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

Final Examination **Spring 2023** **2nd Year 2nd Semester**

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

Full Marks: 50 **Duration: 3 Hours**

Instructions:

1. There are **Five (5)** Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

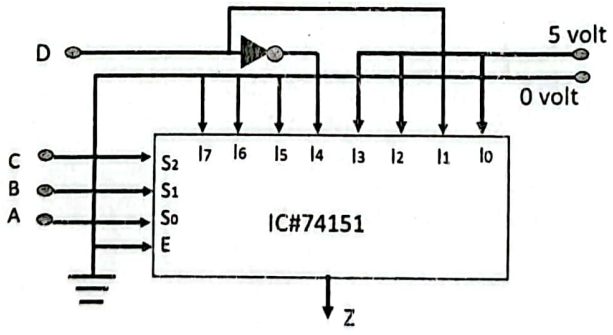
1. a) Draw the internal circuit diagram of clocked JK flip-flop and briefly describe its operation [3] CO3

   b) Design a logic circuit that controls the passage of a signal A according to the following requirements: [3] CO3

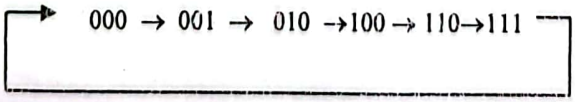
   (i) Output X will equal A when inputs B and C are different

   (ii) Output X will remain HIGH when B and C are the same.

   c) Set up a truth table for the following circuit for the 16 possible combinations of inputs A, B, C, D. Hence write down the sum-of-products expression for Z and simplify using K-map. [4] CO3



2. Design a synchronous counter that will count in this following sequence: [10] CO4



3. a) Write down the instruction set and the corresponding op-code of SAP-1 Computer. [2] CO2

b) How many operations are possible in SAP-1 Computer? Explain your answer. [2] CO2

c) Create an 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. [6] CO2

4. a) Draw the circuit diagram of MOD-11 synchronous up counter using JK flip-flops and briefly describe its operation. [4] CO5

b) Design MOD 70 counter using IC # 74293. [3] CO5

c) Design MOD 6 Ring counter using JK flip flop and describe its operation. [3] CO5

5. a) Draw the internal circuit of IC # 74138(Decoder). Briefly describe its operation. [4] CO3

b) Show that IC # 74138(Decoder) can be used as the 1of 8 Demultiplexer. [2] CO3

c) Design 5 lines to 32 lines decoder using IC# 74138. You can use other logic gates or IC if necessary. [4] CO3

OR

a) Draw the internal circuit of IC # 74151(Multiplexer). Briefly describe its operation. [4] CO3

b) Show how IC # 74151 can be used to generate the logic function Z = AB + BC + CA. [2] CO3

c) Implement the function F (A, B, C, D) = $\sum(0, 1, 4, 6, 7, 8, 10, 12, 14)$ using an IC # 74151(Multiplexer) and NAND gate only. [4] CO3

University of Asia Pacific

Department of Basic Sciences and Humanities

Program: B.Sc. in CSE

Final Examination **Spring-2023** **2nd year 2nd Semester**

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

Time: 2.00 Hours Full Marks: 50

There are **four** questions. Answer all of them. Part marks are shown in the margins.

1.	a.	Explain the difference between GDP and GNP.	[5]	[CO4]
	b.	Explain different methods of calculating GDP.	[5]	[CO4]
2.		$P = 200 - 2Q$ $C = 50 + Q^2$ Calculate equilibrium price and quantity in case of perfect competition market.	[20]	[CO1]
		OR		
		$P = 100 - 2Q$ $C = 10 + Q^2$ Calculate equilibrium price and quantity in case of perfect competition market.	[20]	[CO1]
3.		Discuss the impact of COVID19 on Bangladesh economy and give some policy suggestions.	[10]	[CO3]
4.	a.	$U = X_1^2 X_2^2$. Price of X_1 is 2 tk, price of X_2 is 4 tk and income is 100 tk. Calculate the optimal value of X_1, X_2 and maximum utility.	[5]	[CO2]
	b.	Explain the characteristics of indifference curve.	[5]	[CO2]

University of Asia Pacific

Department of Computer Science and Engineering

Program: B.Sc. in CSE

Final Examination | **Spring-2023** | **2nd year 2nd Semester**

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

Time: 3.00 Hour. | Full Mark: 50

There are **Five** Questions. Answer all of them. Part marks are shown in the margins.

3. You are a computer scientist working on a project to optimize the packing of items into containers for shipping. Each item has a weight and a value, and your goal is to determine the optimal combination of items to maximize the total value while staying within the weight capacity of the containers. Design a step-by-step dynamic programming algorithm/pseudocode to solve this optimization problem. **[6] [CO4]**

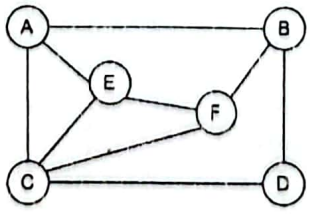
4. What are the key differences between the dynamic programming algorithm and the greedy approach? Why would you choose the above algorithm over the greedy algorithm? **[4] [CO1]**

5. a. You are given a set of jobs, each having a specific deadline and a corresponding profit if completed within the deadline. Each job takes one unit of time to complete. Create a schedule to maximize the total profit by completing jobs within their respective deadlines using the Greedy approach. **[5] [CO2]**

Job	J1	J2	J3	J4	J5
Deadline	2	1	2	1	3
Profit	100	50	10	200	30

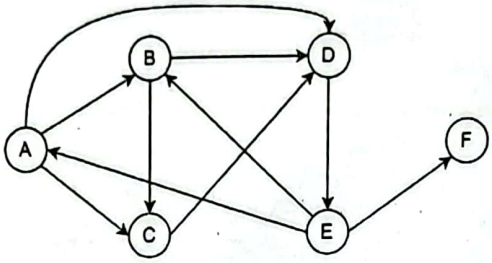
b. Design the algorithm/pseudocode to solve the above problem. **[5] [CO4]**

6. a. Consider the following graph with 6 vertices. Find the chromatic number of this graph with an appropriate illustration. **[3] [CO2]**



b. You have an N×N chessboard and the goal is to place N Queens on the board so that no two Queens threaten each other. Develop the backtracking algorithm to find a solution for an N×N chessboard. [7] [CO4]

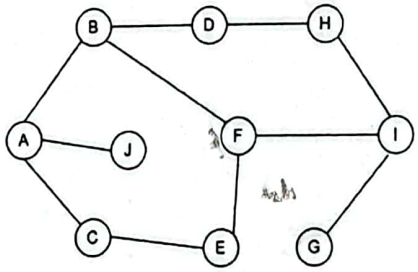
4. a. Suppose the following undirected graph represents a social network, with nodes as friends and edges denoting friendship. Use a graph traversal algorithm to categorize 'A's friends into different levels, and provide the steps of the traversal process. [5] [CO2]



b. You are preparing for a road trip across Bangladesh with a network of cities connected by highways. Each highway has a distance associated with it. Write an algorithm to find the shortest path from your city to all other cities. [5] [CO4]

Or,

a. Determine the Minimum Vertex Cover for the following graph using an approximation algorithm. [5] [CO2]



b. Write a detailed algorithm for finding a Minimum Spanning Tree (MST) in a weighted, connected graph. Include the key steps and necessary explanations for your algorithm. [5] [CO4]

5. a. Consider the text: "CTAGCTAGCATG" and the pattern: "GCTA". Utilize the Rabin-Karp algorithm to find the occurrences of the pattern within the text. [7] [CO2]

Show the step-by-step process including how hash values are calculated, comparisons made and the positions in the text where the pattern is found.

b. Analyze the time complexity of Rabin-Karp algorithm. [3] [CO3]

University of Asia Pacific

Department of Basic Sciences and Humanities

Program: B.Sc. in CSE

Final Examination | **Spring-2023** | **2nd year 2nd Semester**

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

Time: 3.00 Hours | Full Marks: 50

There are **five** questions. Answer all of them. Part marks are shown in the margins.

1. a. Define exact differential equation. Solve the exact differential equation **[6] [CO1]**

$$(2x-y-8)dx+(2y-x-5)dy=0.$$

b. Solve the Bernoulli's equation $x^2\frac{dy}{dx}-2xy=3y^4$. **[4] [CO2]**

OR

An inductor of 2 henrys, a resistor of 16 ohms and a capacitor of .02 farads are connected in series with an electromotive force of 100 volts. At $t=0$, the charge on the capacitor and current in the circuit are zero. Find the charge and current at time $t>0$. (Use Kirchhoff's Laws and Laplace transform.) **[10] [CO1]**

2. Solve the higher order differential equation with variable coefficient **[10] [CO2]**

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

3. a. Define full range fourier series. **[3] [CO3]**

b. Find full range fourier series for $f(x)=\begin{cases}-2, -1<x<0\\ 2, 0<x<1\end{cases}$; with period 2. **[7] [CO4]**

4. Find the laplace transform of **[10] [CO5]**

$$(1)\frac{1}{t}\sinh t \quad (2)\,t^2\sin t \quad (3)\ e^{-4t}\sin(9t) \quad (4)F(t)=\frac{2t}{3}, 0\le t\le 3.$$

5. Find the inverse laplace transform of **[10] [CO5]**

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

University of Asia Pacific

Department of Computer Science and Engineering

Program: B.Sc. in CSE

Final Examination | **Spring-2023** | **2nd year 2nd Semester**

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

Time: 3.00 Hours | Full Mark: 50

There are **Five** Questions. Answer all of them. Part marks are shown in the margins.

1. a. **Discuss** database applications examples in different sectors, such as enterprise information, banking and finance, universities, airlines, telecommunications and navigation systems. **[6]** **[CO1]**

   b. **Explain** the two-tier and three-tier architectures of database applications with proper examples. **[4]** **[CO1]**

OR

   a. **Discuss** the four ACID properties in transaction management. **[6]** **[CO1]**

   b. **Explain** the logical schema, physical schema, instance and physical data independence in database systems. **[4]** **[CO1]**

2. The following relational schema form a part of a restaurant database held in a relational DBMS: **[5×2 =10]** **[CO2]**

   Food (F_ID, F_Name, F_Type, F_Price)
   Customer (C_ID, C_Name, F_ID, W_ID)
   Waiter (W_ID, W_Name, W_Salary)

   Construct (write down) the Relational Algebra for the following queries:

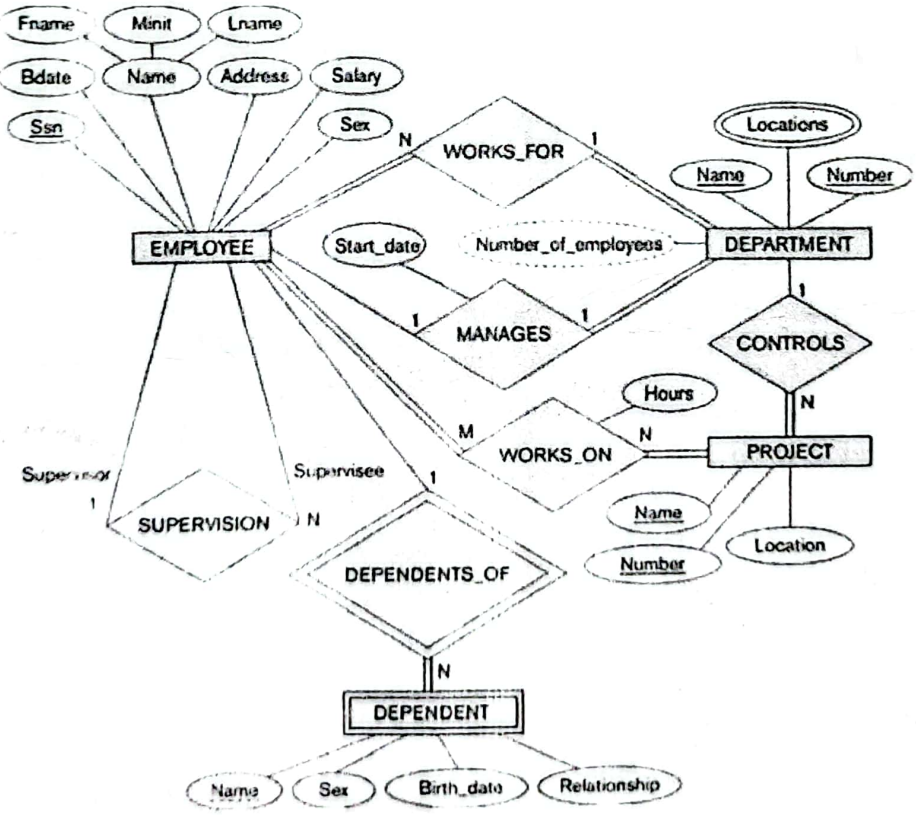
   a) The food names having fast-food type.
   b) The customer names, where the food id is 00101.
   c) The waiter names having salary of more than 15,000 taka.
   d) The food price of Chicken Fried Rice.
   e) The customer IDs, where the waiter ID is 107.

3. **Construct** (write down) the SQL commands for the following queries [5×2 =10] [CO2]

Food (F_ID, F_Name, F_Type, F_Price)
Customer (C_ID, C_Name, F_ID, W_ID)
Waiter (W_ID, W_Name, W_Salary)

a) The food type of the most expensive food.
b) The customer names with the food names.
c) The waiter name with the lowest salary.
d) The food prices of the food names starting with 'B' and ending with 'r'.
e) The customer IDs, where the food ID is 200 but not 300.

4. **Analyze** the ER Diagram below and then convert it into the schema diagram with proper explanation. [10] [CO4]



5. a. **Write** down two important conditions for each of the following normalization methods: [3] [CO3]

i)1NF ii) 2NF iii) 3NF

b. **Apply** the Normalization technique to normalize the following table into Third Normal Form (3NF). [3] [CO3]

Student				
Student-ID	Name	Age	Post-Code	City
101	Mark	20	N-45	New York
102	Zakir	19	1510	Dhaka
103	Johny	21	1200	Rangpur
104	Fahim	20	1515	Dhaka
105	Ashik	21	1200	Rangpur

c. **Discuss** the weak entity set with an appropriate example. [4] [CO4]