Point out the shortcomings in the following email message from a sports celebrity declining   5
      an invitation to speak at a kickoff meeting for workers in a fund-raising campaign for a
      charity.

   "Subject: Your Request for Free Lecture
   Ms. Chung:
   As much as I would like to, I must decline your request that I give your membership a free
   lecture next month. I receive many requests to give free lectures. I grant some of them, but I
   simply cannot do them all. Unfortunately, yours is one that I must decline.
   I regret that I cannot serve you this time. If I can be of further service in the future, please
   call on me.
   Sincerely yours,"

3. a) Explain what is wrong with this sentence: "This procedure is different than the one we use."   5
      How would you correct it? Can you think of other examples of this kind of error?
   b) "Using short words makes the writing sound too simple and non-professional and using the   6
      short sentences too much creates choppy and elementary sounding effect." Discuss the
      statement with relevant examples.
   c) Discuss ways to give more or less emphasis in your sentences. How can you manage   6
      emphasis for a positive effect? Illustrate with examples.

Mandatory to Answer

4. a) Write short notes on the following terms: 8

                i.   You-viewpoint
               ii.   Rubber stamps
             iii.   Strategic buffer
             iv.   Particular contexts

    b) Imagine, you are an assistant director of operation of ABC Computer ltd. You find on your   8
computer an email from an unhappy customer named Mr. Rahim. He is upset that some of
the 80 PCs he ordered arrived in damaged condition with broken motherboard. He writes
"obviously because of poor packaging". He wants the adjustment. Now, you will have to
write a return email saying that the goods are on the way and at the same time, you will try to
regain lost confidence with honest explanation of the problem.

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

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

CSE 4743: Cryptography and Network 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.

---

1. a) What do you understand by the terms *Authentication, Data Confidentiality and Data Integrity*?   8

   b) Write short notes on the following,   7
      i.   Digital Signature.
      ii. Public Key Cryptography.

   c) Distinguish between *Cryptography* and *Steganography*. Mention few historical uses and few   10
      modern uses of Steganography.

2. a) Name some passive attacks and active attacks. Define the type of security attacks in each of the   6
      following cases:
      i.   A student breaks into a professor's office to obtain a copy of the next day's test.
      ii. A student gives a check for $10 to buy a used book. Later she finds that the check was
           cashed for $100.

   b) Use the *Playfair cipher* to encipher the message "The Key Is Hidden". The secret key can be   9
      made by filling the first and part of the second row with the word "GUIDANCE" and filling the
      rest of the matrix with the rest of the alphabets sequentially.

   c) The encryption key in a *Transposition cipher* is (3, 2, 6, 1, 5, 4). Find the decryption key.   5

   d) "The *One-Time Pad* can be proven unbreakable" – justify the statement.   5

3. a) Draw the general structure of *DES (Data Encryption Standard)*.   5

   b) Draw a single *Feistel Round* of *DES*. How the Feistel design helps DES to run the Encryption   10
      and Decryption algorithm in same direction?

   c) What is the *block size*, *key size* and the *number of rounds* in *AES (Advanced Encryption*   5
      Standard)? Why AES is not a Feistel algorithm?

   d) The following ciphertext is encrypted by using *Caesar cipher* with the shift parameter value 3.   5
      Decrypt it.

              "fdhvdu flskhu lv hdvb"

4. a) Are all block ciphers polyalphabetic?   3

    b) What is called the heart of *DES*? Briefly explain the working principle of *S-box* in each round   10
        of *DES*.

    c) What do you understand by *Diffusion* and *Confusion*?   5

    d) Figure 1 demonstrates a simple product cipher with two rounds. How does this product cipher   7
        guarantee the *diffusion* and *confusion* properties? Clarify your statement with appropriate
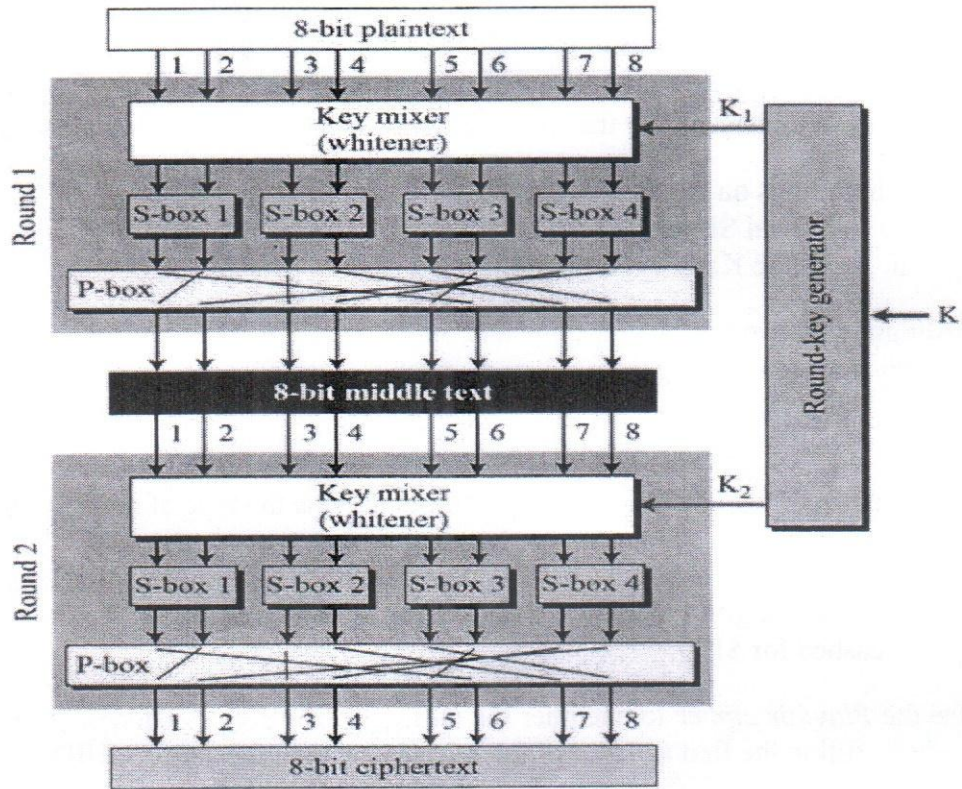   figure.

Figure 1

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11 March 2019 (Afternoon)

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

MID SEMESTER EXAMINATION
DURATION: 1 Hour 30 Minutes

WINTER SEMESTER, 2018-2019
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) Write short notes on genes, chromosomes and DNA.   6
   b) Describe the steps of central dogma in details.   9
   c) Explain the process of alternate splicing.   6
   d) What is mRNA degradation? How does it affect the translation process?   4

2. a) Discuss on various types of translation process.   6
   b) During translation Codons are mapped to Amino Acids to form proteins. Number of different Codons and number different Amino Acids are not equal. Discuss the impact of this scenario.   6
   c) 'k-means' clustering is a method to find k number of clusters within a set of data.
      i. Write down the weakness of k-means clustering method.   3
      ii. Propose at least two methods to modify k-means algorithm to overcome the weakness.   10

3. a) Draw a diagram showing various forms of RNA secondary structures.   6
   b) Explain the advantages of *Zuker Folding Algorithm* over *Nussinov Folding Algorithm* to predict RNA secondary structures.   7
   c) What is sequence alignment? Discuss its importance in bioinformatics study.   5
   d) Classify sequence alignments along with short description.   7

4. a) In agglomerative clustering we need to define a proximity matrix in terms of cluster similarity. Discuss various methods to define inter-cluster similarity.   12
   b) How can we evaluate clusters generated from a clustering method? Discuss them.   4
   c) What is InDel operation? Explain with example.   4
   d) Following two sequences are needed to be aligned locally and globally: 5

   ATGCAATCA
   TGACVGTA

   Show the initialization matrix for both *smith-waterman* and *needleman-wunsch* algorithms. Consider gap, match, and mismatch penalties are -1, +2, and -2, respectively.

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

07 March 2019 (Afternoon)

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

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

CSE 4775: Introduction to Data Mining

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

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1. a) What is data mining? Describe the steps involved in data mining when viewed as a process of knowledge discovery. 15

   b) Describe three challenges to data mining regarding *"Scalability & Efficiency"* and *"Data Mining & Society"*. 10

2. a) Given two objects represented by the tuples (-2, 1, 42, 10) and (21, 0, -6, 10): 5×4
      i.   Compute the Euclidean distance between the two objects.
      ii. Compute the Manhattan distance between the two objects.
      iii. Compute the Minkowski distance between the two objects, using $h = 4$.
      iv. Compute the supremum distance between the two objects.
      v.   Which distance among them is the most suitable one. Justify your Answer.

   b) What are the different types of data used in Data Mining applications? 5

3. a) Briefly outline how to compute the dissimilarity between objects described by mixed attribute. 12

   b) What is *Interquartile Range*? How IQR is used for outlier analysis? 7

   c) What are the conditions a pattern should fulfill to be interesting? 6

4. a) Suppose that the data for analysis includes the attribute age. The age values for the data tuples are (in increasing order): 18

      13, 15, 16, 16, 19, 20, 20, 21, 22, 22, 25, 25, 25, 25, 30, 33, 33, 35, 35, 35, 35, 36, 40, 45, 46, 52, 70.

      i.   What is the *mean* and *Median* of the data?
      ii. What is the *mode* of the data? Comment on the data's modality.
      iii. What is the midrange of the data?
      iv. Can you find (roughly) the first quartile (Q1) and the third quartile (Q3) of the data?
      v.   Give the five-number summary of the data.
      vi. Show a boxplot of the data.

   b) Differentiate between *Data Matrix* and *Dissimilarity Matrix* with appropriate example. 7

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

MID SEMESTER EXAMINATION   WINTER SEMESTER, 2018-2019
DURATION: 1 Hour 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 advantage does a circuit-switched network have over a packet-switched network?   7

   b) Suppose users share a 3 Mbps link. Also suppose each user requires 150 kbps when   7
   transmitting, but each user only transmits 10% of the time.
      i.   When circuit-switching is used, how many users can be supported?
      ii. For the remainder of this problem, suppose packet-switching is used. Find the
           probability that a given user is transmitting

   c) How does the Domain Name System (DNS) work?   5

   d) What is the difference between an intranet and an extranet?   6

2. a) Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has   8
   three links, of rates R1 = 500 kbps, R2 = 2 Mbps, and R3 = 1 Mbps.
      i.   Assuming no other traffic in the network, what is the throughput for the file
           transfer?
      ii. Suppose the file is 4000000 bytes. Roughly how long will it take to transfer the
           file to Host B?

   b) Suppose Alice and Bob are sending packets to each other over a computer network.   9
   Suppose Trudy positions herself in the network so that she can capture all the packets sent
   by Alice and send whatever she wants to Bob; she can also capture all the packets sent by
   Bob and send whatever she wants to Alice. List some of the malicious things Trudy can
   do from this position.

   c) Describe the DHCP client-server interaction process with the aid of an appropriate time   8
   line diagram.

3. a) One of the addresses in a block is 110.23.120.14/20. Find the number of addresses, the   7
   first address, and the last address in the block.

   b) An organization is granted the block 130.34.12.64/26. The organization needs four   10
   subnetworks, each with an equal number of hosts. Design the subnetworks and find the
   information about each network.

   c) Describe the necessity and functionality of Network Address Translation (NAT).   8

4. a) Consider sending a 2400-byte datagram into a link that has an MTU of 700 bytes. Suppose   8
   the original datagram is stamped with the identification number 422. How many
   fragments are generated? What are the values in the various fields in the IP datagram(s)
   generated related to fragmentation?

   b) Multicasting can be emulated using multiple unicasting. What are the potential problems   6
   of doing so? Justify your answer with necessary diagrams.

   c) What is the purpose of loopback address?   5

   d) Compare link-state and distance-vector routing algorithms.   6

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M.Sc TE 1st Semester   11 March 2019 (Afternoon)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)
MID SEMESTER EXAMINATION   WINTER SEMESTER, 2018-2019
DURATION: 1 Hour 30 Minutes   FULL MARKS: 75

CSE 6191: Web Based Instructions 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.

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1. a) Why are ice breakers so important in an E-Learning environment?   6

   b) Discuss the facts to consider while choosing an ice breaker.   6

   c) Briefly describe present E-learning status of your country in undergraduate level. If you   6+7
      have the opportunity to improve the scenario how would you do that? – discuss.

2. a) What is learning? State the OCTR model for learning stages.   10

   b) Every learner have different learning styles or a combination of styles. Discuss on the most   15
      common learning styles.

3. a) Discuss Gagné's nine universal steps of instruction which can be included in the   15
      instructional design of learning materials.

   b) Discuss the importance of bringing a guest lecturer in an online course.   10

4. a) What are the methods to choose a guest lecturer in a course?   5

   b) Discuss on the risk factors to bring guest lecturers in an online course. How these risks can   7+7
      controlled?

   c) Compare traditional learning and e-learning.   6

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

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

CSE 6197: Parallel and Distributed 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) Transparency is an important aspect of distributed systems. However, sometimes it is not   5×3
feasible to hide transparency in a system. Show how transparency or hiding distribution is not
applicable for the following cases:
   i.   A wide- area distributed system that connects two processes in geographically far
        places.
   ii. Distributed systems for devices that people carry around. [e.g. cellphones]
   iii. A case where there has to be several replicas of the same data.

   b) Consider a Body Area Network (BAN) with two possible configurations. For the first   10
configuration, there is a central hub that collects data as needed and does periodic updates as
necessary. The other configuration guarantees a continuous wireless connection to a data
server. What are the advantages and disadvantages of both of these configurations ?

2. a) With the help of figures show how the Beowulf clusters are a typical example of cluster   15
computing systems. Also briefly describe the functionalities of each of the nodes in the cluster
and also how jobs are handled.

   b) Write short notes on the following: 2×5
   i.   Centralized architecture
   ii. Object based Architectural Style

3. a) Using the figure that shows the simplified organization of an internet search engine, explain   12
application layering.

   b) With the help of figures show the two extremes that exist in the organization of sensor   7
networks as distributed databases.

   c) How can you reduce the overall communication in asynchronous communications between   6
server and client? Use the example of checking forms in both the server and the client side to
explain this concept.

4 a) What is a TP monitor? With the help of figures explain the functionality of a TP monitor in   8
distributed systems.

   b) Consider a website that lets its users book trips to various destinations around the world. The   10
system has two subsystems, a hotel booking subsystem and airline ticket booking subsystem.
Since, the entire trip booking has to be a transaction, the entire trip has to be booked entirely
or not at all. This leads to a problem in the sub-transactions. What is that problem and what
property of transactions is violated in the sub-transactions?

   c) Consider a case where there is a server that contains the medical records of all the employees   3+4
of an organization. What are the problems of replicating this information in multiple servers?
What are the problems of having centralized algorithms?

Islamic University of Technology
Organisation of Islamic Cooperation (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION   **WINTER SEMESTER, 2018-2019**
Duration: 1 Hour 30 Minutes   **Full Marks: 75**

CSE 6249: Data Warehousing and Mining

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

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1. (a) What is the basic difference between database driven application and data-mining application? Briefly present one application scenario of a data-mining application that can be used for the people and society around you. [5]

   (b) There are a number of methods to deal with missing values in data preprocessing phase in data-mining applications. Describe them. [5]

   (c) With appropriate argument, derive the formula for proximity measures for binary attributes. You need to explain particularly why the formulas are slightly different for symmetric binary attributes and asymmetric binary attributes. Place suitable example data to establish your argument. [10]

   (d) What are the major challenges of mining a huge amount of data (such as billions of tuples) in comparison with mining a small amount of data (such as a few hundred tuple data set)? [5]

2. (a) Define the following terms with examples: [4]
      i. Data objects and attributes
      ii. Ordinal attribute
      iii. Interval-based attribute and
      iv. Ratio-scaled attribute

   (b) Given two objects represented by the tuples (22, 1, 42, 10) and (20, 0, 36, 8): [6]
      i. Compute the Euclidean distance between the two objects.
      ii. Compute the Manhattan distance between the two objects.
      iii. Compute the Minkowski distance between the two objects, using q = 3.
      iv. Compute the Supremum distance between the two objects.

   (c) We can perform on-line analytical processing directly in an operational database instead of building a separate data warehouse. Present arguments to strengthen the statement. Also provide logics to weaken it. Finally justify your position. [10]

   (d) In data mining the data set may contain hundreds of attributes many of which are irrelevant or redundant. Propose a general outline to minimize the problem. [5]

3. (a) Euclidean, Manhattan and Minkowski distances have a major limitation. Briefly explain. Also explain how cosine similarity eliminates it. [5]

   (b) Consider the following Term-Frequency Vector between document 1 and document 2: [10]

Table 1: Term Frequency Vector for question no. 3(b)

Doc No.	Term Frequency						
..	Coach	Win	Goal	Draw	Season	Best Player	Penalty
Document 1	7	3	1	2	0	0	1
Document 2	0	1	4	0	2	1	0

Based on the document property select a suitable measure of similarity. Finally calculate to what extent they are similar.

(c) Present the definition of data warehouse given by William H. Inmon. The definition leads to a number of key components of data warehouse. Briefly discuss them. [5]

(d) Explain the concept of Entity Identification Problem with a suitable example. [5]

4. (a) Why normalization is used in data mining algorithms? Use the following data to normalize them as directed: [5]

200, 300, 400, 600, 1000

   i. Min-max normalization by setting min = 0 and max = 1

   ii. z-score normalization

   iii. Normalization by decimal scaling

(b) Explain the concept of Snowflake and Star schema with suitable example. Also highlight the strength and weakness of each model. [10]

(c) Suppose that the Statistical Bureau of Bangladesh (SBB) wants to build its own data warehouse for a number of purposes. [10]

SBB is interested to analyze the correlation between the followings:

- Income of people and their geographic location
- Children education level and their financial status
- Results of Higher Secondary Examination and colleges

   i. Determine the major dimensions and measures for the given scenario.

   ii. Draw a start schema diagram for the data warehouse.

   iii. Add other features so that you can convert the start schema into an equivalent snowflake schema.

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CSE 6257: Advanced Pattern Recognition

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.

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1. a) What is Pattern Recognition? Describe the general components of a pattern recognition system which should be able to classify the different characters of English Alphabet from a scanned document. — 1+14

    b) Define the generalized discriminant function for a two-class problem. How can you use the discriminant functions for a multi-class problem? Briefly describe each of those designs. — 1+6

    c) Can you convert a nonlinear classification problem into a linear one? Explain how. — 3

2. a) Consider the hyperplane used for discriminant functions.
    - i. Show that the projection of x_a onto the hyperplane is given by — 5
    $$x_p = x_a - \frac{g(x_a)}{\|w\|^2} w$$
    - ii. Show that the distance from the hyperplane $g(x) = w^t x + w_0 = 0$ to the point x_a is — 15
    $$|g(x_a)| / \|w\|$$
    by minimizing $\|x - x_a\|^2$ subject to the constraint $g(x) = 0$.

    b) Can you define the criterion function J as the number of misclassified samples while using it in the Gradient Descent technique? Justify your choice. — 5

3. a) Consider a Support Vector Machine and the following training data from two categories given in Table 1:

Table 1

category	x_1	x_2
ω_1	1	1
ω_1	2	2
ω_1	2	0
ω_2	0	0
ω_2	1	0
ω_2	0	1

   i. Plot these six training points (use graph paper), and construct the weight vector for the optimal hyperplane, and the optimal margin. — 15
   ii. What are the support vectors? — 5
   [Note: You do not need to calculate the solutions by solving, rather from inspection with graph.]

    b) What is Lagrange Multipliers and Lagrangian? — 5

[Mandatory]

4. a) What are the KKT conditions in SVM classifier? 5

  b) Explain the working principle of SVM classifier and postulate the dual form from the primary problem. Provide all detailed calculations. 15

  c) Why do we need the Kernel trick in SVM? Give some examples of SVM kernels. 5

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M.Sc. Engg. CSE   08 March 2019 (Afternoon)

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

MID SEMESTER EXAMINATION   WINTER SEMESTER, 2018-2019
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 **4 (four)** questions. Answer any **3 (three)** of them.
Figures in the right margin indicate marks.

---

1. Humans are capable of retaining 7±2 items in the short-term memory. This phenomenon raises design implications to many user interface considering the design principle, '*Recognition is better than recall*'. Figure 1 (a), (b) shows Search box interfaces and Figure 1(c), (d) displays Order information from the mobile app version of 'chaldal.com'.
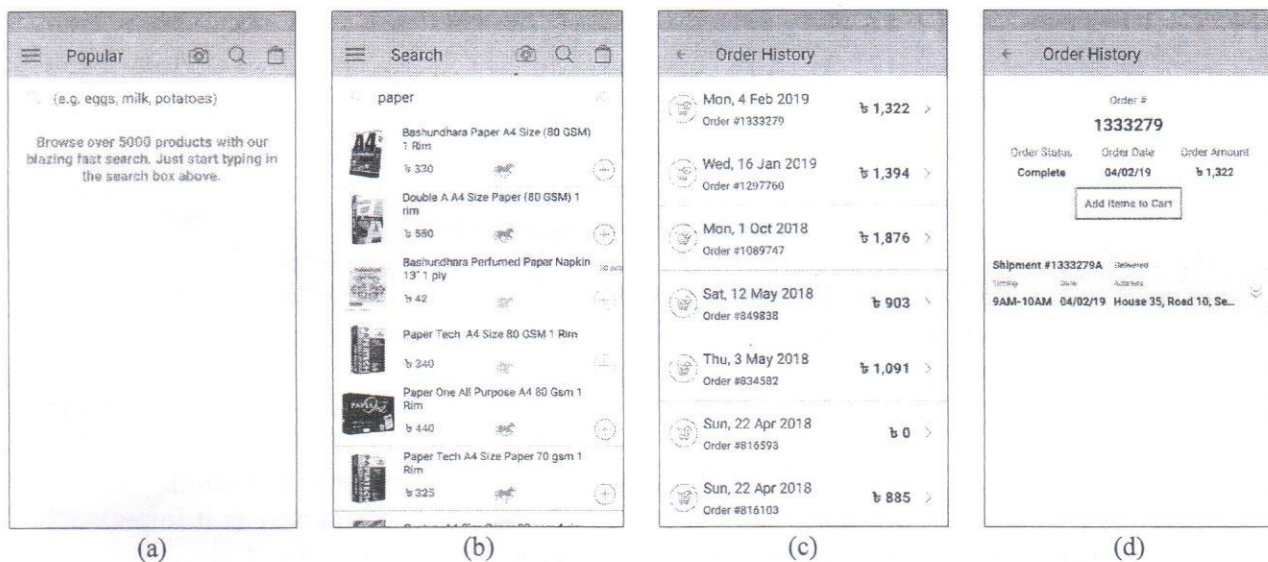

(a)   (b)   (c)   (d)

Figure 1: Interfaces from mobile app

   a) Are there enough visual cues here for the user to find the functionality or item? Explain your answer.   7

   b) Do they have to remember things to understand what's going on? Justify your answer.   6

   c) How can you help the user recall? Explain and redesign the interfaces by drawing hand sketches.   12

2. a) Suppose you want to design a text-based interaction where the font size will be changed according to the distance from a user to display screen. If the screen resolution is 120 dpi, distance is 20 inch, and the visual angle is 21 minutes then what will be the font size of the text?   8

   b) How does the 'Gulf of execution/Gulf of evaluation' design issues became relevant for designing VR-based application?   5

c)   Define Fitts' Law and how it applies to user interface design. Apply your knowledge of this law   4+8
to Figure 2 below and indicate with reasons which target you think is fastest to reach with the
mouse starting at location M. Assume that you can move your hand equally well in all directions,
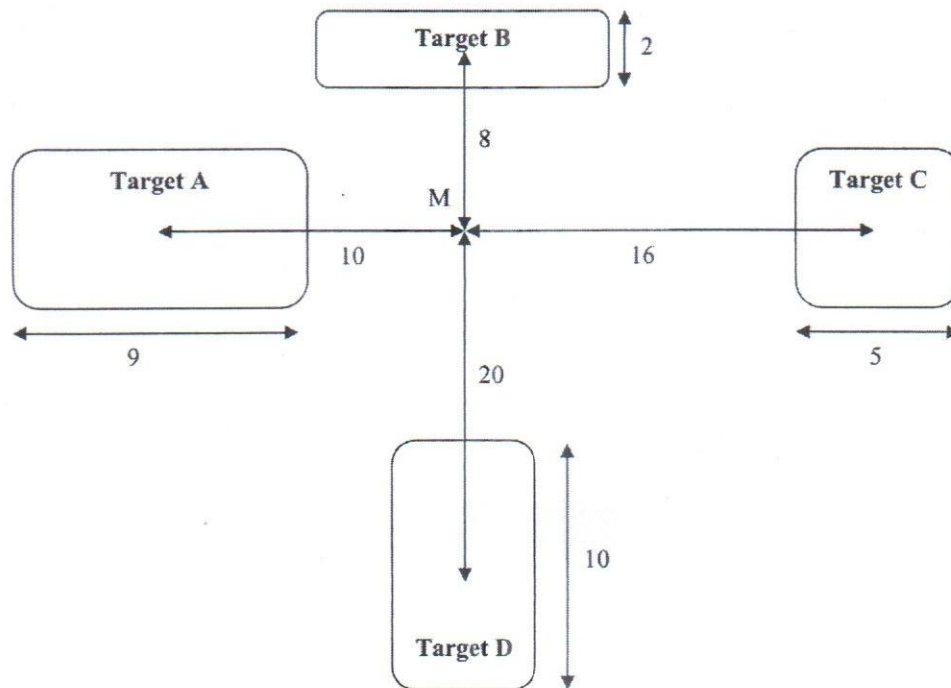and that none of the targets are near a screen edge. Include all calculations in your answer.

Target B

2

8

Target A   M   Target C

10   16

9   5

20

10

Target D

Figure 2: Fitts' law diagram

3.   'Prosopagnosia', also called face blindness, is a cognitive disorder of face perception in which the
ability to recognize familiar faces, is impaired, while other aspects of visual processing (e.g., object
discrimination) and intellectual functioning (e.g., decision-making) remain intact. You are asked to
design a system to improve a prosopagnosia patient's daily life. Answer the followings for the
problem described.
a)   Which interaction styles are suitable for the system? Explain with proper justification.   9
b)   What are the characteristics of input/output devices you recommend and why is it important?   8
Provide adequate justifications/assumptions of your answer.
c)   How could you analyze different interaction problems that may arise while performing   8
interactions?

4.   You are asked to design interaction dialogs using the right hand gesture. Deliberate pointing
movement through finger can be considered as an input modality. Your design should utilize a set of
gestures to control menu-driven interface. There are different types of menu such as selection menu,
pop-up/pop-in menu, pull-down menu, pie menu, etc.
a)   What are the design considerations for menu-driven interface?   8
b)   Suggest a set of gesture-based interaction dialogue to control such menu-driven interface.   12
c)   Comments on the usability issues if you merge mouse-pointer-based menu and gesture-based   5
menu to support multimodality as input.

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

MID SEMESTER EXAMINATION   **WINTER SEMESTER, 2018-2019**
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 **4 (four)** questions. Answer any **3 (three)** of them.
Figures in the right margin indicate marks.

---

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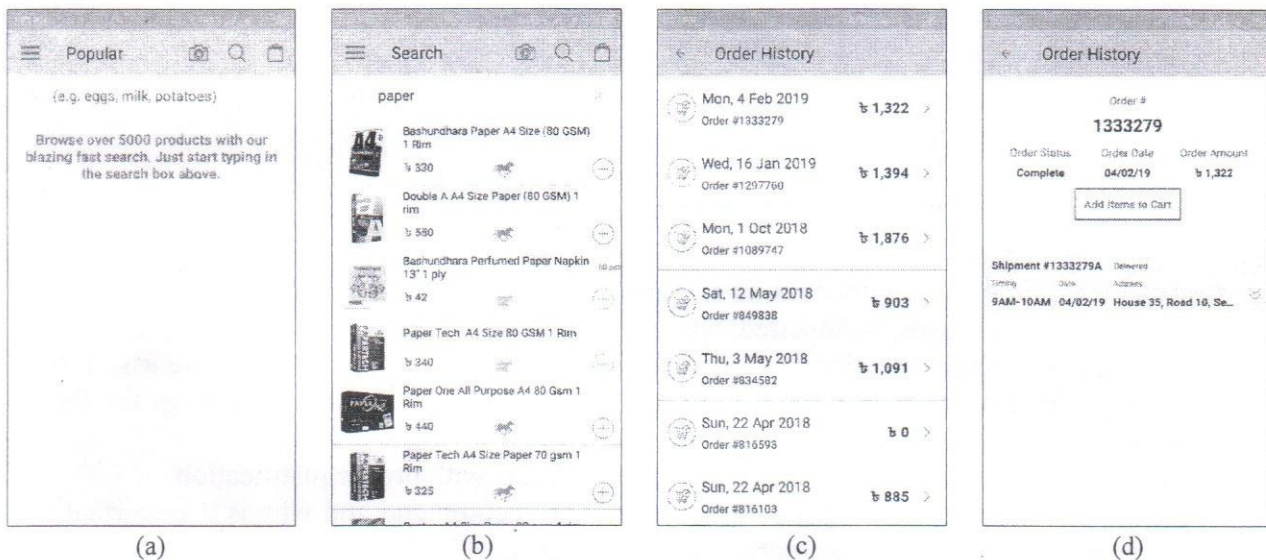

Figure 1: Interfaces from mobile app

   a) Are there enough visual cues here for the user to find the functionality or item? Explain your answer.   7

   b) Do they have to remember things to understand what's going on? Justify your answer.   6

   c) How can you help the user recall? Explain and redesign the interfaces by drawing hand sketches.   12

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   b) How does the 'Gulf of execution/Gulf of evaluation' design issues became relevant for designing VR-based application?   5

c) Define Fitts' Law and how it applies to user interface design. Apply your knowledge of this law   4+8
to Figure 2 below and indicate with reasons which target you think is fastest to reach with the
mouse starting at location M. Assume that you can move your hand equally well in all directions,
and that none of the targets are near a screen edge. Include all calculations in your answer.
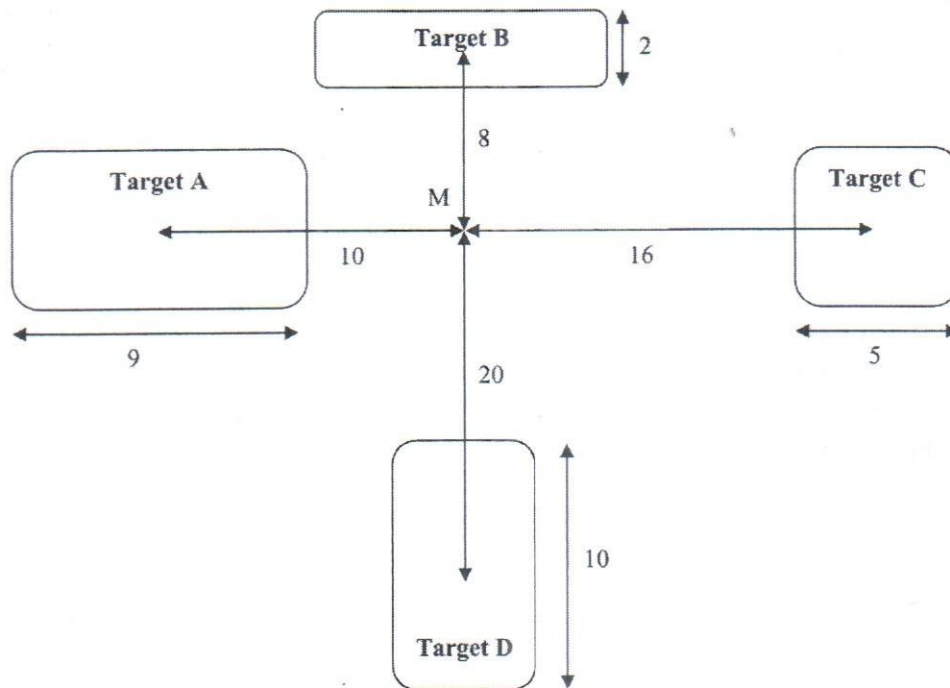

Figure 2: Fitts' law diagram

3. 'Prosopagnosia', also called face blindness, is a cognitive disorder of face perception in which the
ability to recognize familiar faces, is impaired, while other aspects of visual processing (e.g., object
discrimination) and intellectual functioning (e.g., decision-making) remain intact. You are asked to
design a system to improve a prosopagnosia patient's daily life. Answer the followings for the
problem described.
a) Which interaction styles are suitable for the system? Explain with proper justification.   9
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c) Comments on the usability issues if you merge mouse-pointer-based menu and gesture-based   5
    menu to support multimodality as input.