Department of Computer Science & Engineering
University of Asia Pacific (UAP)

Final Examination **Fall 2022** **2nd Year 2nd Semester**

Course Code: CSE 209 **Course Title: Digital Logic & System Design** **Credits: 4**

Full Marks: 150 **Duration: 3 Hours**

Instructions:

1. There are Six (6) Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. a) Discuss the universality of NAND gate. 06

   b) Implement the following Boolean function with only NAND gate

   $y = A\overline{B} + \overline{A}B\overline{C}$ 07

   c) Implement the following function using K-map.

   $F(A, B, C, D) = \sum(0, 2, 3, 4, 8, 9, 12, 13, 14, 15)$ 12

2. a) Draw the internal circuit diagram of clocked JK flip-flop and briefly describe its operation. 10

   b) Design D flip-flop from J-K flip-flop. 03

   c) Design a logic circuits that controls the passage of a signal A according to the following requirements:

   (i) Output X will equal C when inputs A and B are the same.

   (ii) Output X will remain HIGH when A and B are different. 07

   d) Write down the sum-of-products expression for a circuit with four inputs (A, B, C & D) and an output (Y) that is to be HIGH only when input D is HIGH at the same time at least two other inputs are LOW. 05

3. Design a synchronous counter that will count in this fashion: 25

   $000 \rightarrow 001 \rightarrow 100 \rightarrow 101 \rightarrow 111$

4. a) Write down the instruction set and the corresponding op-code of SAP-1 Computer. 05

   b) How many operations are possible in SAP-1 Compute.? Explain your answer. 05

   c) Create a SAP-1 assembly language program and then generate the machine code for the expression of 65 + 80 - 38 + 55 - 6. These numbers are in decimal form. 15

5. a) Draw the block diagram of 4 bit ALU chip (IC # 74382). Describe 8(Eight) operations of the 4 bit ALU chip that perform by select inputs. 10

b) Write down the truth tables of half adder and full adder. Design half adder and full adder using K-map or otherwise. 07

c) Briefly describe the operation of IC # 7483(4-bit parallel adder). Design a 4-bit parallel Adder/Subtractor using IC # 7483 and basic gates if necessary. Briefly describe its operation. 08

OR

a) Draw the circuit diagram of MOD-11 synchronous up counter using JK flip-flops and briefly describe its operation. 10

b) Design MOD 70 counter using IC # 74293. 07

c) Design MOD 5 Ring counter using JK flip flop and describe its operation. 08

6. a) Draw the internal circuit of IC # 74138(Decoder). Briefly describe its operation. 10

b) Show that IC # 74138(Decoder) can be used as the 1of 8 Demultiplexer. 05

c) Design 5 lines to 32 lines decoder using IC# 74138. You can use other logic gates or IC if necessary. 10

OR

a) Draw the internal circuit of IC # 74151(Multiplexer). Briefly describe its operation. 10

b) Show how IC # 74151 can be used to generate the logic function $Z = AB + BC + CA$. 05

c) Implement the function $F(A, B, C, D) = \Sigma(0, 1, 4, 6, 7, 8, 10, 12, 15)$ using an IC # 74151(Multiplexer) and NAND gate only. 10

University of Asia Pacific

Department of Basic Sciences and Humanities

Program: B.Sc. in CSE

Final Examination | **Fall-2022** | **2nd year 2nd Semester**

Course Code: MTH 205 | Course Title: Math-IV | Credit: 3.00

Time: 3.00 Hours | Full Marks:150

Instructions:

1. There are **six (6)** questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. a. Define exact differential equation. Solve the exact differential equation **[15] CO1**

$$(x+y-10)dx+(x-y-2)dy=0.$$

b. Solve the first order linear differential equation $-\frac{dy}{dx}+\frac{y}{x}=x.$ **[10] CO1**

OR

a. Solve the Bernoulli's equation $\frac{dy}{dx}-y=e^x y^2.$ **[15] CO1**

b. Using separation of variable solve $\frac{dy}{dx}+2xy^2=0.$ **[10] CO1**

2. Solve the higher order differential equation with variable coefficient **[25] CO2**

$$(x^2D^2-xD-3)y=x^2\log x.$$

OR

Find the complete solution of the differential equation **[25] CO2**

$$(D^2-4D+4)y=e^{2x}+x^3+\cos 2x.$$

3. Express $f(x)=x$ as a half range sine series in the interval $0<x<2.$ **[25] CO4**

4. Define full range Fourier series. Find full range Fourier series for [25] CO4

$$f(x)=\begin{cases}-1, -1<x<0\\ 1, 0<x<1\end{cases}$$; having period 2.

5. Find the Laplace transform of [25] CO4

(1) $\frac{1}{t}\sinh t$ (2) $t^2\sin t$ (3) $\int_0^{\infty} te^{-4t}\sin t\,dt$ (4) $f(t)=\frac{2t}{3}, 0\le t\le 3.$

6. Find the inverse Laplace transform of [25] CO4

(1) $\frac{1}{s^2-5s+6}$ (2) $\frac{s-1}{s^2-6s+25}$ (3) $\frac{s+4}{s(s-1)(s^2+4)}$ (4) $\frac{s+2}{s^2-4s+13}$.

University of Asia Pacific

Department of Computer Science and Engineering

Program: B.Sc. in CSE

Final Examination | **Fall-2022** | **2nd year 2nd Semester**

Course Code: CSE 211 | Course Title: Database Systems | Credit: 3

Time: 3.00 Hours | Full Mark: 150

Instructions:

1. There are Six (6) Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. a) Suppose, you were withdrawing money from an ATM booth. You put the card inside the machine, gave password correctly and clicked 'OK' button. After few minutes, the machine failed and gave your card back to you. Which ACID property(s) can play role for the management of this transaction? **Explain** that property. [13] CO1

   b) Suppose, you were withdrawing money from an ATM booth in Dhaka. At the same time, your father was depositing cash money in another branch. Which ACID property (s) can play role for the management of this transaction? **Explain** that property. [12] CO1

2. a) Suppose that you have an ordered file with r = 40,000 records stored on a disk with block size B = 1024 bytes. File records are of fixed-length and are unspanned, with a record size R = 100 bytes. Now suppose that the ordering key field of the file is V = 11 bytes long, a block pointer (block address) is P = 8 bytes long, and a primary index has been constructed for the file.
   Identify the improvement. [15] CO3

   b) In case of insertion and deletion in the primary and dense index, which shows higher overhead? Additionally, which one has more space overhead? **Explain** the reasons. [10] CO3

3. a) **Apply** the normalization techniques to the below table. [20] CO3

Person						
ID-Name-Age	City-Code	City-Name	Favorite-Book-ID	Book-Genre-ID	Genre-Type	Price
101-Manna-20	1	Dinajpur	2	1	Travel	25
102-Sharmin-19	2	Magura	1	1	Travel	22
103-Mollika-21	4	Borishal	3	2	Gardening	18
104-Anik -20	3	Sylhet	2	1	Travel	25
105-Adib -19	3	Sylhet	1	1	Travel	22
106-Mridul -21	4	Borishal	4	3	Sports	30

b) Who is the father of modern database systems? **Explain** how his opinion differs with Hugh Darwen and Chris Date in regards of Atomicity with examples. [5] CO3

4. a) **Explain** the difference between inner join and natural join with an example. [5] CO2

b) Suppose you have the following tables. **Apply** the below join operations. [12] CO2

Course_id	Title	Dept_name	Credits
CSE-301	DataCom	CSE	3
EEE-200	Circuit Design	EEE	3
CSE-321	Database	CSE	3

Course

Course_id	Prereq_id
CSE-301	CSE-235
EEE-200	EEE-100
CSE-333	CSE-305

Prerequisite

i) Left Outer Join ii) Right Outer Join iii) Full Outer Join

c) **Explain** the advantages of Role in database management. [8] CO1

5. a) Suppose in a movie database, a movie is identified by id, name, year and ratings where a movie might have a sequel. [Example: Mission: Impossible 2 is a 2000 American action spy film. This movie is sequel to 1996 film Mission: Impossible]. Movies are casted by actors where an actor has specific role [Example: MI 2 is starred (i.e. main character) by Tom Cruise] and an actor is identified by id, firstname, lastname and gender. A movie might have multiple genres [Example: MI 2 is characterized by three genres: Action | Adventure | Thriller]. A director who directs a movie is identified by id, firstname and lastname. We assume a movie can have at-most one director. [Example: John Woo is the director of MI 2 and he also directed well-known movies like 'A better tomorrow', 'Red Cliff', 'Hard Boilded', 'Face/Off'] [15 + 10] CO4

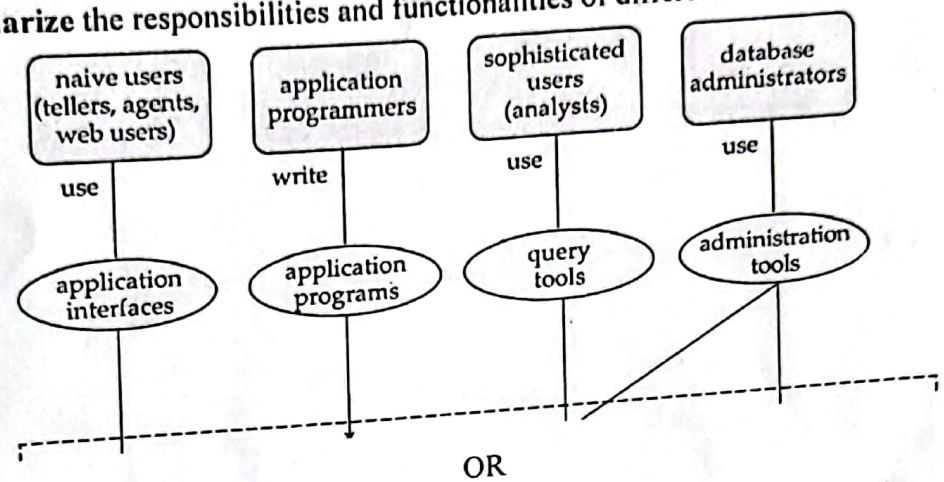
i) **Analyze** the scenario and then draw the ER diagram with proper notation.
ii) Also, **construct** the Schema diagram form ER diagram.

OR

a) A Bus Company owns a number of busses. Each bus is allocated to a particular route, although some routes may have several busses. Each route passes through a number of towns. One or more drivers are allocated to each stage of a route, which corresponds to a journey through some or all of the towns on a route. Some of the towns have a garage where busses are kept and each of the busses are identified by the registration number and can carry different numbers of passengers, since the vehicles vary in size and can be single or double-decked. Each route is identified by a route number and information is available on the average number of passengers carried per day for each route. Drivers have an employee number, name, address, and sometimes a telephone number. [15 + 10] CO4

i) **Analyze** the scenario and then draw the ER diagram with proper notation.
ii) Also, **construct** the Schema diagram form ER diagram.

6. a) **Summarize the responsibilities and functionalities of different users shown in below.** [25] CO1



OR

a) **Summarize the following symbol in relational algebra with proper examples.** [25] CO1

σ (Selection),
Π (Projection),
x (Cartesian Product),
∪ (Union),
- (Set Difference),
⋈ (Natural Join)

University of Asia Pacific
Department of Basic Sciences and Humanities
Program: B. Sc. in CSE

Final Examination | **Fall - 2022** | **2nd year 2nd Semester**

Course Code: ECN 201 | Course Title: Economics | Credit: 2

Time: 2.00 Hours | Full Marks: 100

Instructions:

1. There are four (4) questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. $P = 100 - 5Q$

   $C = 50 + 2Q^2$

   a. Calculate equilibrium price and quantity in case of perfect competition market. **[15] CO2**

   b. Explain the characteristics of perfect competition market. **[10] CO2**

OR

   $P = 50 - 2Q$

   $C = 10 + 2Q^2$

   a. Calculate equilibrium price and quantity in case of perfect competition market. **[15] CO2**

   b. Explain the characteristics of monopoly market. **[10] CO2**

2. Describe GDP and GNP. Explain different methods of calculating GDP. **[25] CO3**

OR

   Describe full employment. Explain different types of unemployment. **[25] CO3**

3. Explain the criteria of LDC graduation. In case of Bangladesh describe the benefits, challenges and give some policy suggestions regarding LDC graduation. **[25] CO4**

4. a. $U = X_1^2 X_2^2$. Price of X_1 is 1 tk, price of X_2 is 2 tk and income 100 tk. Calculate the optimal value of X_1, X_2 and maximum utility. **[15] CO1**

   b. Explain the properties of indifference curve. **[10] CO1**

University of Asia Pacific

Department of Computer Science and Engineering

Program: B.Sc. in CSE

Final Examination | **Fall-2022** | **2nd year 2nd Semester**

Course Code: CSE 207 | Course Title: Algorithms | Credit: 3

Time: 3.00 Hours. | Full Mark: 150

Instructions:

1. There are **Six (6)** Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

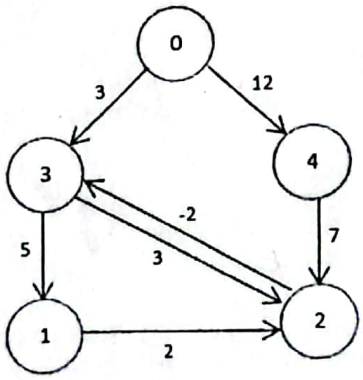
1. a. Define 'Optimization' in Algorithms with two optimization techniques. [10] CO1

b. Explain with example why does dynamic programming is called the 'clever brute force' technique? State the reasons of using dynamic programming? [10+5] CO1

OR

a. Discuss 'Time Complexity' in Algorithm. Explain why measuring 'Time Complexity' in Algorithm is important? [5+5] CO1

b. Explain how can you store the following graph in a computer memory? [10+5] CO1



Demonstrate 'Depth First Search' for the above-mentioned graph.

2. a. Compute the complexity of the following algorithm. What will be output for n=5? [10] CO2

```
for (i=0; i<n; i++)
        for (j=0; j<i; j+=i)
                print (i+j)
```

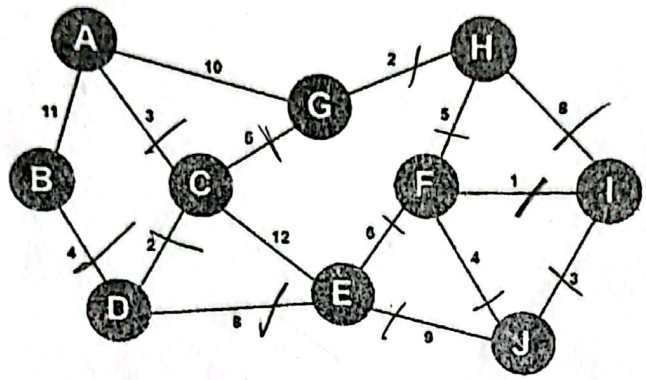
b. Solve the following equation using the Master's method. [15] CO2

$$T(n) = 2T(n/4) + n^{0.51}$$

3. a. Generate a directed graph with 7 nodes and 14 edges such that the nodes are numbered from 0 to 6. [5] CO

b. Assemble the shortest path list of the SSSP (Single Source Shortest Path) using Dijkstra's algorithm on the graph that you generated for Q3a. [20] CO4

4. [25] CO4



Consider the graph above, develop the Minimum Spanning Tree (MST) of this graph by simulating of the Kruskal's algorithm step by step.

OR

a. Consider the graph in Q4/a, develop the Minimum Spanning Tree (MST) of this graph by simulating of the Prim's algorithm step by step. [25] CO4

5. a. Identify the five applications of the graph algorithms and five applications of the Minimum Spanning Tree. [10] CO3

b. In an airport, planes are docked at gates to board and get off passengers. Only one plane can use a gate at a time and there is a 10 minutes safety period between the departure of one plane and arrival of next. In Hajrat Shahjalal International Airport, for gate 01, the following docking requests are received from different flights. As an in-charge of that gate, you need to identify/find the maximum number of flights that can use the gate without any collision. Apply the appropriate algorithm among the ones you have studied in Algorithms and select the flights. Outline detail steps of your selection and list the selected flights. [15] CO3

Two arrays of arrival and departure time of flights are given below.

Flight #	1	2	3	4	5	6	7	8
Arrival time	8:00	14:00	9:40	10:00	14:30	8:50	12:00	17:00
Departure time	9:35	16:00	11:30	11:30	16:30	10:40	14:00	20:00

6. a. You went to the annual picnic of CSE and become the winner of the "Jumping King" game. As the winner of the game, you are provided with a gift bag of capacity M kg and you are allowed to fill-up the bag with n available gift items with different prices and weights. The bag with the items you filled-in will be your prize. So, you have to select the items in such a way so that you get the maximum total value in the gift bag by using a DP algorithm. Given the following configuration, show the detail steps of your solution: [25]

Capacity of the Gift Bag is 10 kg

Available gift items:

Weight:	1	2	3	4	6
Value:	2	1	7	6	12

University of Asia Pacific

Department of Computer Science and Engineering

Lab Final, Fall-2022

Program: B.Sc. in CSE

Course Title: Algorithms Lab | Course No. CSE 208 | Credit: 1.50

Time: 2:00 Hrs | Full Mark: 45

There are **Nine (9)** Questions. **Answer any 45 marks (15 Quiz + 30 Lab Final) including Question no. 1 and 4.**

1. Calculate the space complexity of the following code segment. **[5]**

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

2. You are given a list of N student names and their achieved numbers in final. You have to query a student name. If the student name and her/his number have already been taken as input then you will check if the number is >= 80. In that case print "A+". Otherwise print "Not A+". If the student's name has not been taken as input, print "NO STUDENT RECORD AVAILABLE". The sample IO is given below: **[10]**

Sample Input	Sample Output
3 Tamim 50 Shakib 80 Mahmudullah 85 Mustafiz	NO STUDENT RECORD AVAILABLE

3. Write a program to print the adjacency matrix of Figure 1 before and after executing the following code segment. **[5]**

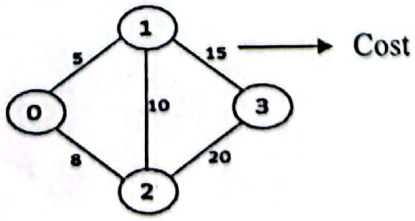


Figure-1: Graph

```
for(I = 1; I <= 4; i++){
      for(j = 1; j <= 4; j++){
         scanf("%d", & cost[i][j]);
         if(cost[i][j] == 0){
            cost[i][j] = 999;
         }
      }
}
```

Output:

Adjacency matrix before executing the code	Adjacency matrix after executing the code

4. Write a program to sort a list of numbers in ascending order using quicksort or merge sort. **[10]**

Sample Input:

Enter the number of elements: 5
Element-1: 10
Element-2: -20
Please enter positive number only.
Element-2: 5
Element-3: 2
Element-4: 0
Element-5: 5469874532147
Thank you for inserting 5 valid numbers.

Sample Input:

Sorted elements (ascending order): 0 2 5 10 5469874532147

5. Write a program to implement BFS or DFS algorithm and print the sequence start with A. **[10]**

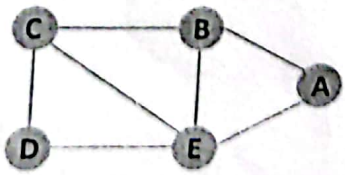


Figure-2: Graph

6. Write a program to find the minimum cost of the following graph using Prim's or Dijkstra algorithm. [10]

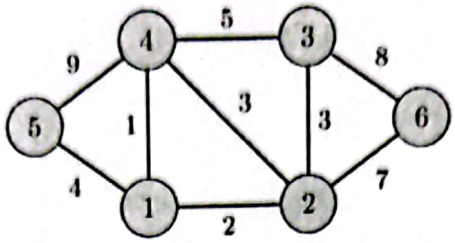


Figure-3: Graph

Sample Input: [5]

Enter the number of nodes: _____
Enter the adjacency matrix:

Sample Output:

Minimum Cost: _____

7. Write a program to implement 0/1 Knapsack problem using dynamic programming. [10]

8. **[Bonus]** Write a program to print the following output. [10]

Sample Input:

Enter the number of rows: 4

Sample Output:

UAP
UAP UAP
UAP UAP UAP
UAP UAP UAP UAP

9. Table 1 given the time complexity of different sorting algorithms. Which algorithm, in your opinion, is the best? Why? [5]

Sorting Algorithm	Best Case	Average Case	Worst Case
Insertion	O(n)	$O(n^2)$	$O(n^2)$
Selection	$O(n^2)$	$O(n^2)$	$O(n^2)$
Bubble	$O(n^2)$	$O(n^2)$	$O(n^2)$

Table-1: Complexity of different sorting algorithms