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B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, NOV / DEC 2012

B.Tech IT

VII Semester

IT9030 Knowledge Engineering

(Regulation ...2008.....)

Time : 3 Hours

Answer ALL Questions

Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. What is the need for logic and reasoning in Engineering?
2. Prove the validity of the inference from $p \rightarrow (q \wedge r)$, $\neg q$ to $\neg p$.
3. Is $\phi = ((p1 \vee \neg p2) \wedge (\neg p3 \vee p4)) \rightarrow (p5 \wedge \neg p6)$ a horn clause? Explain.
4. What is skolemization? Give an example.
5. What is the function of the interpreter in Production rule systems?
6. Give examples for logical symbols and non logical symbols in Description Logic.
7. What is the main difference between probability and fuzzy logic ? Give examples.
8. How is reasoning carried out in Truth maintenance systems?
9. What is a frame problem? Is there any solution to it? Explain.
10. Represent the action of getting bread, tea and book from the store using STRIPS/ADL

Part – B (5 x 16 = 80 marks)

11. i) Consider the following piece of knowledge: Tony, Mike, and John belong to the Alpine Club. Every member of the Alpine Club who is not a skier is a mountain climber. Mountain climbers do not like rain, and anyone who does not like snow is not a skier. Mike dislikes whatever Tony likes, and likes whatever Tony dislikes. Tony likes rain and snow.
(a) Prove that the given sentences logically entail that there is a member of the Alpine Club who is a mountain climber but not a skier. (6).
- ii) Donald and Daisy Duck took their nephews, age 4, 5, and 6, on an outing. Each boy wore a tee-shirt with a different design on it and of a different color. You are also given the following information:
 1. Huey is younger than the boy in the green tee-shirt.
 2. The 5-year-old wore the tee-shirt with the camel design.

3. Dewey's tee-shirt was yellow.
4. Louie's tee-shirt bore the giraffe design.
5. The panda design was not featured on the white tee-shirt.

- (a) Represent these facts as sentences in FOL. (3)
- (b) Using your formalization, is it possible to conclude the age of each boy together with the color and design of the tee-shirt he is wearing? Show semantically how you determined your answer. (4)
- (c) If your answer was "no," indicate what further sentences you would need to add so that you could conclude the age of each boy together with the color and design of the tee-shirt he is wearing. (3)

12. a) i) What is the need for resolution? Determine whether the following sentence is valid using Resolution:

$$\exists x \forall y \forall z ((P(y) \supset Q(z)) \supset (P(x) \supset Q(x))). \quad (6)$$

- ii) Give a succinct representation of syntax and semantics in classical logic (10)

OR

- b) i) Which is more expressive form of logic? Why? Substantiate your answer with examples and case studies (8)
- ii) With an example, explain the algorithm to convert the predicate logic formula to CNF. With CNF, how will you use resolution to arrive at the conclusion? (8)

13. a) i) With an example, explain the forward chaining method to arrive at a conclusion from the given premises in an expert system (8)

- ii) Differentiate IF-THEN rules and frames. Explain the advantage of using frames over classical logic and production rules. List a few application areas where production rules are used and a few areas where frames are used. (8)

OR

- b) i) Explain the working of a production system with an example. (8)
- ii) Explain the need of IF-ADDED and IF-NEEDED procedure with an example (8).

14. a) i) Give the syntactic representation of Description Logic with examples. How is reasoning carried out in Description Logic, when individuals are involved (10)

- ii) What is the difference between classical logic and fuzzy logic? Explain how uncertainty is handled in logical formalisms? (6)

OR

- b) i) What is the difference between monotonic and non-monotonic logic? Explain Default logic with an example (6)

- ii) Take any one of the following real world application (a) Washing machine (b) Vehicle transmission system (c) Decision of choosing a project given three constraints. Develop a quantitative fuzzy model with fuzzification, rule base and an appropriate defuzzification methodology. (10)

15. a) i) How are actions represented in classical logic formalisms? With an example, explain fluent, possibility and effect axioms in situation calculus. Explain any one method to avoid the frame problem. (8)

- ii) How is planning carried out using Situation calculus. (8)

OR

- b)
- i) Three blocks A, B, C are on the table in the initial state. A robot has been given the task of placing these three blocks one on top of the other such that C is at the top and A is at the bottom. How will the robot achieve this task? Give the representation and the strategy (algorithm) behind this stacking. (10)
 - ii) What is the difference between Knowledge Engineering and Knowledge Management? List a few application areas where you will use the logical formalisms learnt in this course? Explain. (6)