CBCS SCHEME

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18AI71

Seventh Semester B.E. Degree Examination, June/July 2025
Advanced Artificial Intelligence

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. What is an agent? Explain an agent interaction with the environments through sensors and actuators with an example. **(10 Marks)**

b. List and explain the PEAS description of the task environment for an automated taxi. **(10 Marks)**

OR

2 a. What is a simple reflex agent? Explain with a diagram and also write an agent program for a simple reflex agent in the two-state vacuum environment. **(10 Marks)**

b. How the components of agent programs work? Explain with a neat diagram. **(10 Marks)**

Module-2

3 a. What is the probability that a patient has diseases meningitis with a stiff neck?
Given Data: A doctor is aware that disease meningitis causes a patient to have a stiff neck, and it occurs 80% of the time. He is also aware of some more facts, which are given as follows:
i) The known probability that a patient has meningitis disease is 1/30,000.
ii) The known probability that a patient has a stiff neck is 2%. **(10 Marks)**

b. Suppose that a woman in her forties goes for a mammogram and receives bad news: a "positive" mammogram. However, since not every positive result is real, what is the probability that she actually has breast cancer? Given that the fraction of women in their forties who have breast cancer is 0.014 and the probability that a woman who has breast cancer will get a positive result on a mammogram is 0.75. The probability that a woman who does not have breast cancer will get a false positive on a mammogram is 0.1 H. List and explain the different factors involved in this case study. **(10 Marks)**

OR

4 a. For each of the following statements, either prove it is true or give a counter example.
i) If P (a | b, c) = P (b | a, c), then P (a | c) = P (b | c)
ii) If P (a | b, c) = P(a), then P (b | c) = P(b)
iii) If P(a | b) = P(a), then P(a | b, c) = P(a | c) **(10 Marks)**

b. Use the Alpha-Beta pruning algorithm to prune the game tree in Fig.Q4(b) shown below, assuming child nodes are visited from left to right. Show all final alpha and beta values computed at root, each internal node explored, and at the top of pruned branches. **(10 Marks)**

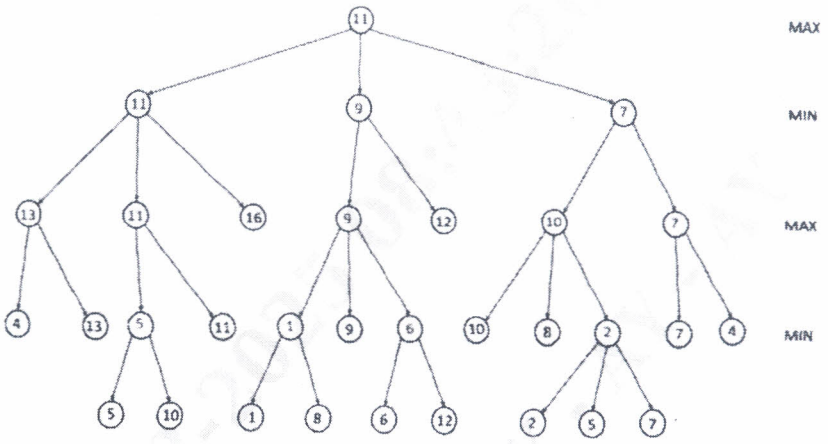

Fig.Q4(b)

Module-3

5 a. Consider the following Bayesian network, where F = having the flu and C = coughing :

i) Write down the joint probability table specified by the Bayesian network.
ii) Determine the probabilities for the following Bayesian network.
iii) Which Bayesian network would you have specified using the rules learned in class?
iv) Are C and F independent in the given Bayesian network? **(10 Marks)**

b. Write the likelihood-weighting algorithm for inference in Bayesian networks and explain the working of the algorithm. **(10 Marks)**

OR

6 a. Write the variable elimination algorithm and rejection-sampling algorithm for inference in Bayesian networks. **(10 Marks)**

b. A patient has a disease N. Physicians measure the value of a parameter P to see the disease development. The parameter can take one of the following values {low, medium, high}. The value of P is a result of patient's unobservable condition/state S. S can be {good, poor}. The state changes between two consecutive days in one fifth of cases. If the patient is in good condition, the value for P is rather low (having 10 sample measurements, 5 of them are low, 3 medium and 2 high), while if the patient is in poor condition, the value is rather high (having 10 measurements, 3 are low, 3 medium and 4 high). On arrival to the hospital on day 0, the patient's condition was unknown, i.e, Pr(S0 = good) = 0.5.

i) Draw the transition and sensor model of the dynamic Bayesian network modeling the domain under consideration
ii) Calculate probability that the patient is in good condition on day 2 given low P values on days 1 and 2.
iii) Can we determine the most likely patient state sequence in days 0, 1 and 2 without any additional computations? Justify. **(10 Marks)**

Module-4

7 a. Explain the concept of Pinhole camera for the formation of images with a neat diagram. **(10 Marks)**

b. List and explain early image processing operations. **(10 Marks)**

OR

8 a. Write short notes on the following using vision:
i) Words and Pictures
ii) Reconstruction from many views
iii) Controlling movement **(10 Marks)**

b. Explain the concept object recognition by appearance. **(10 Marks)**

Module-5

9 a. Identify the morphological type (Noun phrase, Verb phrase, Adjective Phrase) of following sentence segments:
i) Importance to Bill
ii) Looked up the tree **(10 Marks)**

b. List and explain different phases of Natural Language Processing (NLP) with an example for each. **(10 Marks)**

OR

10 a. List and discuss different challenges of Natural Language Processing (NLP). **(10 Marks)**

b. What is Language Modelling? List and explain different approaches of Language Modelling. **(10 Marks)**

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