

Programming Fundamentals Lab (CL1002)

Date: 10/10/2025

Course Instructor(s)

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Lab Mid Exam (A)

Total Time: 90 minutes

Total Marks: 20

Total Questions: 03

Semester: FL-2025

Campus: Karachi

Dept: Computer Science)

Submission Instructions:

- You must comment your student ID on top of each file. (Line#1 of your code).
- Name the file for each question according to Roll_No e.g. **k24-xxxx_Q1.c**, **k24- xxxx _Q2.c** etc.
- Submission is via a client software so open the application present on the Desktop.
- Enter your username as **24K-xxxx** and its assigned password (**Default is Fast1234**).
- Submission is timed so after the time no submission will be accepted.

Student Name	Roll No	Section	Student Signature
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CLO # 1: Understand and Analyze flowcharts, PAC (Process-Activity-Control) charts, and IPO (Input-Process-Output) models to represent system workflows and these diagrams into algorithm and pseudocode implementation.

Q1. [5 marks] You are tasked with developing a pricing calculator for “ShopKarachi,” an online marketplace that determines the final price of a product based on various business rules. The program should first calculate the subtotal by multiplying the base price by the quantity of the product. Then, based on the seller's tier (1 for New Seller, 2 for Established, and 3 for Premium), the marketplace applies a commission as a percentage of the subtotal. The charged amount is determined by adding the commission to the subtotal. If the subtotal exceeds Rs. 5000, a discount is applied based on the seller's tier: 5% for Tier 1, 10% for Tier 2, and 15% for Tier 3, reducing the charged amount. Delivery charges are then calculated based on the distance to be covered: Rs. 100 for distances up to 50 km, Rs. 200 for distances between 51 and 150 km, and Rs. 300 for distances over 150 km. The program must validate the inputs for quantity, seller tier, and distance to ensure they are positive and within the allowed ranges. If any input is invalid, an error message should be displayed, and the program should stop. Finally, the program should output the subtotal, commission amount, charged amount, discount, amount after discount, delivery charges, and the final total amount, reflecting all the calculations based on the provided inputs.

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CLO # 2: Gain hands on experience in writing code that provides the use of logical and bitwise operators to perform efficient data manipulation and apply decision and nested decision structures in control flow to create dynamic, condition-based logic within C-code.

Q2. [7 marks] A hospital ICU uses an 8-bit encoding system to monitor patient vital signs, where each bit corresponds to a specific health indicator. The 8-bit status code is structured as follows:

- Bit 0: Heart rate abnormal
- Bit 1: Blood pressure abnormal
- Bit 2: Oxygen level low
- Bit 3: Temperature abnormal
- Bit 4: Respiratory distress
- Bit 5: Pain level high
- Bit 6: Medication overdue
- Bit 7: Critical flag

The nursing station needs a program to process data for multiple patients and generate appropriate alerts based on these bits. The alert levels are determined by the following rules:

CRITICAL: If bit 7 is set or if bits 0, 1, and 2 are all set.

URGENT: If bit 4 (respiratory distress) is set.

MONITORING: If either bit 2 (oxygen level) or bit 3 (temperature) is set.

ROUTINE: If only bit 6 (medication overdue) is set.

STABLE: If no bits are set (indicating all clear).

The program should take the number of patients (N , where $1 \leq N \leq 8$), and for each patient, input their ID and 8-bit status code (ranging from 0 to 255). Using bitwise operations, the program will check the relevant bits and categorize each patient's condition into one of the above alert levels. After processing all patients, the program should display a summary showing the total number of CRITICAL, URGENT, and STABLE cases.

The solution must utilize bitwise AND (`&`) and OR (`|`) operators to efficiently check the status bits and determine the appropriate alert level for each patient.

CLO # 3: Understand and implement code utilize loops for iteration and arrays for data storage and manipulation, demonstrating efficient traversal and management of elements in C-code, while optimizing control flow and enhancing program efficiency.

Q3. [8 marks]

Farmer Ahmed from rural Sindh wants to save enough money to buy an irrigation pump that costs Rs. X. He earns income from farming over N seasons, and his income varies depending on whether the season is odd or even.

For odd seasons (1, 3, 5, and so on), Ahmed grows wheat and makes a fixed profit of Rs. P per season. However, he loses 10% of the profit due to inefficiencies. Therefore, his net savings for each odd season is the profit minus 10% of it.

For even seasons (2, 4, 6, etc.), Ahmed grows vegetables, with profits increasing by Rs. 5,000 each season. For example, in season 2, he earns Rs. 10,000; in season 4, he earns Rs. 15,000; and in season 6, he earns Rs. 20,000. However, he must pay Rs. 2,000 for water supply, so his net savings for each even season is the vegetable profit minus Rs. 2,000.

In addition to his farming income, Ahmed earns compound interest on his total savings at the end of each season, with an interest rate of R%. Every K seasons, bad weather results in a loss of D% from Ahmed's total savings.

The program needs to calculate Ahmed's total savings after N seasons, taking into account his profits, interest, and weather losses. It should then determine whether Ahmed can afford the irrigation pump. If his total savings after N seasons are greater than or equal to the cost of the pump, the program should indicate that he can afford it and show the surplus amount. If not, it should show the shortfall and how much more he needs to save.

The program should take the following inputs: N (the number of seasons), X (the cost of the pump), P (the profit from wheat in odd seasons), R (interest rate percentage), K (the frequency of weather losses), and D (the weather loss percentage). Using a loop, the program will calculate the savings for each season, taking into account whether the season is odd or even, applying interest, and considering the weather losses. Finally, it should output the total savings, the pump cost, and whether Ahmed can afford the pump or not, along with any surplus or shortfall.