University of Asia Pacific

Department of Computer Science and Engineering

Program: B.Sc. in CSE

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

Course Code: CSE 207 | Course Title: Algorithms | 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. Imagine a group of university students participating in a programming contest. They can bring limited reference books to aid them during the competition. Each book has its weight and relevance score based on the topics covered. **[5]** **[CO2]**

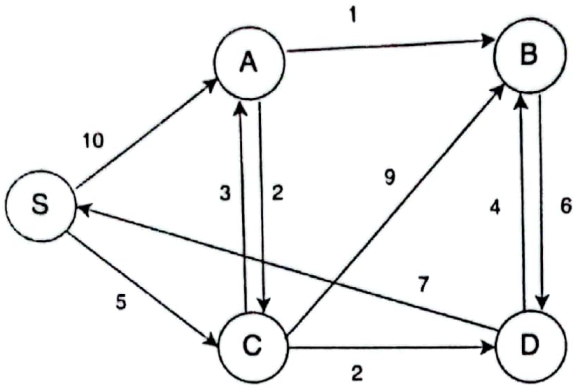
Book Title	Weight (kg)	Relevance Score
Introduction to Algorithms textbook	2	9
Programming in Python Guidebook	2	8
Data Structures and Algorithms in C++	3	7
Competitive Programming Handbook	3	9

Assuming each student can carry a backpack with a weight limit of 5 kg. Utilize the 0/1 knapsack algorithm to determine the optimal combination of books to maximize the total relevance score. Show the calculation steps.

b. A software development company tasked with completing multiple client projects, each with its deadline and monetary value. Due to resource constraints, the firm can only work on one project at a time. Design a greedy algorithm to maximize their profit by selecting projects based on deadlines and values. **[5]** **[CO4]**

2. a. Given a directed unweighted graph where nodes represent a member and edges represent their connection in a social network. Develop a Depth First Search (DFS) algorithm to determine if there is a connection between two members. **[5]** **[CO4]**

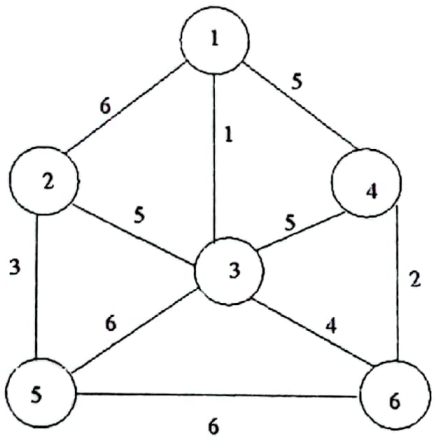
b. A transportation company operates a network of roads connecting different cities. Each city is a node in the network, and the roads between cities are edges with associated distances. Apply Dijkstra's algorithm to the following transportation network to find the shortest path from City A to all other cities in the network. **[5]** **[CO2]**



OR

a. Given a directed unweighted graph, nodes represent a member and edges represent their connection in a social network. Develop a Breadth First Search (BFS) algorithm to determine if there is a connection between two members. **[5] [CO4]**

b. The following graph represents a network of roads connecting several neighborhoods in a newly developed residential area. Where nodes represent the area and edges represent the road construction cost. Draw the minimum spanning tree (MST) that connects all neighborhoods with the least total construction cost. **[5] [CO2]**



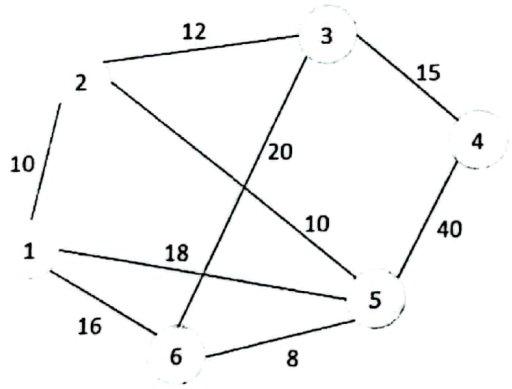
3. a. Mention the fundamental principles of the recursive and backtracking approaches, highlighting their strengths and weaknesses. Also, illustrate the execution of both algorithms using a specific example. [5] [CO1]

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. [5] [CO4]

4. a. Develop an algorithm to find the pattern occurrences within the text using the rolling hash technique. [5] [CO4]

b. Analyze the complexity of your algorithm in 4(a). [5] [CO3]

5. a. A courier service is responsible for delivering packages to various cities. Apply the approximation algorithm to find the shortest route that visits each city exactly once and returns to the origin city. [5] [CO2]



b. Apply the graph coloring algorithm to graph 5(a) such that no two adjacent cities have the same color. Find the chromatic number of the graph. [5] [CO2]

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Department of Computer Science and Engineering

Program: B.Sc. in CSE

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

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

Time: 3.00 Hour. Full Mark: 50

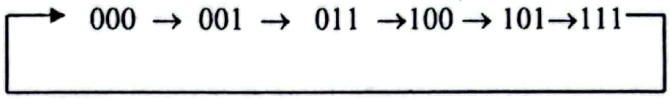
There are **Five** Questions. Answer all of them. Part marks are shown in the margins.

1. a) Discuss the universality of NAND gate. [3] CO3

   b) Implement the following Boolean function with only NAND gate [3] CO3
   $y = A`B + B`C + BC`$

   c) Implement the following function using K-map. [4] CO3
   $F(A, B, C, D) = \sum(0, 2, 3, 5, 7, 8, 10, 11, 12, 14)$

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 a SAP-1 assembly language program and then generate the machine code for the expression of 75 - 82 + 36 + 54 - 12. These numbers are in decimal form. [6] CO2

4. a) Draw the circuit diagram of MOD-13 synchronous up counter using JK flip-flops and briefly describe its operation. [4] CO5

   b) Design MOD 60 counter using IC # 74293. [3] CO5

   c) Design MOD 10 Johnson 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 4 lines to 16 lines decoder using IC# 74138. You can use other logic gates 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) = Σ(0, 1, 3, 6, 7, 8, 10, 13, 15) using an IC # 74151(Multiplexer) and NAND gate only. [4] CO3

University of Asia Pacific

Department of Computer Science and Engineering

Program: B.Sc. in CSE

Final Examination | **Fall-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** the four types of database users with relevant examples. **[6] [CO1]**

b. **Discuss** the concept of keys in database, i.e. Superkey, Candidate Key, Primary Key and Foreign Key with examples. **[4] [CO1]**

OR

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

b. **Discuss** the concept of DDL and DML in database with examples. **[4] [CO1]**

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

Product (P_ID, P_Name, P_Type, P_Price)
Customer (C_ID, C_Name, C_Address, P_ID, DR_ID)
DeliveryRider (DR_ID, DR_Name, DR_Contact)

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

a) The list of products (names) where the type is *Computer Accessories*.
b) The customer names where the address is *74/A, Green Road, Dhaka-1205*.
c) The delivery rider names having contact number as *0123456789*.
d) The product price of *T-Shirt*.
e) The customer IDs where the delivery rider ID is *567*.

3. The following relational schema form a part of an online shopping database held in a relational DBMS: [5×2 =10] [CO2]

Product (P_ID, P_Name, P_Type, P_Price)
Customer (C_ID, C_Name, C_Address, P_ID, DR_ID)
DeliveryRider (DR_ID, DR_Name, DR_Contact)

Construct (write down) the SQL commands for the following queries:

a) The product type of the *least expensive* product.
b) The customer names and product names (using *Join operation*).
c) The delivery rider names *starting with 'T' and ending with 'n'*.
d) The product prices of the product names having *exact five letters*.
e) The customer names who ordered product type *Clothing* (using *Subquery*).

4. **Construct** the ER Diagram from the following description: [10] [CO4]

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, first-name, last-name 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, first-name and last-name. 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 Boiled', 'Face/Off'].

5. a. **Explain** the necessary conditions for achieving the normal forms below: [3] [CO3]

i) 1NF

ii) 2NF

iii) 3NF

b. **Model** (Normalize) the following table into Third Normal Form (3NF). **[3] [CO3]**

Customer				
Cus_ID	Name	Date_of_Birth	Location_ID	Location
1001	Asif	04/06/2003	B-4	Barishal
1002	Banna	27/11/2004	D-1	Dhaka
1003	Chowdhury	16/03/2002	S-3	Sylhet
1004	Deb	09/07/2001	D-1	Dhaka
1005	Eshan	21/04/2004	R-7	Rangpur

c. Discuss the following attributes with examples: **[4] [CO4]**

i) Composite attribute
ii) Single-valued attribute
iii) Multivalued attribute
iv) Derived attribute

University of Asia Pacific

Department of Basic Sciences and Humanities

Program: B.Sc. in CSE

Final Examination | **Fall-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. Using integrating factor solve the DE $(x+1)\frac{dy}{dx} - y = e^x(x+1)^2$. **[05] [CO1]**

b. Solve the homogeneous equation $(x^2 + y^2)\,dy = xy\,dx$. **[05] [CO2]**

OR

The rate at which a body cools is proportional to the difference between the temperature of the body and that of the surrounding air. If a body in air at 25 degree Celsius will cool from 100 degree Celsius to 80 degree Celsius in 2 minutes, find its temperature at the end of 4 minutes. **[10] [CO1]**

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

$$y'' - 4y' + 4y = x^3 e^{2x}.$$

3. a. Define half range fourier sine series and half range fourier cosine series . **[03] [CO3]**

b. Find half range sine series and cosine series for function x in the interval (0, 2). **[07] [CO4]**

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

$$i)\ (\sin t \cos t)' \quad ii)\ t^3 e^{-2t} \sin 4t \quad iii)\ \frac{\sin 2t}{t} \quad iv)\int_0^t \cos^2 t\,dt.$$

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 Basic Sciences and Humanities

Program: B.Sc. in CSE

Final Examination | **Fall-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.		Explain the impact of change in income on equilibrium price and quantity.	**[10]**	**[CO1]**
		OR		
		Explain the impact of change in input price on equilibrium price and quantity.	**[10]**	**[CO1]**
3.		Discuss the impact of Padma Bridge on Bangladesh Economy.	**[20]**	**[CO3]**
X **4.**		$U = X_1^2 X_2^2$. 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.	**[10]**	**[CO2]**

4. corrected Question:

Explain Different types of Elasticity of supply.