Course Code : CST 323 **KOLP/RW – 19 / 9546**

Sixth Semester B. E. (Computer Science and Engineering) Examination

ARTIFICIAL INTELLIGENCE

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions are compulsory.
(2) All questions carry marks as indicated.
(3) Explain your answer with neat sketches, wherever applicable.

1. (a) For each of the following activities, give a PEAS (Performance, Environment, Actuators, Sensors) description of the task environment and characterize it in terms of the properties of task environments

   (i) Performing a high jump.

   (ii) Shopping for used AI books on the Internet. 5 (CO 1)

   (b) Formulate Standard Missionaries and Cannibals problem in terms of States, Initial State, Action, Goal Test and path cost. 5 (CO 1)

2. (a) Compare Breadth first Search, depth First Search, Best first search, Iterative deepening DFS and A* in terms of completeness, optimality, Time and space complexity. 5 (CO 2)

   (b) Determine heuristic function for 8-Queen problem. Apply A* on 8-Queeen for three iterations, with suitable initial and goal states. 5 (CO 2)

3. (a) Consider a first-order logical knowledge base that describes worlds containing people, songs, albums (e. g., "Meet the Beatles") and disks (i. e., particular physical instances of CDs). The vocabulary contains the following symbols:

   Copy of (d, a): Predicate. Disk d is a copy of album a.
   Owns(p, d): Predicate. Person P owns disk d.
   Sings(p, s, a): Albuma includes a recording of song s sung by person p.

Wrote(p, s): Person p wrote song s.
McCartney, Gershwin, BHoliday, Joe, EleanorRigby, TheManILove, Revolver : Constants with the obvious meanings.

Express the following statements in first-order logic :

(i) Every song that McCartney sings on Revolver was written by McCartney.

(ii) Gershwin did not write any of the songs on Revolver.

(iii) Every song that Gershwin wrote has been recorded on some album. (Possibly different songs are recorded on different albums)

(iv) There is a single album that contains every song that Joe has written.

(v) Joe owns a copy of an album that has Billie Holiday singing "The Man I Love." 5 (CO 3)

(b) Convert the following English statements to statements in first order logic

(a) Every boy or girl is a child

(b) Every child gets a doll or a train or a lump of coal

(c) No boy gets any doll

(d) No child who is good gets any lump of coal

(e) Jack is a boy

Using the above five axioms construct a proof by resolution of the statement "if Jack doesn't get a train then Jack is not a good boy" 5 (CO 3)

4. (a) In your local nuclear power station, there is an alarm that senses when a temperature gauge exceeds a given threshold. The gauge measures the temperature of the core. Consider the Boolean variables A (alarm sounds), FA (alarm is faulty), and FG (gauge is faulty) and the multivalued nodes G(gauge reading) and T (actual core temperature).

(i) Draw a Bayesian network for this domain, given that the gauge is more likely to fail when the core temperature gets too high.

(ii) Suppose there are just two possible actual and measured temperatures, normal and high; the probability that the gauge gives the correct temperature is x when it is working, but y when it is faulty. Give the conditional probability table associated with G. 5 (CO 4)

(b) For the following Fuzzy sets, find the result of the operation Union, Intersection and Set difference (X-Y) between X and Y

Universal set = {A, B, C, D, E, F, G}

X = {0.2/B, 0.6/C, 1/D, 0.9/E, 0.7/G}

Y = {0.1/A, 0.4/B, 0.1/C, 1/F} 3 (CO 4)

(c) Explain the following probability terms : Random variables and Full joint probability distribution with an examples of each. 2 (CO 4)

5. (a) Apply ID3 algorithm to find the root node for the given dataset.

Day	Outlook	Temp.	Humidity	Wind	Play Tennis
D1	Sunny	Hot	High	Weak	No
D2	Sunny	Hot	High	Strong	No
D3	Overcast	Hot	High	Weak	Yes
D4	Rain	Mild	High	Weak	Yes
D5	Rain	Cool	Normal	Weak	Yes
D6	Rain	Cool	Normal	Strong	No
D7	Overcast	Cool	Normal	Weak	Yes
D8	Sunny	Mild	High	Weak	No
D9	Sunny	Cold	Normal	Weak	Yes
D10	Rain	Mild	Normal	Strong	Yes
D11	Sunny	Mild	Normal	Strong	Yes
D12	Overcast	Mild	High	Strong	Yes
D13	Overcast	Hot	Normal	Weak	Yes
D14	Rain	Mild	High	Strong	No

5 (CO 5)

(b) Design a neural network model that implements a Boolean function $A \longrightarrow B$. 5 (CO 5)

6. (a) How the Expert system shell is used in expert system design ? 2 (CO 6)

(b) Provide the details about following expert systems

(1) PROSPECTOR

(2) DENDRAL 4 (CO 6)

(c) Explain forward and backward chaining methods used to derive inference in expert system working. 4 (CO 6)