Reg. No.: 22BRS1111

Name:

VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

Continuous Assessment Test I – JAN 2025

Programme	:	B.Tech(CSE) and its specializations	Semester	:	Winter24-25
			Code	:	BCSE306L
Course	:	Artificial Intelligence	Class Nbr	:	CH2024250501799 CH2024250501798 CH2024250502347
Faculty	:	Dr. SUGANYA G Dr. JOSHAN Dr. RADHIKA SELVAMANI	Slot(s)	:	D1+TD1
Time	:	1½ Hours	Max. Marks	:	50

Answer ALL the Questions

1. Hospital X, a multi-specialty hospital, struggles to manage its appointment scheduling system due to increasing patient demands and limited doctor availability. The manual scheduling process created many problems such as long waiting times, unsatisfied customers, and ineffective resource utilization. To overcome these challenges, the hospital wishes to have an AI based system to optimize the appointment scheduling process. The following points were noted during the discussion with an AI engineer. **15**

- Prioritize patients based on the criticality of the illness.
- Accommodate patient preferences to a possible extent.
- Minimize waiting times of patients.
- Effectively optimize the use of resources.

Identify the type of agents that may be suitable for the following requirements and justify them. Also, write appropriate PEAS for each type of agent identified.

i. Assign the patient to any earliest available slot with any doctor, if the patient is critical. If patient preference matches an available doctor and time, assign it. If no preference is stated, assign the first available slot. If a doctor calls in sick, the agent must immediately search for an alternative time slot for that patient's appointment. If the patient cannot be rescheduled immediately, the agent may automatically place the patient on a waiting list for the next available slot. (5 marks)

ii. There are 3 doctors available in the hospital namely, Dr. A (Cardiologist), Dr. B(neurologist), and Dr. C(General Medicine) with 5 consultation rooms. The constraints of the hospital are as follows:

a) Each doctor can only see one patient at a time in a fixed time slot.
b) The hospital needs to minimize patient waiting times and avoid scheduling conflicts.
c) Doctors have limited availability.

Given the requirements for 'n' patients (sample provided below), the AI solution must optimize the appointment scheduling system such that, in the case of 'Patient 1', who has a critical cardiology emergency and prefers Dr. A, the system should prioritize their case and assign the earliest available slot with Dr. A without causing any conflict. (5 marks)

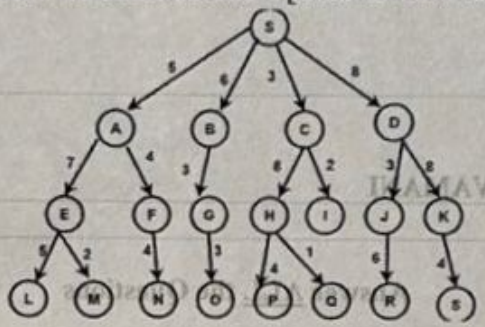
iii. The hospital has a mixed set of patients, doctors, and rooms available. The details of patients and their scheduling requests are stored in the hospital repository system. The patients

record their requests with details about their problem, criticality, and doctor and slot preference. The doctors have dynamic slot time based on the nature of the problem raised in the patient's request. The AI-based system needs to calculate the probable slot time, probable request from old patients for a particular date and time etc., from the experience. Overall, the system should look dynamic and give a personalized feel to both doctor and patient. (5 marks)

2. Consider the state space graph shown below. S is the start state, and Q is the goal state. The costs for each edge are shown on the graph. Each edge can be traversed in the directed directions. 10

   i. For the given scenario, illustrate two suitable blind search algorithms to find an optimal path. [3marks+3marks]

   ii. Compare the searching strategies in terms of time and space complexity, considering branching factor (b), least cost depth (d), and maximum depth (m), and justify the optimality and completeness of the solution. [2marks+2marks]



3. The farmer wants to successfully cross the river with corn, chicken, and fox, which he purchased in the market. In his little boat, he can only carry one item at a time. Since the fox will eat the chicken, he is unable to leave the fox along with the chicken. Additionally, the chicken will eat the corn, so he cannot leave them together. Each trip (while crossing the shore) will cost Rs. 15 for gasoline. 10

   i. Clearly identify the task and its related (starting and ending) states and actions that are required to build the state space representation. (4 marks)

   ii. Create a search graph in state space for the given river-crossing puzzle (4 marks).

   iii. Calculate how much diesel was wasted altogether (in rupees) when the farmer was traveling the river by himself. (2 marks)

4. A manufacturing company wants to minimize the total production time for assembling a product. There are five tasks (T1, T2, T3, T4, T5) that must be completed in a specific order, but the sequence of execution can vary to optimize efficiency. The time taken for each task depends on its position in the sequence, as shown below: 15

Task Position	T1	T2	T3	T4	T5
1	8	10	7	6	9
2	5	6	8	7	5
3	7	8	6	9	8
4	6	5	9	8	6
5	9	7	10	5	8

(i) Give the problem definition (initial state, successor function, objective function) for using the Simulated Annealing algorithm, where successors are generated by swapping two random tasks in the current sequence (3 marks)

(ii) Analyze the importance of the "cooling schedule" in Simulated Annealing and discuss how it impacts the exploration of solutions and convergence (over 5 iterations). Set the initial temperature to 500 and the cooling factor to 0.9. Additionally, assume the number of iterations for the inner loop as 1, and the number of iterations for a particular temperature (outer loop) also as 1. (9 marks)

(iii) Evaluate the effectiveness of Simulated Annealing for solving this problem and compare it to a basic greedy approach. (3 marks)

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