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

Final Examination | **Fall 2021** | **2nd Year 2nd Semester**
Course Code: CSE 211 | **Course Title: Database Systems** | **Credits: 3**
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 purpose of Database Systems with relevant examples. **[15]**

   b. Differentiate between Two-tier and Three-tier architectures. **[10]**

2. The following relational schema form a portion of a tourism database held in a relational database system:

   Package (P_ID, P_Destination, P_Days, P_Price)
   Tourist (T_ID, T_Name, T_Profession, T_Address, T_Phone_Number)
   Operator (O_ID, O_Name, O_Address, O_Phone_Number)
   Booking (B_ID, P_ID, T_ID, O_ID)

   Please write down the Relational Algebra for the following queries:

   a. Show the tour package prices of tours in Maldives for 4 days. **[5]**

   b. Find the profession of a tourist whose ID is 53124. **[5]**

   c. Show the tourist's name where his/her phone number is 01612345678. **[5]**

   d. List the tour operators' names and phone numbers who are located at Gulshan-2. **[5]**

   e. Find the booking IDs maintained by an operator whose ID is 017. **[5]**

3. The following relational schema form a portion of a tourism database held in a relational database system:

   Package (P_ID, P_Destination, P_Days, P_Price)
   Tourist (T_ID, T_Name, T_Profession, T_Address, T_Phone_Number)
   Operator (O_ID, O_Name, O_Address, O_Phone_Number)
   Booking (B_ID, P_ID, T_ID, O_ID)

   Please write down the DML statements for the following queries:

   a. Find all the places with package price between 15,000 taka to 45,000 taka. **[5]**

   b. Show the package days available for Cox's Bazar tours. **[5]**

c. Using Join operation, list the tourists' professions who booked Sundarbans tours. [5]

d. Find the details of tour operators whose name started with 'B' and ended with 'd'. [5]

e. List the booking IDs and package IDs sorted by the descending order of the package IDs. [5]

4. The following relational schema form a portion of a tourism database held in a relational database system:

Package (P_ID, P_Destination, P_Days, P_Price)
Tourist (T_ID, T_Name, T_Profession, T_Address, T_Phone_Number)
Operator (O_ID, O_Name, O_Address, O_Phone_Number)
Booking (B_ID, P_ID, T_ID, O_ID)

Please write down the DML statements for the following queries:

a. Find the tour package IDs for Indonesia but not for Malaysia. [5]

b. Show the average tour package price for each destination. [5]

c. Count the number of tourists who are students by profession. [5]

d. Using subquery, find tourists' names whose addresses match with tour operators' addresses. [5]

e. Delete booking details for booking ID as 0102030. [5]

OR

a. Find the tour package IDs for both Sylhet and Bandarban. [5]

b. Show the minimum tour package price for each destination. [5]

c. Count the number of tourists who are teachers by profession. [5]

d. Using subquery, find the tour operators' phone numbers whose addresses match with the tourists' addresses. [5]

e. Update the package ID from 02040 to 03050 for the tourist ID as 21435. [5]

5. Sometimes, Readers visit Libraries to borrow Books. Librarians issue two to five Books per Reader. Then, Readers bring those Books to their homes and read. After finished with reading, the Readers return the books to the Librarians. If the due date of the issued Books is expired, the Readers have to deposit fines to the Library's Bank Account before borrowing their next Books. [25]

Details of Readers (R_ID, R_Name, R_Contact_Number, R_Address), Books (B_ID, B_Name, B_Due_Date) and Librarians (L_ID, L_name, L_Contact_Number) are required.

Based on this scenario, please draw the corresponding Entity-Relationship (E-R) diagram using the new notations (please do not use the old or alternative notations). Make sure you mention the primary keys in underlines. You can draw additional attributes, entity sets and relationship sets if you wish.

Please note that, the records of the Bank Account are not stored via any of the attributes in the entity sets of Libraries. Therefore, draw the diagram accordingly.

6. a. Differentiate between the Hadoop Distributed File System (HDFS) and Sharding with relevant examples. [15]

b. Show the dissimilarity between Availability and Consistency. [10]

OR

a. Discuss the MapReduce paradigm with relevant examples. [15]

b. Describe and distinguish the features of MapReduce operations and SQL queries. [10]

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Final Examination **Fall 2021** **2nd Year 2nd Semester**

Course Code: CSE 207 **Course Title: Algorithms** **Credits: 3**

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

Instructions:

I. There are Six (6) Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.

II. Non-programmable calculators are allowed.

1. You went to the annual picnic of UAP. Everybody is participating in a game called "Jumping King" where you have to traverse N meters with a **minimum** number of jumps. You can jump at only 5 different lengths: 1, 2, 3, 5, and 6 meters. You have to figure out at which combinations you will jump to cover N meters that will require a minimum number of jumps. Now do the following. **[25]**

   i) **Propose** an efficient DP algorithm to find the jump configurations based on the algorithms you learned so far in the CSE207 course.

   ii) Also simulate the problem for N = 10 meters.

Or

You went to the annual picnic of UAP and become the winner of the "Jumping King" game (**Q1**). 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 try to select the items in such a way so that you **get the maximum total value** in the gift bag. Given the scenario: **[25]** ১৩

i) **Propose** a **DP** algorithm to fill-up in such a way so that you can get the **maximum total valued items in the bag.**

ii) Given the following configuration, show the simulation of your solution.

Capacity of Gift Bag: **10**

Available gift items:

Weight	2	3	4	5	6
Value	1	3	3	7	4

2. Find the shortest paths to all nodes from source node "a" using **Dijkstra's** algorithm for **figure-I**. Show the detailed steps. [25]
Do you see any discrepancy/incorrectness in your results? If so, explain the reason behind the incorrectness?

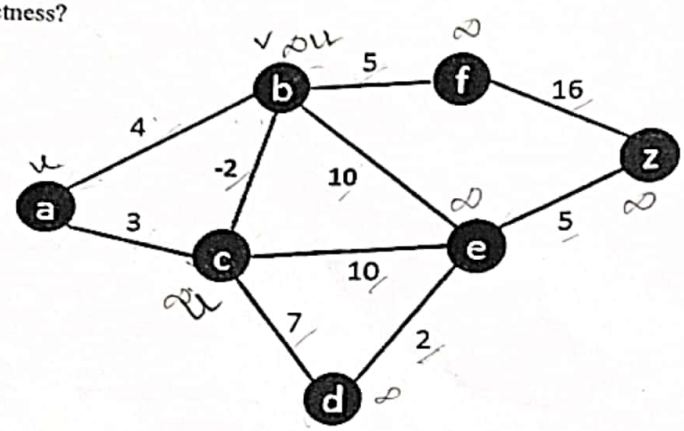

Figure-I

3. Find the minimum cost spanning tree using **Prim's** algorithm for the **figure-II** step by step. [25]

Or

Find the minimum cost spanning tree using **Kruskal's** algorithm for the **figure-II** step by step. [25]

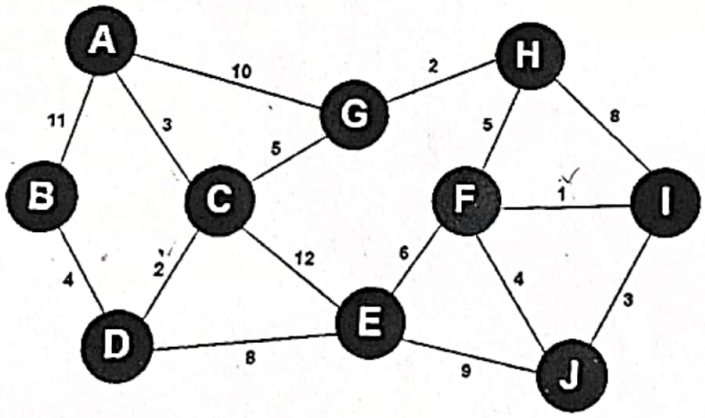

Figure-II

4. **a.** Draw the **state-space diagram** for the 4-Queen problem in the backtracking approach and also mark the **dead-end** of the diagram. [15]

b. Which types of problems can be solved using the **backtracking approach**? [10]

5. a. Write down the time complexity of **Insert, Extract Min** and **Decrease Key** operation of Dijkstra's Algorithm using **Array** and **Binary Min Heap**. [10]

b. Why does dynamic programming call the clever brute force technique? Describe with an appropriate example. [10]

6 a. A volunteer wants to visit some houses to collect food for street children. He starts from a house and then wants to visit every house connected (which are direct neighbours) to this house and so on. [15]

Write the most efficient graph traversing **algorithm** that can be used to solve this problem and the time complexity is exactly **O(|V|+|E|)**. Here, |V| is the number of vertices and |E| is the number of edges in the graph.

b. Adjacency Matrix is a **2-D** array of size V x V where **V** is the number of vertices in a graph. Let the **2-D** array be adjmat[][], a slot **adjmat[i][j] = 1** indicates that there is an edge from vertex **i** to vertex **j**. [10]

Write an **algorithm** finding the **out degrees** of all vertices in that directed graph.

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Final Examination **Fall 2021** **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.

$F(A, B, C, D) = \sum(0, 1, 2, 3, 6, 7, 8, 10, 11, 13, 14, 15)$ 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 A when inputs B and C are the same.

(ii) Output X will remain HIGH when B and C 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 A 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

$000 \rightarrow 010 \rightarrow 100 \rightarrow 110 \rightarrow 111$

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 Computer? Explain your answer. 05

c) Create a SAP-1 assembly language program and then generate the machine code for the expression of 37 - 23 + 32 – 58 +8. 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-10 synchronous up counter using JK flip-flops and briefly describe its operation. 10

b) Design MOD 60 counter using IC # 74293. 07

c) Design MOD 6 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) = $\Sigma(1, 2, 4, 7, 11, 12, 13, 15)$ using an IC # 74151(Multiplexer) and basic gates if necessary. 10

University of Asia Pacific
Department of Basic Sciences & Humanities
Final Examination, Fall 2021
Program: B.Sc. Engineering (Computer Science)
2nd Year /2nd Semester

Course Title: Math-IV | Course Code: MTH-205 | Credit: 3.00
Time: 3.00 Hours | Full Marks: 150

There are **Eight** questions. Answer **Six**. All questions are of equal values, indicated in the right margin.

1. (a) Solve the differential equation using substitution method $\frac{dy}{dx} = (-2x+y)^2$ 12

   (b) Solve the first order differential equation using integrating factor $y' + 3x^2y = x^2$ 13

2. Solve the differential equation with constant coefficient 25

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

OR

3. Find the complete solution of the differential equation 25

$$y'' - 4y' + 3y = 3e^{3x}\cos 2x + 2xe^{3x}$$

4. Solve the following boundary value problem by the method of separation of variables 25

$$\frac{\partial U}{\partial t} = 3\frac{\partial^2 U}{\partial x^2}, U(0,t) = 0, U(\pi,t) = 0, U(x,0) = 5sin5x + 4sin4x.$$

5. (a) Find the Fourier series of the function of period $-\pi < x < \pi$ as follows: 15

$$f(x) = \begin{cases} o\ when\ -\pi < x \le 0 \\ sinx\ \ when\ 0 < x \le \pi \end{cases}$$

(b) Express $f(x) = 2x$ as a half range sine series in the interval $0 < x < 3$. 10

6. (a) Solve the differential equation $f''(t)+4f(t)=0, f(0)=10, f'(0)=0$ by applying Laplace transform and Inverse Laplace transform. 10

(b) Find the inverse Laplace transform of $\frac{s^2-5}{(s-1)(s+2)(s-4)}$ by applying Heaviside's expansion formula. 15

7. (a) Find the Laplace transform of 15

$$(i)\ t^{3/2}\cos at \quad ii)\ (\sin t)'' \quad (iii)\ \int_0^t \frac{\sin 2t}{t}$$

(b) Find the inverse Laplace transform of $\frac{s^2+4}{(s+2)(s-1)(s-4)}$ 10

OR

8. (a) Find the inverse Laplace transform of $i)\frac{1}{9s^2+6s+1}$ $ii)\frac{s+8}{s^2+4s+5}$ 10

(b) Find the Laplace transform of 15

$$i)\int_0^t t^{1/2}dt \quad ii)\ t^2e^t\cos t \quad iii)(e^{2t})''$$

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Final Examination **Fall2021** **2nd Year 2nd Semester**

Course Code: ECN (CSE) 201 **Course Title: Economics** **Credits: 2**

Full Marks: 50 **Duration: 2 Hours**

Instructions:

1. There are Six (6) Questions. Answer any Five (5). All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. Illustrate the calculation of elasticities with an example. 10

2. What are long run and short run production adjustments? Write with examples. 10

3. (a) Show the relationship between average cost (AC) and marginal cost (MC) drawing the graph of cost curves. 5
   (b) What is least-cost rule? Explain. 5

4. (a) Write the definition of gross domestic product (GDP)? 2
   (b) What are the two measures of GDP)? 1
   (c) Describe earnings or income approach of GDP with diagram. 4
   (d) Define gross national product (GNP) with examples. 3

5. (a) Draw the curves and show demand-pull inflation with brief illustration. 5
   (b) How economic growth is associated with inflation rate? 5

6. (a)

Units of Labor input	Total Product	Marginal Product
0	0	
1	2000	
2	3000	
3	3,500	
4	3,800	
5	3,900	

The table shows the total product that can be produced by different inputs of labor when other inputs (capital, land etc.) and state of technical knowledge are unchanged. Calculate marginal product from the table.
(b) A firm's engineers have calculated that the desired output level of 9 units could be produced with two possible options. In both cases energy (E) costs $2 per unit, while labor (L) costs $5 per hour. Under option 1, the input mix is E = 10 and L = 2. Option 2 has E = 4 and L = 5. Which is the preferred (least-cost) option?
(c) Draw the curves and show cost-push inflation with brief illustration.