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

Final Examination Fall 2019 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 NOR gate. 06

   b) Implement the following Boolean function with only NOR 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

   $000 \rightarrow 010 \rightarrow 011 \rightarrow 110 \rightarrow 111$

4. a) Write down the op-code of each Mnemonics of SAP-1 computer. 05

   b) Draw the architecture of SAP-1 computer. Explain the working procedure of Program Counter (PC). 10

   c) Write down both assembly and machine code according to the arithmetic operation basis on SAP-1 computer for the expression of 2+9+8-3-7. 10

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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 10 Johnson counter sing 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 can be used as a 1 line to 8 lines 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 $F(A, B, C, D) = \sum(0, 1, 2, 4, 7, 11, 12, 13, 15)$ using an IC # 74151(Multiplexer) and basic gates if necessary. 10

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Final Examination **Fall 2019** **2nd Year 2nd Semester**

Course Code: CSE 207 **Course Title: Algorithm** **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. Construct **maximum sum** of consecutive subsequence for the following sequence tracing the values of **maxsum** and **suffixmax**: -1, 2, 13, -14, -2, -15, 7, 2, -14, 21, 18, -12, -34, -2. [10]

b. Write down an efficient algorithm for finding minimum and maximum of an array. Deduce its complexity. [15]

OR

a. Construct a minimum spanning tree(MST) for the graph with edges (weights in parentheses) AB(3), C(2), AD(5), AG(7), BC(1), BE(1), BF(9), BH(2), CE(1), CG(3), CH(2), DE(1), DG(2), EF(3) using **Kruskal's** algorithm showing actions in details. [10]

b. Consider the digraph of #a where for every vertex direction of even edge is reversed. Construct a **mincost arborescence** for the digraph. [15]

2. a. Compute 1237^{1579} mod 43 using modular exponentiation. [10]

b. Apply **Karatsuba** algorithm to compute product of **1234** and **5678** showing every step. How many single digit multiplications do we need to perform in multiplying two n digit integers? [15]

3. a. Construct a heap using heap creation by **insertion** on the elements 7,2,5,1,9, 6,4, 8,3, 10. [10]

b. Construct a heap using heap creation by **adjustment algorithm** on the elements 7, 2, 5, 1, 9, 6, 4, 8, 3, 10 [15]

4. a. What are the 2 elements of Greedy algorithm? Provide brief description of each element. [10]

b. Discuss the classes P and NP. What is an NP-complete problem? Reduce an arbitrary instance of SAT problem into an instance of 3-SAT problem. [15]

5. a. You are asked to sort the array {2, 4, 5, 7, 9, 10, 12, 14, 15, 17, 20, 25} using **insertion** sort algorithm. How many comparison and swapping will be there to sort the array. [10]

b. You are a traveler and currently you are visiting **HuLala** country. At the tourist information center, you asked **Mr. Hashem** (the person sitting at desk) about how to travel from city A to X using shortest travel distance. He gave you the following path. Without knowing anything about the cities or distance between the cities, you **figured out this is not the correct path**. How did you figure out this is not the shortest path? [15]

Path → A, G, D, E , F, I, L, K, F, L, X

OR

a. Given the following **Dijkstra's** algorithm to the single source shortest path problem. What would be the time complexity of the algorithm for an input graph G=(V,E) if an **array is used instead of priority queue.** [10]

```
DIJKSTRA(G,w,s)
1 INITIALIZE-SINGLE-SOURCE
2 S=φ;
3 for each vertex v∈G.V d[v]=∞;
4 d[s]=0
5 Q=G.V   [priority queue where key is d[v]
6 while Q≠φ
7   u=EXTRACT-MIN(Q)
8   S=S∪{u}
9   for each vertex v∈G.Adj(u)
10    RELAX(u,v,w)
```

```
RELAX(u,v,w):
  if (d[v]>d[u]+w(u,v))
    d[v]=d[u]+w(u,v)
    π[v]=u
```

b. Suppose that you have performed the Dijkstra's algorithm to find the shortest paths from a single source in a given graph G with positive edge weights. If all the edge weights are **reduced** by the **same constant amount**, would you need to perform the Dijkstra's algorithm again in order to find the shortest paths? Why or why not? Illustrate your answer with example(s) [15]

6. Assume a **directed** graph G = (V, E) is represented in the **adjacency matrix** form. Now answer the following.

a. Design an O(V) algorithm to detect whether a specific vertex v is isolated (not connected to any other vertex) or not. Use the basic Graph concept and do not use Disjoint Set operations [10]

b. What would be the complexity if you use **adjacency list** to represent the graph instead of adjacency matrix? Explain your answer. [8]

c. What would be the complexity if the graph is **undirected** and represented using adjacency list? Explain your answer. [7]

University of Asia Pacific
Department of Basic Sciences & Humanities
Final Examination, Fall-2019
Program: B.Sc. Engineering (Computer Science)
2nd Year / 2nd Semester

Course Title: Math IV: Differential Equations and Laplace and Fourier Transformations | Course No: MTH 205 | Credit: 3.00

Time: 3.00 Hours | Full Marks: 150

There are **8** questions. Answer **6 questions including 1, 2, 3 and 4.** All questions are of equal value. Figures in the right margin indicate marks.

1. (a) Define Laplace transform. **2**

   (b) Find the Laplace transform of $t^2\cos at$. **10**

   (c) Using Laplace transform prove that $\int_0^\infty \frac{e^{-at}-e^{-bt}}{t}dt = \log\frac{b}{a}$. **13**

2. (a) Define inverse Laplace transform. **2**

   (b) Evaluate $L^{-1}\left\{\frac{3}{s^2(s+2)}\right\}$ by use of convolution theorem. **10**

   (c) Solve the differential equation $y''(x)+y(x)=x;\ y(0)=0, y'(0)=\pi$ by using Laplace transform. **13**

3. (a) Define Fourier series. Write down Drichlet's conditions of Fourier series. **1+4**

   (b) Find the Fourier series expansion of the function $f(x)=\begin{cases}0, & -\pi < x \le 0\\ x, & 0 < x \le \pi\end{cases}$. Hence evaluate the sum $\sum_{n=1}^{\infty}\frac{1}{(2n-1)^2}$. **20**

4. (a) Show that $\int_0^\infty \frac{\cos ux}{u^2+1}du = \frac{\pi}{2}e^{-x}, x>0$. **5**

   (b) Use finite Fourier transform to solve **20**

   $$\frac{\partial U}{\partial t}=\frac{\partial^2 U}{\partial x^2}, U(0,t)=0;$$
   $$U(\pi,t)=0, U(x,0)=2x$$
   where, $0<x<\pi, t>0$.

5. (a) Solve the differential equation $(D^2+6D+9)y=\frac{e^{-3x}}{x^3}$. **10**

(b) Solve the differential equation $\frac{d^3y}{dx^3}-7\frac{d^2y}{dx^2}+10\frac{dy}{dx}=e^{2x}\sin x$. 15

Or

6. Find the solutions of the following differential equations 25

(i) $\frac{d^2y}{dx^2}-8\frac{dy}{dx}+15y=0$.

(ii) $\frac{d^2y}{dx^2}+6\frac{dy}{dx}+9y=5e^{3x}$.

(iii) $\frac{d^2y}{dx^2}-6\frac{dy}{dx}+9y=6e^{3x}+7e^{-2x}-\log 2$.

7. (a) Define ODE. Solve the following differential equation 15

$(y^4+2y)dx+(xy^3+2y^4-4x)dy=0$.

(b) Solve $y=(x-a)p-p^2$. 10

Or

8. (a) Define order and degree of a differential equation. 15

Solve $\frac{dy}{dx}=\frac{x^3+y^3}{xy^2}$.

(b) Solve $y=2px+yp^2$. 10

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

Final Examination **Fall 2019** **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 the questions. 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 ATM booth. You clicked 'OK' button on the machine and then it got hung. Which ACID property(s) can play role for the management of this transaction? Explain that property. 10

b) A transaction in a database can be in one of the following five states ('Active, 'Partially committed', 'Failed', 'Aborted' and 'Committed'). Draw the state diagram of the states with a brief description. 15

2.a) RAID level 3 is as good as level 2, but is less expensive. Explain the scenario with necessary figure. 10

b) What is Indexing in DBMS? In case of primary and dense index, which shows higher performance improvement? Additionally, which one has more space overhead? Explain the reasons. 10

c) Create a Primary Index on the ordering key field on below table: 5

PRIMARY KEY FIELD		
NAME	GENDER	SALARY
Aaron, Ed		
Abbot, Diance		
... ...		
Accosta, Marc		
Adams, John		
Adams, Robin		
... ...		
Akera, Jan		
Arnold, Mack		
Arnold, Steven		
... ...		
Atkins, Jan		
... ...		
... ...		
Wong, James		
Wood, Donald		
... ...		
Woods, Manny		
Wright, Pam		
Yang, Toe		
... ...		
Zimmy, Baron		

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3.a) Who is the father of modern database systems? How his opinion differs with Hugh Darwen and Chris Date in regards of Atomicity? Explain with examples.

b) Analyze the below table and normalize. 20

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

4.a) What is the difference between inner join and natural join? Explain with an example. 5

b) Suppose you have the following tables. Write down the output of the following join operations. 12

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

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

c) Describe the advantages of Role in database management. How you can Grant and Revoke authorization of a database user? 8

5.a) Suppose a simple healthcare database, patients are treated in a single ward by the doctors assigned to them. Usually each patient will be assigned a single doctor, but in rare cases they will have two. Healthcare assistants also attend to the patients, a number of these are associated with each ward." Draw the ER diagram. 10

b) In ER diagram, two entities of a binary relationship may have one-to-many/many-to-one and many-to-many relationships. How many tables can be created in both scenarios? Demonstrate both scenarios with proper examples. 15

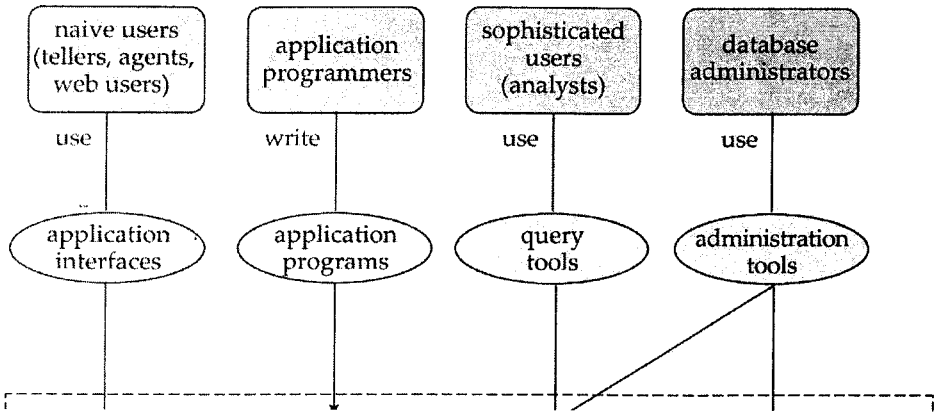
OR

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'] 25

i) Draw ER diagram with proper notation.

ii) Also derive Schema diagram.

6.a) Describe the responsibilities and functionalities of diffreent users shown in below. 24



b) Define NULL in database. 1

OR

6.a) Describe the following symbol in relational algebra with proper examples. 24

σ, Π, X, ∪, -, ⋈

b) Define tuple and attribute in a database table. 1

UNIVERSITY OF ASIA PACIFIC

Department of Computer Science and Engineering

Final Examination, Fall-2019

Program: B.Sc. Engineering (2nd Year/ 2nd Semester)

Course Title: Principles of Economics **Course No. ECN 201** **Credit: 2.00**

Time: 2.00 Hours **Full Mark: 50**

Answer any Five out of Seven Questions. All Questions are of equal mark

Q-1 Discuss Price Elasticity of Demand covering such areas as **(a)** Elastic and Inelastic Demand and **(b)** Price Elasticity of Demand and Total Revenue. Illustrate with numerical examples and diagrams as considered appropriate.

Q-2 Discuss Income and Cross-Price Elasticity of Demand. Illustrate with numerical examples as considered appropriate.

Q-3 Discuss the Impact of an Excise Tax covering such areas as **(a)** The Effect of Price Elasticity of Demand, **(b)** The Effect of Price Elasticity of Supply and **(c)** Role of Elasticity in Tax Policy. Illustrate with appropriate diagrams.

Q-4 Discuss Perfect Competition in the Short Run covering such areas as **(a)** Business's Demand Curve, **(b)** Revenue Conditions including Average Revenue and Marginal Revenue, and **(c)** Relationship between Revenue Conditions and Demand. Illustrate with appropriate schedules and diagrams.

Q-5 Discuss Perfect Competition in the Short Run covering such areas as **(a)** Profit maximization of a Perfect Competitor and **(b)** Why should a business close including Business's Supply Curve and Market Supply Curve. Illustrate with appropriate schedules and diagrams.

Q-6 Discuss Inflation covering such areas as **(a)** The Consumer Price Index (CPI) and **(b)** Nominal versus Real Income. Illustrate with appropriate numerical examples.

Q-7 Discuss Unemployment covering such areas as **(a)** Labor Force Survey including the Participation Rate and **(b)** The Official Unemployment Rate including the drawbacks of Official Unemployment Rate. Also, discuss the Types of Unemployment. Illustrate with appropriate numerical examples.

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