Mid-semester Examination

Department: Computer Science and Engineering

Course Name: Artificial Intelligence **Code: CS 561**

Full Marks-60 **Time: 2 hours**

Make reasonable assumptions as and whenever necessary. Answer the questions in any sequence. However, the answers to any particular question should appear together.

Answer ALL the questions

1. Show that breadth first search is a special case of uniform cost search. Under what situations BFS and DFS outperform each other? What are the problems of DFS? How can these be eliminated? Why is bi-directional search useful? Derive the time and space complexities of uniform cost search. **3+3+3+3+2+6**

2. (a). Why is propositional logic monotonic? Define resolution theorem in propositional logic. Consider the following propositional logic knowledge base:

   $KB = (B_{1,1} \Leftrightarrow (P_{1,2} \vee P_{2,1})) \wedge \neg B_{1,1}$

   Use resolution algorithm to show whether $\alpha = \neg P_{1,2}$ can be concluded or not.

   (b). Define Modus Ponens and horn clause in Propositional logic.

   (3+3)+10+4

3. (a). For propositional logic, why is entailment with horn clauses more efficient?

   (b). Prove, or find a counterexample to, each of the following assertions:

   (i). If A=>B or C=>B (or both) then $(A \wedge C)$=>B

   (ii). A=>(B $\wedge$C) then A=>B and A=>C

   (c). Consider a vocabulary with only four propositions: A, B, C and D. How many models are there for the following sentences?

   (i). $\neg A \vee \neg B \vee \neg C \vee \neg D$

   (ii). $(A \Rightarrow B) \wedge A \wedge \neg B \wedge C \wedge D$

   (d). A propositional 2-CNF expression is a conjunction of clauses, each containing 2 literals, e.g., $(A \vee B) \wedge (\neg A \vee C) \wedge (\neg B \vee D) \wedge (\neg C \vee G) \wedge (\neg D \vee G)$

   Prove using resolution that the above sentence entails G. **3+3*2+3*2+5**