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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S1 (R,S) Examination December 2025 (2024 Scheme)

Course Code: UCEST105

Course Name: ALGORITHMIC THINKING WITH PYTHON

Max. Marks: 60 Duration: 2 hours 30 minutes

PART A

(Answer all questions. Each question carries 3 marks)

		CO	Marks
1	How can heuristic problem-solving strategy assist in creating an effective time management plan for a study schedule when preparing for multiple subjects in a university examination of your second semester?	CO1	(3)
2	What will be the output of the following Python code?	CO1	(3)
	(i) (8 + 6 * 2 ** 3**1) / 7 - 4	CO4	
	(ii) 8> 5 and 4<= 4 or 25 != 30		
3	Develop a flowchart for calculating the parking fee at a parking lot. The flowchart should consider different rates based on vehicle types (Car, Bike, Truck). The program should prompt the user for their vehicle type and parking duration (in hour), then output the final parking fee. You can fix the rate for parking each vehicle type per hour appropriately.	CO2	(3)
4	Write an algorithm to display all odd numbers between 1 and 500 in descending order.	CO2	(3)
5	Explain any one method with a suitable example to return multiple values from a function in Python.	CO3	(3)
6	Write a recursive function that searches for a given key in a list of *N* integers. The function should be initially called by taking the list, the key, and the starting index as arguments. The function should return the index of the key if it exists in the list. If the key is not found, it should return -1.	CO3	(3)
7	Identify a real-world scenario where the brute force approach is preferred over divide and conquer. Explain why brute-force is more suitable in such	CO4	(3)

cases.

8		Compare and contrast Greedy and Dynamic Programming problem solving strategies.	CO4	(3)

PART B

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

Module -1

9		Walk through the six problem-solving steps to find the area of a right triangle	CO1	(9)
10	a)	As a fitness expert, you're passionate about helping people improve their health and well-being through exercise. Your goal is to write and publish a comprehensive fitness book that provides readers with customized workout routines. The book should be designed to accommodate different fitness levels and be simple to follow. You want to complete and publish this book within a year. How can you use means-ends analysis to achieve this goal?	CO1	(7)
	b)	List out any four Python built-in modules.	CO1 CO4	(2)

Module -2

11	a)	Develop a pseudocode to find the average of some numbers entered by the user. The user will keep entering numbers until they input the value -5555, which will signal the end of the input. The pseudocode should compute the average of those numbers entered that are divisible by 4 (excluding –5555) and display the result. Consider the following points for more clarity: • If no numbers divisible by 4 are entered, the pseudocode should output an appropriate message (e.g., "No numbers divisible by 4 entered"). • The **pseudocode** should consider only those numbers **that are divisible by 4** for the average calculation.	CO2	(5)
	b)	A farmer wants to calculate the average yield per hectare of their farm after harvesting crops from different sections. The farmer has divided the farm into six sections, and after harvesting each section, the total amount of crops	CO@	(4)

harvested and the area harvested are recorded. The task is to calculate the average yield per hectare for the entire farm. Develop a **flowchart** to help the farmer calculate the average yield.

12	a)	Consider the movement of a robot on a 2D grid. An N x N matrix like structure represents the grid, and the robot starts at a specified initial position. The top-left corner of the grid is positioned as (0,0). The robot can move in four directions: up, down, left, and right. **Write an algorithm** that takes a list of movement commands ("up", "down", "left, "right") and calculates the robot's final position on the grid. The robot cannot move outside the boundaries of the grid (i.e., the position must always stay within the grid). For example, if the grid size is 5x5 and the robot starts at position (2, 2) and receives the commands ["left", "down", "right"], the robot should end up at position (3, 2). Hint: *See the positions (row number and column number) in the example to understand how rows and columns of the grid are numbered, and how it changes when moving.*	CO2	(5)
	b)	**Develop a flowchart** that simulates a traffic light control system. The program should take a traffic light colour input (Red, Yellow, or Green) and display the corresponding action ("Stop", "Prepare to stop", or "Go"). If the input colour is not valid, display an error message.	CO2	(4)

Module -3

13	a)	You are working as a software developer for a security firm that designs encryption algorithms for online banking. One of the tasks involves generating secure keys based on twisted prime numbers. A twisted prime number is a prime number whose reverse is also a prime number. You are asked to implement a system that can validate twisted prime numbers as part of a security key generation process. Your task is to create a **Python program** that checks if a given number is a twisted prime number.	CO3	(6)
	b)	Write a **Python program** to input a list of n numbers. Calculate and display the sum of cubes of each value in the list.	CO3	(3)

14 a) Consider the following recursive function, which takes a non-negative integer as input. CO3 (5)

1. Describe what the function computes.
2. Explain how the call stack grows and shrinks during the computation using an example input 123.

```
def function_1(n):
  if n == 0:
    return 0
  else:
    num = n % 10
    smallerNumber = n // 10
    return  num + function_1(smallerNumber)
print(function_1(123))
```

b) Compare set and list in Python (Any two features). Write the Python code to convert the following list into set, and also write your observation when you print the corresponding set. CO3, CO4 (4)

my_list = [1, 2, 2, 3, 4, 4, 5]

Module -4

15 a) Ram is trying to solve a problem where he needs to determine the number of distinct ways to climb a staircase with *N* steps. At each step, he can either take 1 step or 2 steps at a time. He needs to reach the top by choosing from these two options for each step. Ram is trying to use dynamic programming (DP) to solve this problem, but he is confused. His teacher had told him to first identify the *optimal substructure* and *overlapping subproblems* in the problem before deciding on the best DP approach. Can you help Ram identify these two properties in this problem so that he can confirm that this problem can be solved using the DP approach? To understand the problem, consider an example, with N = 3, the number of distinct ways he can climb a staircase with 3 steps is 3, which is as follows: CO4 (6)

1. Take 1 step, then another 1 step, and then another 1 step: (1 , 1 , 1)
2. Take 1 step, then take 2 steps at once: (1 , 2)
3. Take 2 steps at once, then take 1 step: (2 , 1)

b) List out any three advantages and three disadvantages of divide and conquer approach. CO4 (3)

16 a) Write a algorithm to solve the following problem using the greedy method: CO4 (6)

You are given an array of positive integers, where each integer represents the weight of an item. You also have a bag that can hold a maximum weight limit. Your goal is to maximize the number of items that can be added to the bag without exceeding the weight limit.

The problem may be done considering the following example:

Input

items = [3, 2, 5, 1, 4, 6] # List of item weights

max_weight = 10 # Maximum weight the bag can hold

Output:

Maximum number of items that can be added to the bag: 4

b) What does the Memoization and Tabulation mean in the context of problem solving? (programs not needed) CO4 (3)

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