Technologies (CL1000)

Date: December 28st 2024

Course Instructor(s)

Ms. Maham Naeem, Ms. Marwa Khan,
Ms. Saba Tariq, Ms. Rubab Anam,
Ms. Seemab Ayub, Ms. Saira Arif

Total Time (Hrs):	3
Total Marks:	132
Total Questions:	17

Roll No _____ Section _____ Student Signature _____

Instruction/Notes:
- Attempt q2-q4,q8-q9 and q14-q17 on question paper.
- Attempt all other question on provided answer sheet.
- You are required to attempt all questions and parts thereof in a sequence. This implies tha attempt all parts of Question 1, then the same for Question 2 and so on.
- If you find any ambiguity in a question, you can make your own assumption and answer question accordingly by stating your assumption.

Do not write below this line *Attach question paper with answer book.*

CLO 2#: Explain the basics of computer organization, software and communication components. Describe and explain data representation in terms of number systems, the role of the computer networks for personal and professional uses.

Q1: Consider the following set of processes, with the length of the CPU burst given in milliseconds: **[15 marks]**

Process	Arrival Time (AT)	Burst Time (BT)
P1	50	20
P2	0	12
P3	60	7
P4	6	4
P5	9	15
P6	3	8

a) Use the following scheduling algorithm to make Gantt chart.
   1. Shortest Job Next Non-pre-emptive **[2 Marks]**
   2. Round Robin with time quantum = 4 **[2 Marks]**

b) Write turnaround time and waiting time for each process using both algorithms. **[6 Marks]**
c) What is the average turnaround time of the scheduling algorithms in part a? **[2 Marks]**
d) What is the average waiting time of the scheduling algorithms in part a? **[2 Marks]**
e) Which of the algorithms results in the minimum average waiting time? **[1 Marks]**

Department of Computer Science

Final 2024

Q2: Fill out the missing values in the following table: **[6 marks]**

Decimal	Binary	Octal	Hexadecimal
3479	110011001 011	66 27	D 97
1367	10101010111	2527	5 5 7
2028	11111101100	3754	7 EC
560048	10111100101	210 56 56	88BAE

$\Rightarrow$ Too long   Please revise

Q3: For an image, calculate the total memory (in KBs) required to store a grayscale 256 x 256 image, assuming each pixel is stored as 1 byte. **[2 marks]**

$$256 \times 256 = 65536$$

Q4: Determine whether the following statements are true or false. **[2 marks]**

a. $(1001)_2 < (5)_{10}$	false	c. $(0011)_2 > (2)_{10}$	True
b. $(0111)_2 = (111)_{10}$	false	d. $(1001)_2 > (1101)_2$ (9) (13)	false

Q5: For the following binary numbers, perform the conversions to 1's complement, 2's complement, and signed magnitude forms. Also, provide the decimal equivalent of the 2's complement representation only. **[8marks]**

a. $(111011101110)_2$	c. $(1111111110001000)_2$
	d. $(00101010)_2$
b. $(10000000)_2$	

Q6: Refer to Figure 1, suppose a tollbooth services a car at a rate of one car per 2 seconds. Once serviced, a car proceeds to the next toll booth, which is 400 kilometers away at a rate of 10 kilometers per second. Use value of speed two times of previous speed for path between second and third toll booth. Assume processing delay negligible. **[15 Marks]**
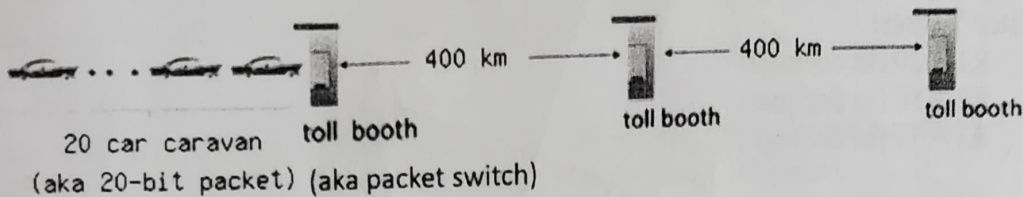


```
    ...           ---- 400 km --- →    ←--- 400 km --- →
20 car caravan    toll booth           toll booth            toll booth
(aka 20-bit packet) (aka packet switch)
```

Figure 1

a) **Answer all the parts in the answer sheet. [2 * 4 = 8 Marks]**
   1. How long does it take for the car to receive service at the tollbooth (Transmission Delay)?
   2. Once the first car leaves the tollbooth, how long does it take until it arrives at the next tollbooth (Propagation Delay)?
   3. Once the first car leaves the second tollbooth, how long does it take until it enters service at the next tollbooth (Propagation Delay)?
   4. How much time is required in total by a car to reach 3rd toll booth?

b) If a source starts transmitting a packet of size 1500 Bytes, and while source was still transmitting this packet, the first bit arrived at the final destination. Which statement is true w.r.t. given scenario? Give 2 line explanation of your answer. **[2 Marks]**
   1. Transmission delay and propagation delay both are high
   2. Transmission delay and propagation delay both are low
   3. Transmission delay is high and propagation delay is low
   4. Transmission delay is low and propagation delay is high

c) For each of the following real-life tasks related to computer communication, identify the OSI layer where the task is primarily executed. Provide a concise 2 line explanation of how each task aligns with the functions performed at that layer. **[5 Marks]**
   1. Converting data to electrical signals for transmission
   2. Ensures error detection and correction for data during a file download
   3. Encrypting ATM transaction
   4. Provide reliable connection during online transactions
   5. Forwarding packets across multiple networks

Q7: The following assembly program consists of 5 Assembly instructions: **[20 marks]**

1. LOAD R1, [500]// Load the value at memory address 500 into register R1. (Direct Addressing Mode)
2. OR R1, R2// Perform a bitwise OR operation between R1 and R2, store the result in R1.
3. XOR R3, R1// Perform a bitwise XOR operation between R3 and R1, store the result in R3.
4. AND R2, R3// Perform a bitwise AND operation between R2 and R3, store the result in R2.
5. STORE R3, [600]// Store the value in R3 at memory address 600. (Direct Addressing Mode)

Initial Setup

- **Program Counter (PC):** Starts at 400.
- **Memory Values:**
  - [500] = 85 (in decimal)
  - [600] = 0 (initial value is empty)
- **Register Values:**
  - R1 = 20 (in decimal)
  - R2 = 50 (in decimal)
  - R3 = 75 (in decimal)

Instructions to Students

1. Perform the **fetch-decode-execute-write_back** cycle for each instruction in the program.
2. For each phase of every instruction (fetch, decode, execute):
   - Clearly explain how data moves between the **Memory Address Register (MAR)**, **Memory Data Register (MDR)**, **Current Instruction Register (CIR)**, **Instruction Register (IR)**, and **Program Counter (PC)**.
   - Explain the role and status of the involved **registers** (R1, R2 and R3) and how they change.
3. Show the **final values** of all registers and memory locations by update them step by step throughout the execution.

Use the given addressing modes as specified in the comments.

CLO 3#Demonstrate the capabilities related to the main processes involved in ICT.

Q8: First column has database concepts where the cases have table attributes and you have to write the correct type of keys:[5 marks]

Cases (Table Attributes)	Types of Keys
1. A column that uniquely identifies each row in a table, e.g., Student_ID in a student table	Primary
2. A column that is used to establish a link between two tables, e.g., Customer_ID in an order table	Complementary ✗
3. A key, which, when combined with other columns, uniquely identifies a record	Super ✗
4. These keys are created when a primary key is large and complex and has no relationship with many other relations.	Candidate ✗
5. A key that is part of a table's candidate keys but is not selected as the primary key, e.g., Social_Security_Number	Candidate ✓

Q9: Given the table Products with columns Product_ID, Product_Name, and Price, write a query to retrieve all products ordered by Price in descending order.[2 marks]

```
SELECT * FROM "Products" ORDER
GROUP BY "Price" = desc
```

2

Q10: You are working at a retail company in charge of a large online store. The company uses a relational database to handle its product inventory, customer orders, and shipment tracking. In recent times, the company has been experiencing problems that revolve around data integrity and performance. The CIO has asked your team to build the database so that it can go on smoothly during the peak holiday season when traffic increases.[10 marks]

The database includes the following key tables:
- **Products**: Contains details of items sold (ProductID, Name, Price, StockQuantity).
- **Customers**: Holds customer data (CustomerID, Name, Email, Address).
- **Orders**: Tracks customer orders (OrderID, CustomerID, OrderDate, TotalAmount).
- **Order_Details**: Lists products in an order (OrderDetailID, OrderID, ProductID, Quantity).
- **Shipments**: Tracks order shipments (ShipmentID, OrderID, ShipDate, DeliveryDate).

Write SQL queries:
1. Write a query to add a new customer with the name "John Doe," email "john.doe@example.com," and address "123 Main St" to the Customers table.
2. Write a query to Filter Orders in Last 30 Days from the Products table.
3. Write a query to update the Shipments table to set the DeliveryDate as NULL for shipments where the ShipDate is greater than today's date.
4. Write a query to retrieve the CustomerName and OrderDate for all orders from the Customers and Orders tables.
5. Write a query to retrieve all products that have been ordered at least once.

CLO4 #:Work on different software and ICT related technologies.

Q11: Write html code to make the given web page, use internal style sheet for the following characteristics: **[10 marks]**
   For heading: **Color**: Blue **Font Family**: Verdana   **Font size**: 270 %

This is Heading 1

Product Performance By Region

Product	Performance Metrics			
Region	Q1	Q2	Q3	Q4
Product	$30,000	$28,000	$35,000	$32,000
	95%	92%	98%	94%

Q12: Write down the 5-number summary of the data. Draw Box-plot and identify outlier if any. **[10 marks]**
41,22,34,38,18,43,29,46,15,54,25,76,20,32

Q13: Imagine that you're studying the relationship between newborns' weight and length and babies born last month at local hospital. Compute **Pearson's coefficient of correlation (r)** as per the data given below, also tell that relation has Direction=**positive/negative/none**, and its strength=**weak/strong/moderate**: Draw the complete Table to facilitate Calculation **[5 marks]**

Weight (kg)	Length (cm)
3.63	53.1
3.02	49.7
3.82	48.4
3.42	54.2
3.59	54.9
2.87	43.7
3.03	47.2
3.46	45.2
3.36	54.4
3.30	50.4

Q14: You are helping a grocery store to predict its revenue, and have data on its items sold per week, and price per item. What do you think it's a classification type problem or regression? Give proper reasoning. **[2 marks]**

It is regressive because outcome /output is not defined what it should be. Regressive type is used for forecasting and predicting.

Proper reasoning

Q15: Which of the following are supervised / unsupervised learning problems? Write in front of them: **[5 marks]**

Problem	supervised / unsupervised
A) Grouping people in a social network	unsupervised
B)A system trained to recognize handwritten digits based on labeled examples from a dataset like MNIST.	Supervised ✓
C) Predicting the price of a car based on previous history	unsupervised ✗
D) A recommendation system that clusters users based on similar preferences without any predefined labels.	unsupervised ✓

E)A model used to categorize news articles into predefined topics using labeled examples of articles and topics.	Supervised ✓

Q16: Write the type/sub-types(Binary) of attributes in front of them: [5 marks]
1. Students grades (A, B, C, D, F) is an example of a _Character_ attribute.
2. Color of a car (red, blue, green, etc.) is an example of a _Color_ attribute. ✗
3. Gender: Male (0) or Female (1) _Bool_ ✗ attribute.
4. Height of a person: _Double_ attribute.
5. Holiday: Not Holiday (0) or Holiday (1) _Bool_ ✓ attribute.

Q17: Consider a road network connecting six cities: **Lahore (L), Karachi (K), Multan (M), Islamabad (I), Faisalabad (F),** and **Peshawar (P)**. The distances (in kilometers) between the cities are given below:[10 marks]

Lahore to Karachi: 500 km	Lahore to Multan: 300 km
Lahore to Islamabad: 200 km	Multan to Faisalabad: 200 km (unidirectional)
Lahore to Faisalabad: 150 km	Islamabad to Faisalabad: 100 km
Karachi to Multan: 450 km (unidirectional)	Islamabad to Peshawar: 150 km (unidirectional)
~~Lahore to Peshawar: 350 km~~	Multan to itself : 25 km
Karachi to Islamabad: 400 km (unidirectional)	Faisalabad to Peshawar: 350 km(unidirectional)
Multan to Islamabad: 250 km	Peshawar to Lahore: 350 km (unidirectional)

Task:

1. **Create an adjacency matrix** representing the road network between the cities.
2. **Draw the directed graph** based on the adjacency matrix you created. Label each edge with its corresponding distance.

Create an adjacency matrix:

	(L)Lahore	(K)Karachi	(I)Islamabad	(F)Faisalabad	(M)Multan	(P)Peshawar
(L)Lahore	0	500	200	150	300	-350
(K)Karachi	500	0	400	0	450	0
(I)Islamabad	200	0	0	100	250	150
(F)Faisalabad	150	0	100	0	0	350
(M)Multon	300	0	250	200	25	0
(P)Peshawor	350	0	0	0	0	0