Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025

Date: 22-12-2025 **Time:** 01:00pm – 04:00pm

School: SOCSE	**Program:** CSE, CBC, CBD, CDV, CCS, CIT, CSI, CSN	
Course Code: CSE2264	**Course Name:** Essentials of AI	
Semester: V	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**20**	**20**	**20**	**40**	

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

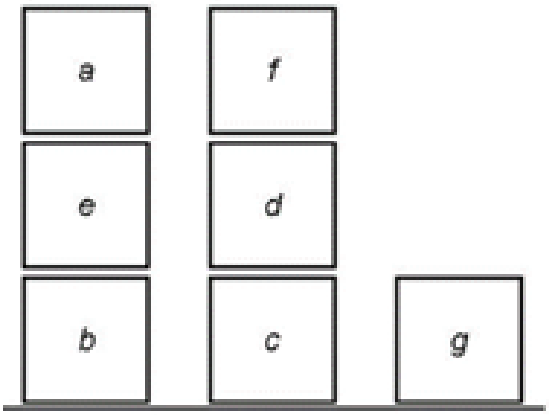
Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

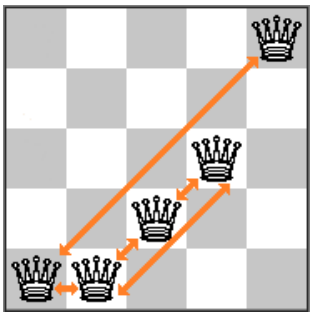
1.	State true or false. In alpha beta pruning, the alpha value represents the ***lower bound*** of the utility that is found so far.	**2 Marks**	**L1**	**CO1**
2.	State the name of the scientist who came up with an algorithm to find the best state sequence, given an observation sequence.	**2 Marks**	**L1**	**CO1**
3.	Expand DNF in the context of logic.	**2 Marks**	**L1**	**CO1**
4.	List the 2 inference rules of first order logic, which are missing from propositional logic due to the presence of the Existential Quantifier.	**2 Marks**	**L1**	**CO1**
5.	State the CNF equivalent of P ^ (Q v R)	**2 Marks**	**L1**	**CO1**
6.	State the sample space for a single coin toss.	**2 Marks**	**L1**	**CO1**
7.	State the domain of the variables for the Cryptarithmetic problem in **BASE 9**.	**2 Marks**	**L1**	**CO1**
8.	State yes or no. For a water jug problem, if we are having **2 jugs** of capacities 3 litres, and 5 litres, we can measure out all integral volumes (i.e. 1 litre, 2 litres, ….) of water from 1 litre to 8 litres.	**2 Marks**	**L1**	**CO1**
9.	State true or false. The Viterbi Algorithm is a Greedy Algorithm.	**2 Marks**	**L1**	**CO1**

10.	State true or false. A multilayer perceptron (MLP) requires **at least 1 hidden layer** (i.e. we cannot have an MLP with no hidden layer).	**2 Marks**	**L1**	**CO1**

Part B

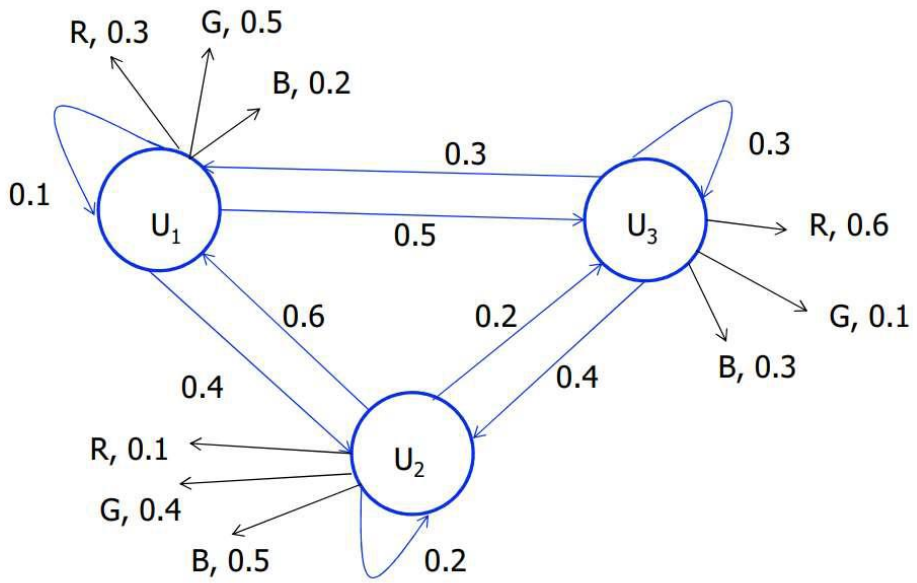
Answer the Questions. **Total Marks 80M**

11.	The blocks world is a representation of the different blocks stacked on top of each other. A sample is as follows:  The following are the predicates which we use to represent this scenario: • Top(x, y) = x is placed on top of y • Table(x) = x is on the table • Above(x, y) = x is above y For each of the following, predict whether the statement will be either **TRUE** or **FALSE**. Consider that FORALL represents the Universal Quantifier, and EXISTS represents the Existential Quantifier. **1.** FORALL x Table(x) **2.** EXISTS x Table(x) **3.** EXISTS x Top(x, g) **4.** EXISTS x Top(x, b) **5.** Above(a, b) **6.** Above(c, d) **7.** FORALL x FORALL y Above(x, y) -> ~Above(y, x) **8.** FORALL x FORALL y Top(x, y) -> Top(y, x) **9.** ~EXISTS x Top(x, a) **10.** FORALL x Table(x) -> ~EXISTS y Top(x, y)	**20 Marks**	**L2**	**CO3**
	Or			
12.	For the blocks world described in **Question 11**, let us define the relation of Above(x, y) as follows: "x is above y if and only if, either x is on top of y, or there exists another block z, where x is on top of z and z is above y".	**20 Marks**	**L2**	**CO3**

13.	One of the ways in which we solve an N-Queen's problem is that we constrain each column can have only 1 queen, and represent the configuration of the board as an N-dimension vector where each dimension represents the row number of the queen. For example, if we have the following configuration:  It is represented as [1,1,2,3,5]. In this way, we ensure that no 2 queens will be in the same column. To find out if 2 queens are in the same row, it is also quite easy. We simply check and see if a number is repeated in the vector (Eg. 1 is repeated twice). But how do we find out if 2 queens are in the same diagonal? Ponder how we solve the problem, and then calculate the number of queens that share a diagonal (in the above example, it is 3) for the 13x13 representation: [8,5,1,2,12, 3,7,9,6,13,4, 11,10].	**20 Marks**	**L3**	**CO2**
	Or			
14.	A ***chakra distribution*** of regions (where the number of regions is more than 2) in a map is one where there is a **central region**, which is surrounded by a number of other regions, in such a way that **each region borders the central region** (lets call it region 0), and the regions 1 to n each border 2 adjacent regions – namely the ith region will border regions (i-1) and (i+1) (with the region n bordering regions (n-1) and region 1). Calculate the minimum number of colours needed to colour such a map if (a) n is odd, and (b) n is even. Based on the inferences, complete the table given below:	**20 Marks**	**L3**	**CO2**

N	**Number of colours**
3	?
4	?
10	?
11	?
100	?
100000000	?

15.	Compute the following probabilities, assuming a fair coin: **a)** The probability of getting 3 heads **b)** The probability of getting a **3rd** head, on the 3rd toss, given 2 heads in the previous tosses. **c)** The probability of getting at most 2 heads in 2 tosses. **d)** The probability of getting at least 2 heads in 2 tosses. e) The probability of getting exactly 2 heads in 2 tosses.	**20 Marks**	**L2**	**CO4**
	Or			
16.	Compute the following probabilities, assuming a fair dice: a) The probability of rolling more than a 6. b) The probability of rolling at least a 6. c) The probability of rolling exactly a 6. d) The probability of rolling less than a 6. e) The probability of rolling at most a 6.	**20 Marks**	**L2**	**CO4**

17.	Consider the following HMM represented as a state diagram.  Calculate the most probable state sequence to produce the observations **B G B R B**. Assume that each state has equal initial probability. You must mention the Viterbi probability and back-pointer at each and every step.	**20 Marks**	**L3**	**CO4**
	Or			
18.	Consider the HMM given in **Question 17** and calculate the most probable state sequence to produce the observations **G B G B G**. Assume that each state has equal initial probability. You must mention the Viterbi and back-pointer at each and every step.	**20 Marks**	**L3**	**CO4**