First Semester B.Tech End Semester Examination

Monsoon Semester 2024 - 2025

EC1002E Introduction to Programming

Time: 180 Minutes

Maximum Marks: 30

(i) Answer all the questions.

(ii) Show details and steps wherever necessary.

(iii) Make judicious assumptions where necessary and mention them clearly.

(iv) Write your codes and logic neatly so that humans can also evaluate the same

Question Nos.	*1*	*2*	*3*	*4 a, b*	*4 c, d*	*5*	*6*	*7*	*8*	*9a*	*9b*	
Course Outcomes	*3*	*3*	*3*	*4*	*4*	*4*	*4*	*4*	*4*	*2*	*4*	
*Difficulty Level **	*2*	*3*	*4*	*2*	*3*	*1*	*1*	*3*	*2*	*3*	*4*	
Marks	*5*	*2*	*3*	*2*	*3*	*1*	*3*	*3*	*3*	*3*	*2*	

CO1: Illustrate the use of algorithms to solve real-world problems.

CO2: Design and develop computer programs to implement the algorithms.

CO3: Apply concepts of object-oriented programming to implement real-world entities like inheritance, polymorphism etc. in programming.

CO4: Assess the performance of computer programs for basic algorithms.

**1. Knowledge / Recall level; 2. Understand / Comprehend level; 3. Apply / Analyze level; 4. Evaluate / Create level*

PART-A

Q. No.		Questions	Marks
1	a)	Create a Python class named BankAccount with instance variables for the account holder's name and balance. Implement methods to deposit, withdraw, and display the account details. Ensure that the initial account balance is non-negative, and the deposit and withdrawal amounts are always positive. If the user attempts to perform an invalid action, raise an appropriate error message on the console.	3
	b)	Demonstrate Python encapsulation by having private attributes for account number and balance.	2
2		Create an abstract class `Employee` with an abstract method `calculate_salary()` and a non-abstract method `show_employee_info()`, which prints the name of the employee. Then, create two subclasses, `Manager` and `Developer`, each providing their own implementation of the `calculate_salary()` method.	2
3		A new education system needs a new tracking system that will manage both students and teachers and distinguish their unique roles and information requirements. The scenario is as follows: Write a system where both students and teachers are derived from a common Person class. Ensure that the common attributes (like name) are initialized by the parent class, and then handle additional attributes like subject taught for teachers and grades for students using super().	3

P.T.O.

PART-B

Q. No.		Questions	Marks
4		Given a Python list **test** of length N, evaluate the asymptotic time complexity T(N) in terms of O notation (eg: O(N)) for the following blocks of code. Note: Show the calculation steps briefly.	

	a)	`if test[1] % 2 == 0:`
		`  print("Even")`
		`else:`
		`  print("Odd")`
			1

	b)	`for item in test:`
		`  if item % 2 == 0:`
		`  print(item, "Even")`
		`  else:`
		`  print(item, "Odd")`
			1

	c)	`def res(test):`
		`  if len(test) == 1:`
		`  return test[0]`
		`  else:`
		`  return test[0] + res(test[1:])`
		
		`print(res(test))`
			1

	d)	`def res(test):`
		`  print(test)`
		`  if len(test) == 0:`
		`  return 1`
		`  elif len(test) == 1:`
		`  return test[0]`
		`  else:`
		`  return res(test[1:]) + res(test[2:])`
		
		`print(res(test))`
			2

5		Describe the use of timeit() to measure the execution time of a program with an example.	1
6	a)	Give the difference between map(), filter() and reduce() with an example each.	1.5
	b)	Explain exception handling using try-except-else blocks with an example.	1.5
7	a)	You are working with a machine that gives a sequence of atomic numbers corresponding to the elements present in any test sample. Assume that the atomic numbers from test sample are given as a Python list and the numbers are present in a random order. Write a Python program that can search for a specific element (atomic number) from the list. Give the asymptotic time complexity of the search. *Hint:* How do you search for a value?	1
	b)	Suppose that the machine received a software upgrade and gives the atomic numbers as a sorted list, can you propose a better algorithm for finding a specific element? Explain the algorithm in terms of steps and the asymptotic time complexity.	2
8		While working in a power plant, your team has been given temperature readings for the past one month. The team has decided to sort the readings in order to find the frequency of recorded temperatures. While one senior technician argues that merge sort algorithm should be used, a manager trainee assures that bubble sort is most efficient for the task. Assuming time complexity is important for your team, whom do you agree with? Give the algorithms for bubble sort and merge sort assuming float data values. Compare their asymptotic time complexity and justify your choice.	3

P.T.O.

a)	For your statistics course, you are simulating simultaneous dice throws with 'N' dices, each having faces 1-6. Write a Python program to simulate N throws, each with N dices where N must be taken as user input. The program must also evaluate the number of outcomes, where the sum of faces is $N^{N}+1$.	3
b)	Can you propose an algorithm for evaluating the number of outcomes with sum = '$N^{N}+1$' and having asymptotic time complexity better than $O(N^2)$, where 'N' dices are thrown simultaneously 'N times? Explain the automated process with steps. **Hint**: What are the possible outcomes that give required sum? Can you directly get the number of times these outcomes occur? Assume that direct Dictionary/List operations like adding or accessing a value is O(1) here. Time complexity of operations such as sum of elements of list, count of element, and conversion of list to set is O(N) using built-in methods, where N is the length of the list.	2