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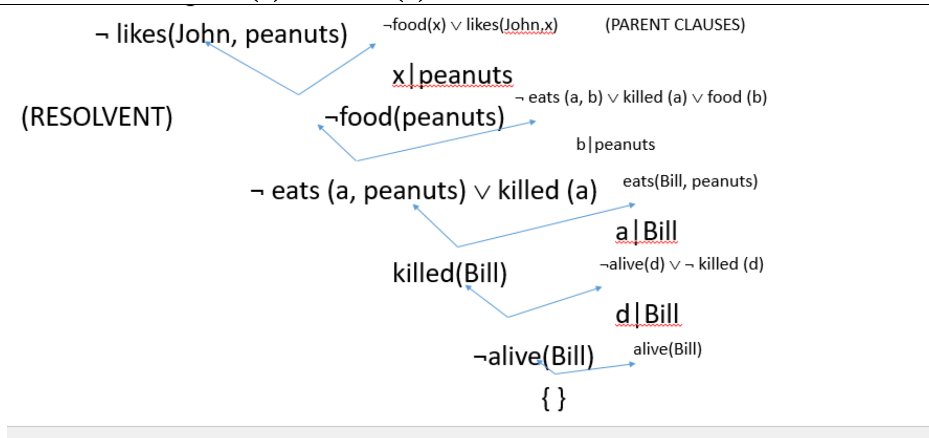
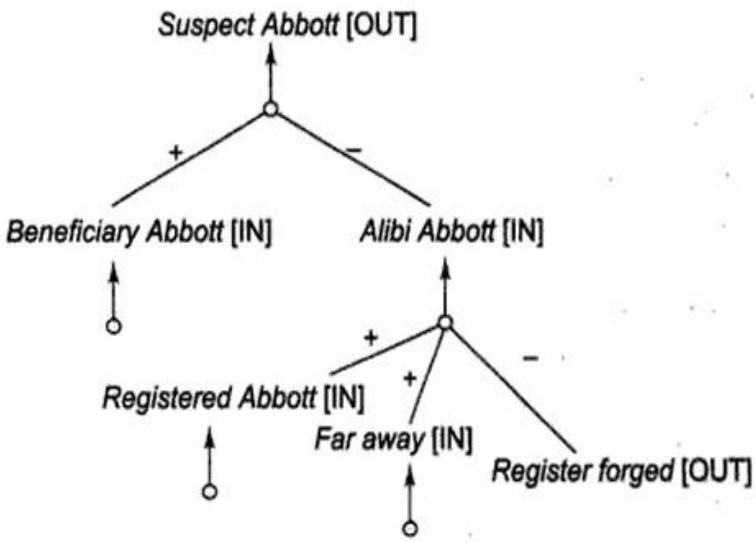
DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Internal Assessment Test II – Nov. 2017
ARTIFICIAL INTELLIGENCE (10CS562) Scheme and Solution by Prasad B S

	Answer any three from Part-I and any one from part-II PART -1	MARKS	CO	RBT
1	What qualities does a good knowledge representation system should possess? Explain the different approaches used for knowledge representation and list the issues involved in knowledge representation.	[2+6+2]	CO2	L2
Ans:	Qualities a good knowledge representation should possess: 1. Representational adequacy 2.Inferential adequacy 3. Inferential efficiency 4.Acquisitionalefficiency Approaches to knowledge representation: (Explain with example) 1.Simple relational knowledge 2.Inheritable Knowledge 3.Inferential knowledge 4.Procedural knowledge Important issues: Identifying Important attributes •Important relationships among attributes. •Choosing the granularity of representation. •Representing sets of objectives •Finding the right structure for large amount of knowledge.			
2 (a)	Explain 'Frame problem' in knowledge representation with a suitable example.	[3+2]	CO2	L2
Ans.	The problem of representing the facts that change and that do not change is known as the frame problem. Any suitable example.			
(b)	Differentiate between Forward and Backward reasoning and what are the factors that influences the choice between them.	[1+4]	CO3	L2
Ans.	Reasoning: Search through problem space from Initial state to goal state. •Forward: Start search from initial state •Backward: Start search from goal state Factors influencing : 1. Are there more possible start states or goal states. If so move from the smaller set of states to the larger set of states. 2. In which direction is the branching factor more? Choose the direction in which branching factor is less. 3. Will the program be asked to justify its reasoning process to a user? Then proceed in direction closer to way the user will think. 4. If it is the arrival of new fact which triggers problem solving event then forward reasoning, if it is a query to which the response needed then backward reasoning.			
3 (a)	What is Resolution? Explain Algorithm for Resolution in propositional logic.	[1+3]	CO2	L2

Ans:	Proof procedure with a single operation on variety of processes.Resolution takes two clauses(parent clauses) and produces a new clause (resolvent clause) containing all the literals of the two original clauses except the two complementary literals. •This process continues until one of the two things happen: •There are no new clauses that can be added. •An application of the resolution rule derives the empty clause.]•An empty clause shows that the negation of the conclusion is a complete contradiction. ALGORITHMProducing a proof by resolution of proposition P with respect to a set of axioms F is below: 1. Convert all the propositions of F to clause form. 2. Negate P and convert the result to clause form. 3. Repeat until either a contradiction is found or no progress can be made. a. Two clauses(one being p) , call these the parent clauses. b. Resolve them together. The resulting clause called the resolvent. Which will be the disjunction of all of literals of both clauses, if there are any pairs of literals L and ~L , such that one of the parent clause contains L and other contains ~L then eliminate such pair. c. If the resolvent is the empty clause, then a contradiction has been found. If it is not, then add it to the set of clauses available to the procedure.			
(b)	Illustrate the representation of the following in predicate logic with an example: 1. ‘instance’ and ‘isa’ relationship 2. Adding exception 3. Computable functions	[2+2+2]	CO2	L3
Ans:	**isa and instance relationship:** 1.Instance(Marcus,man) 2.Instance(Marcus ,Pompeian) 3.isa(Pompeian,Roman) 4.instance (Caesar, ruler) 5. $\forall$x: instance(x,Roman) $\rightarrow$loyalto(x,Caesar) $\vee$hate(x, Caesar) **Exception:** $\forall$x: romans(x)$\wedge\neg$ eq(x, Paulus) $\rightarrow$loyalto(x,Caesar) $\vee$hate(x, Caesar) **Computable functions:** gt(2+3,1)			
4	Define CNF? Give an algorithm for converting proposition logic into CNF and apply the same to convert the following propositions to CNF: 1. Marcus was a man. 2. Marcus was a Pompeian 3. All Pompeians were Romans 4. Caesar was a ruler 5. All romans were either loyal to Caesar or hated him 6. Everyone is loyal to someone 7. People only try to assassinate rulers they are not loyal to. 8. Marcus tried to assassinate Caesar.	[1+3+6]	CO2	L2
	CNF: Every sentence in Propositional Logic is logically equivalent to a conjunction of disjunctions of literals. A sentence expressed as a conjunction of disjunctions of literals is said to be in Conjunctive normal Form or CNF. (AND of ORs). Algorithm for converting logic to CNF			

5	Apply resolution to prove the predicate 'likes(John, peanuts)' using following set of predicates: 1. ∀x : food(x) → likes (John, x) 2. food (Apples) 3. food (Banana) 4. ∀ a : ∀ b: eats (a, b) ^ ¬killed (a) → food (b) 5. eats (Bill, Peanuts) ^ alive (Bill) 6. ∀c : eats (Bill, c) → eats (Sue, c) 7. ∀ d : alive(d) → ¬ killed (d) 8. ∀ e: ¬ killed(e) → alive(e)	[10]	CO1	L3
Ans.				
6 (a)	What are the key issues in non-monotonic reasoning system? Explain the two approaches used for logic representation for-non monotonic reasoning.	[2+4]	CO2	L2
Ans.	Key issues: 1. How can knowledge base be extended to allow inferences to be made on the basis of lack of knowledge as well as on the presence of it? 2. How can the knowledge base be updated properly when a new fact is added to the system? 3. How can knowledge be used to help resolve conflicts when there are several inconsistent non-monotonic inferences that could be drawn? Two approaches: (with one example each) 1. Non-monotonic Logic 2. Default Logic			
(b)	Define minimalistic reasoning? Explain how minimalistic reasoning is implemented using Closed World Assumption (CWA).	[4]	CO2	L2
	There are many fewer true statements than false ones. If something is true and relevant it makes sense to make it part of the knowledge base. Therefore assume that the only true statements are those that necessarily must be true in order to maintain the consistency of the knowledge base CWA: Presumption that a statement that is true is also known to be true.			
7 (a)	Differentiate Between chronological backtracking and dependency directed backtracking.	[3]	CO2	L2
Ans	Instead of backtracking to the most recently made guess during reasoning, backtrack to the guess which caused the problem leaving everything else that has happened in the meantime intact.			

(b)	Explain Justification based Truth Maintenance System (JTMS)? What are the two critical criterion that must be met during labeling of JTMS nodes and illustrate with suitable example.	[1+3+3]	CO3	L2
Ans.	Allows assertion to be connected via a spreadsheet-like network of dependencies serving as a bookkeeper. Purely syntactic , domain independent way to represent beliefs and change it consistently. Two critical criterion: 1. Consistency 2. Well foundedness example:  			
8 (a)	Define Bayes' theorem. How certainty factor is used to overcome its limitation?	[2+4]	CO2	L2
	▪ To compute conditional probability, we need to take into account the prior probability of H(the probability that we would assign to H if we had no evidence) & the extent to which E provides evidence of H. ▪ To do this we need to define a universe that contains an exhaustive, mutually exclusive set of H_i's , among which we are trying to discriminate. ▪ $P(H_i \backslash E)$ – The probability that hypothesis H_i is true given evidence E ▪ $P(E\backslash H_i)$ – The probability that we will observe evidence E given that hypothesis i is true. ▪ $P(H_i)$ – The a priori probability that hypothesis I is true in the absence of any specific evidence. These probabilities are called prior probabilities or priors. ▪ K = The number of possible hypothesis. $$P(H_i\|E) = \frac{P(E\|H_i)P(H_i)}{\sum_{k=1}^{n} P(E\|H_k)P(H_k)}$$			
(b)	Explain Dempster-Shafer theory with suitable example?	[4]	CO2	L2
	Considers a set of proposition instead of individual proposition and assigns to each of them an interval [Belief, Plausibility] Belief (Bel) measures the strength of the evidence in favor of a set of propositions and ranges from 0 to 1.			

	Plausibility(Pl) is given by $$Pl[s] = 1 - Bel(\sim s)$$ Plausibility also ranges from 0 to 1 and it measures the extent to which evidence in favor of ~s leaves room for belief in s. It also tells us the amount of information we have on s. If Pl(s) is 0 then Bel(s) is also 0. Suitable example.			