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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY B.Tech Degree S1 (S) Examination May 2025 (2024 Scheme)

Course Code: UCEST105

Course Name: ALGORITHMIC THINKING WITH PYTHON

Max. Marks: 60

1

2

3

4

5

Duration: 2 hours 30 minutes

PART A

(Answer all questions. Each question carries 3 marks)	СО	Marks
Identify the most suitable problem-solving strategies for the following use	COI	(3)
cases. Justify your answer:		
i) You are solving a complex Sudoku puzzle and are unsure how to		
proceed as you approach the final few cells.		
ii) You are tasked with planning a family trip that involves selecting a		
destination, booking flights, and finding accommodation within a		
budget.		
What will be the result of the following expressions in Python?	CO1,	(3)
i) (50 - 5 * 6) // 4	CO4	
ii) not $(10 < 5)$ or $(5 = = 5)$		
iii) True and 5		
What are the advantages of using pseudocode over directly writing the code?	CO2	(3)
Draw a flowchart to print integers below 50.	CO2	(3)
Given the following list:	СО3,	(3)
numbers = [10, 20, 30, 40, 50, 60, 70, 80, 90]	CO4	
Write the slicing expressions to:		
1. Extract the first 5 elements.		
2. Extract every second element starting from the first element.		

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- 3. Reverse the list using slicing.
- 6 What is circularity in recursion? How can you prevent circularity in recursive CO3 (3) functions?
- 7 Compare **Dynamic Programming** and **Recursion** in terms of their approach, CO4 (3) efficiency, and use cases.
- 8 What is the brute-force computational problem-solving approach, and how CO4 (3) many maximum attempts are required to guarantee opening a four-digit numerical padlock (digits ranging from 0 to 9) using this approach?

PART B

(Answer any one full question from each module, each question carries 9 marks)

Module -1

9	a)	Walk through the six problem-solving steps to calculate the area of a circle.	COI	(6)
	b)	What are the basic data types in Python? Provide examples for each.	CO1,	(3)
			CO4	
10	a)	What is the difference between algorithms and heuristics in problem-solving?	COI	(5)
		Provide an example where heuristics lead to a faster solution than an		
		algorithm.		
	b)	Write a Python program to convert the time input in minutes to hours	CO1,	(4)
		and minutes. For example, 85 minutes is 1 hour 25 minutes.	CO4	
		Module -2		
11	2)	You visit a shop to huw a new mobile. In connection with the festive season	CO2	(5)

a) You visit a shop to buy a new mobile. In connection with the festive season, CO2 (5) the shop offers a 10% discount on all mobiles. In addition, the shop also gives a flat exchange price of 1000 for old mobiles. Draw a flowchart to input the original price of the mobile and print its selling price. Note that all customers may not have an old mobile for exchange.

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- b) If the three sides of a triangle are input, write an algorithm/pseudocode to CO2 (4) check whether the triangle is isosceles, equilateral, or scalene.
- a) Write pseudo code to determine the average age of students in a class. The CO2 (5) user will stop giving the input by giving the age as 0.
 - b) Draw a flowchart to find the largest number from a series of numbers entered CO2 (4) sequentially.

Module -3

- 13a)What are the primary differences between lists, tuples, and strings in PythonCO3,(3)in terms of mutability, usage, and methods?CO4
 - b) Write a Python function isValid_mobile_no to check whether a given CO3 (3) number is a valid mobile number or not. The program should validate the number based on the following rules:
 - 1. The number must contain exactly 10 digits.
 - 2. The first digit of the number must be 7, 8, or 9.
 - c) Write a recursive function in python to find the GCD of two numbers. CO3 (3)
- a) Write a Python program to Input two lists from the user. Merge these lists CO3, (4) into a third list such that in the merged list, all even numbers occur first CO4 followed by odd numbers. Both the even numbers and odd numbers should be in sorted order.
 - b) Write a recursive function to multiply two positive numbers. Trace the CO3 (5) function calls for multiplying 3 and 4, and explain the changes in the call stack during execution.

Module -4

a) Illustrate the process of sorting the array [15, 8, 3, 12, 6, 10, 4, 1] using the CO4 (6) merge sort algorithm. Draw a diagram showing how the array is split and merged at each stage.

- b) What is memoization, and how does it differ from tabulation in dynamic CO4 (3) programming?
- a) A vending machine needs to return change to a customer using the least CO4 (5) number of coins. The machine has an infinite supply of coins of denominations. Implement the greedy algorithm to determine the combination of coins that minimizes the total number of coins used to make a given amount of change.
 - b) Compare Greedy Algorithms and Dynamic Programming in terms of their CO4 (4) approach, solution guarantee, and applicable scenarios. Provide examples where each approach is preferred.

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