**M.Sc. Computer Science**
**MCSC-102: Artificial Intelligence**
**Unique Paper Code : 223411102**
**Semester I**
**March-2021 (OBE)**
**Year of Admission : 2020**

**Time: Three Hours** **Max. Marks: 70**

**Attempt any FOUR questions**
**All questions carry equal marks**

1. How constraint satisfaction problem is different than problem solving using search? Describe in your own words.

   Using constraint satisfaction algorithm, solve the following cryptarithmetic problem:

```
  EAR
+ EAR
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DRUM
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```

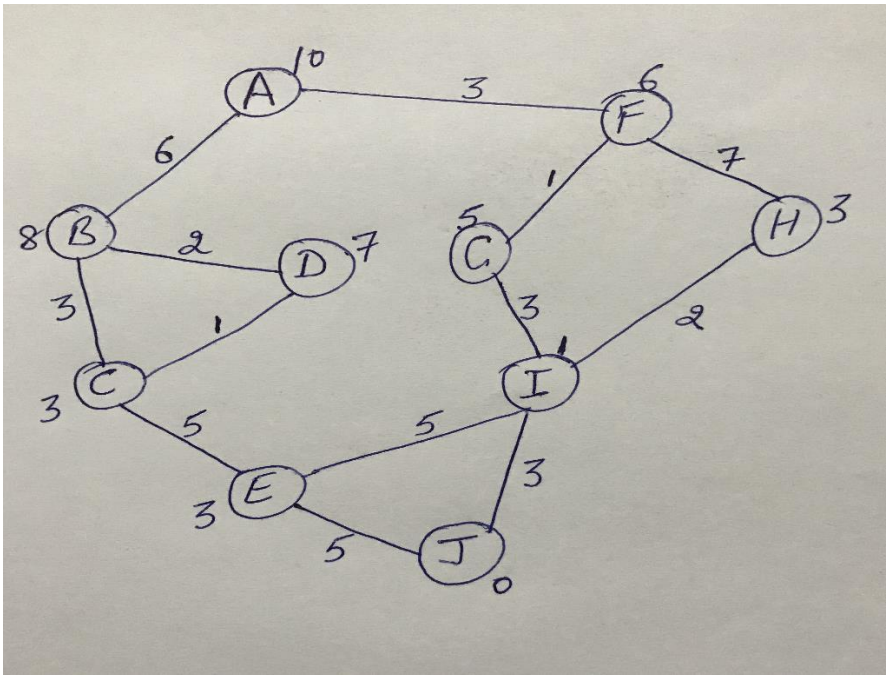
2. Describe various types of knowledge representation techniques with the help of an example for each representation.

   Consider the sentence "Someone walked slowly to the supermarket" and a lexicon consisting of the following words:
   Pronoun → someone
   Verb → walked
   Adv → slowly
   Prep → to
   Article → the
   Noun → supermarket
   Which of the following three grammars, combined with the lexicon, generates the given sentence? Show the corresponding parse tree(s). Also give reasons and justify, if the given sentence cannot be generated using a grammar.

| (A): | (B): | (C): |
|---|---|---|
| S → NP VP | S → NP VP | S → NP VP |
| NP → Pronoun | NP → Pronoun | NP → Pronoun |
| NP → Article Noun | NP → Noun | NP → Article NP |
| VP → VP PP | NP → Article NP | VP → Verb Adv |
| VP → VP Adv Adv | VP → Verb Vmod | Adv → Adv Adv |
| VP → Verb | Vmod → Adv Vmod | Adv → PP |
| Prep → Prep NP | Vmod → Adv | PP → Prep NP |
| NP → Noun | Adv → PP | NP → Noun |
| | PP → Prep NP | |

3. What do you understand by underestimation and overestimation of a heuristic function? Under what conditions $A^*$ gives optimal solution.

Consider the graph given below.




The numbers on the edges represent the distance between the nodes. The numbers written on the node n represents the heuristic value h(n), where n=A,B…J.

Find the best path from start state A to goal state J giving step by step description using

a) Greedy best first search algorithm
b) A* algorithm

4. A hungry monkey finds himself in a room in which a bunch of bananas is hanging from the ceiling. The monkey unfortunately, cannot reach the bananas. However, in the room there are also a chair and a stick. The ceiling is just the right height so that a monkey standing on a chair could knock the bananas down with the stick. The monkey knows how to move around, carry other things around, reach for the bananas, and wave a stick in the air. Formulate the problem and plan the best sequence of actions for the monkey to take to acquire lunch?

5. Consider the following sentences:

Everyone who loves all animals is loved by someone.
Anyone who kills an animal is loved by no one.
Jack loves all animals.
Either Jack or John killed the cat, who is named Pussy.
You can assume all cats are animals, if required.

a) Translate these sentences into formulae in Predicate Logic.

b) Convert these formulae to Prenex Normal Form.
c) Skolmize the formulae.
d) Use resolution algorithm to answer the question “Who killed Pussy”?

6. Differentiate between the following:
   a) Turing Test approach and Rational Agent approach to Artificial Intelligence
   b) Knowledge based systems and Expert systems
   c) Best first search and Breadth first search
   d) Hill climbing search and Iterative deepening search
   e) Substitution and Unification
   f) Model based agent and Goal based agent
   g) Problem solving using Search and Planning