B. E. Seventh Semester (Computer Technology) / SoE – 2014 – 15 Examination

Course Code : CT 1451 / CT 410 **Course Name : Artificial Intelligence**

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions are compulsory.
(2) All questions carry marks as indicated.
(3) Assume suitable data wherever necessary.
(4) Diagrams should be given wherever necessary.
(5) Q. 1 B 2 — For que. with multiple choice, answer written on page NA with highest number will be evaluated [if ans. is attempted for more than one time]

1. (A) (A1) What are different types of Intelligent agents ? Explain any one of them. 3

OR

(A2) Discuss any three properties of task environment. 3

(B) (B1) What are the different task domains of AI ? 3

(B2) "Can machines think ?" — the answer, in your opinion, is ———

(1) Yes. As an example we humans are also machines

(2) In principle yes but in practice we cannot build them because they would be too complex.

(3) Yes, AI researchers are increasingly demonstrating machines that do more and more things better than humans.

(4) No. Only human beings can think. Machines just follow instructions.

(5) Yes, if we can make breakthroughs in Machine Learning that will enable machines to learn all knowledge.

(6) Maybe. It depends upon what you mean by thinking

(7) Maybe. But how will one know that it is thinking ?

(8) Maybe. Computers can be good at calculation, and information retrieval, but may not be good at other things like creativity

(9) No. We often make decisions based on intuition and machines lack that

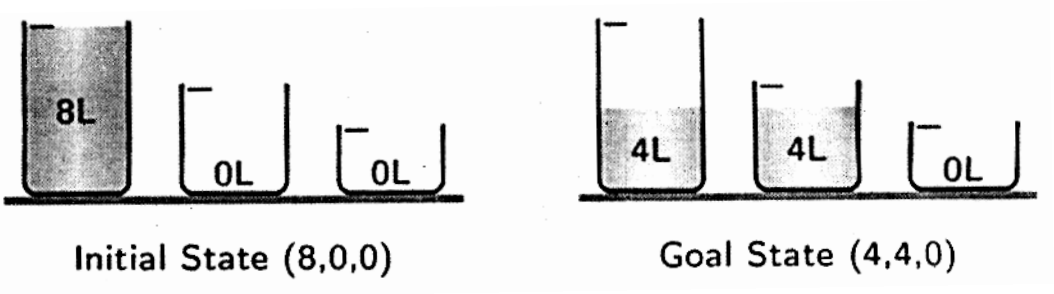
(10) No. Thinking involves introspection and computers cannot do that

(11) No. Thinking needs consciousness, and machines cannot acquire that

(12) No. Only living creatures can think. Machines are inanimate

(13) No. Only human beings can think. Machines just follow instructions. 3

(C) **Water jug puzzle :** An eight liter jug is filled with water, you are required to divide it into 4 + 4 liters. You may use two empty jugs of size 5 and 3 liters for this purpose. There is no other way of measuring water except by the size of the jugs, i. e., one can either empty a jug into another or fill another jug to its brim.



Model this puzzle as a state – space search problem. A state is represented by a tuple (A , B , C), where A is the amount of water in 8L jug. B is the amount of water in 5L jug and C is the amount of water in 3L jug.

The initial state is (8 , 0 , 0), if you transfer water from 8L jug to 5L jug we reach (3 , 5 , 0) state and if you transfer ther remaining water from 8L jug to 3L jug we reach (0 , 5 , 3) state. Now we can reverse these two transfers. The state – space expresses all valid states and their transitions. Build the state – space to answers the following questions.

(B1) Starting from (0 , 0 , 0) , what is the least number of transfers required to reach (4 , 4 , 0) ? 4

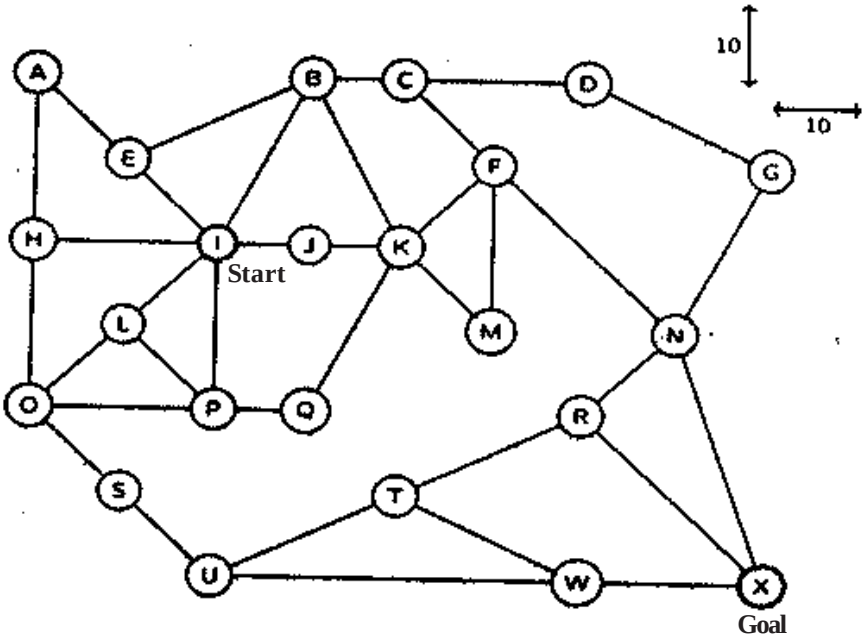
OR

(B2) Starting from (8 , 0 , 0), what is the least number of transfers required to reach (4 , 4 , 0) ? 4

2. Using Figure 2.1 answer following question :—

(A1) List the order in which the Best First Search algorithm explores the graph till termination. Use Manhattan distance as the heuristic function.

Figure 2.1



3

OR

(A2) Given the goal node X in Figure 2.1 label each node with its heuristic value. Use the Manhattan Distance as the heuristic function. What is the value returned by the heuristic function for the nodes A, I and X respectively ? 3

(B) Use Figure 2.1 to answer following questions

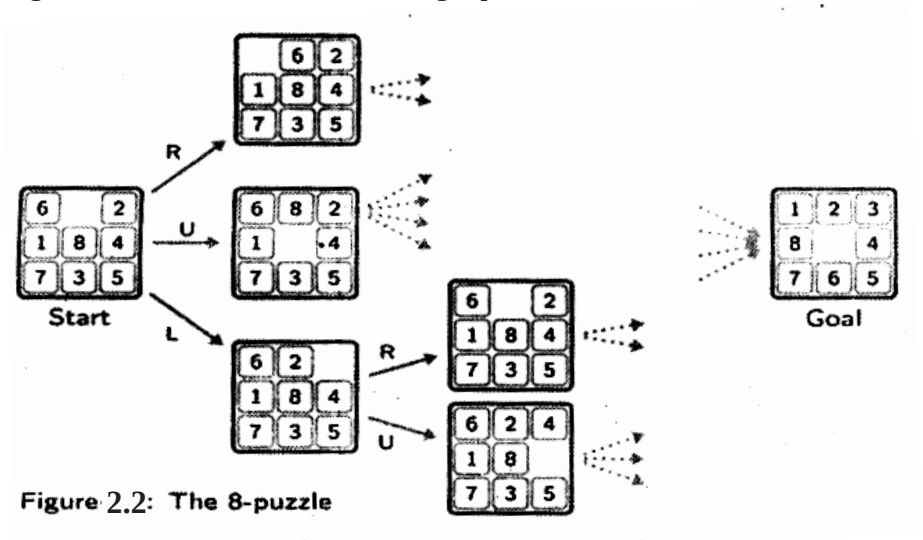


Figure 2.2: The 8-puzzle

(B1) Figure 2.2 shows an 8 – puzzle problem with the start and the goal state. The heuristic function h1 (N) counts the number of tiles (from 1 to 8) that are out of place, what is the heuristic value of the start state ? 3

OR

(B2) Given the start state in the above porblem, which move from the set {R, L, U} could be chosen by the Hill Climbing algorithm using the heuristic function h1 ? 3

(C) Use the below figure 2.3 for answering following question :—

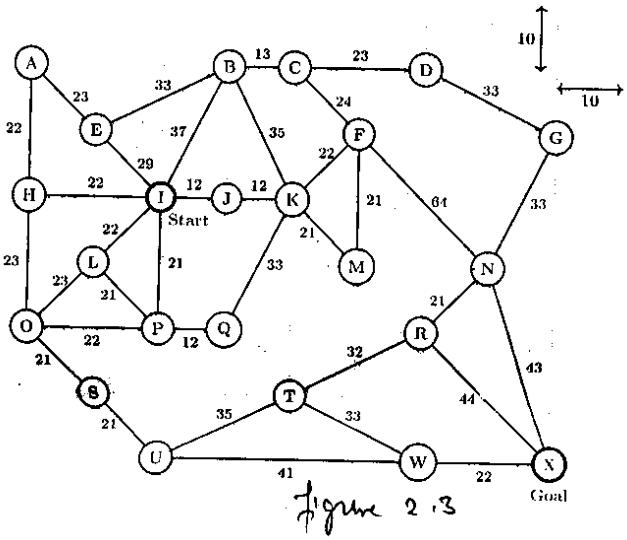


Figure 2.3

(C1) List the order in which the A* algorithm explores the graph till termination. Use Manhattan distance as the heuristic function. 4

OR

(C2) What is the path found (if any) by the A* algorithm in the previous question ? 4

3. (A) (A1) What are the issues in issues in knowledge representation ? 3

OR

(A2) Differentiate between Procedural Vs Declarative. 3

(B) (B1) Convert the following sentences to clausal form.

(a) $p /\backslash q \Longrightarrow r \backslash/ s$

(b) $p \backslash/ q \Longrightarrow r \backslash/ s$

(c) $\neg (p \backslash/ q \backslash/ r)$

(d) $\neg (p /\backslash q /\backslash r)$

(e) $p /\backslash q \Leftrightarrow r$ 3

OR

(B2) Given the premises $(p \Longrightarrow q)$ and $(r \Longrightarrow s)$, use Propositional Resolution to prove the conclusion $(p \backslash/ r \Longrightarrow q \backslash/ s)$. 3

(C) (C1) Apply CNF conversion on following facts and the conclusion : **If John is a light sleeper, then John does not have any mice**

Consider the following axioms :

(1) All hounds howl at night.

(2) Anyone who has any cats will not have any mice.

(3) Light sleepers do not have anything which howls at night.

(4) John has either a cat or a hound. 4

OR

(C2) Consider the following axioms :—

(1) Every child loves Santa.

(2) Everyone who loves Santa loves any reindeer.

(3) Rudolph is a reindeer, and Rudolph has a red nose.

(4) Anything which has a red nose is weird or is a clown.

(5) No reindeer is a clown.

(6) Scrooge does not love anything which is weired.

Convert above facts and conclusion into CNF. 4

4. (A1) If a problem – solving search program were to be written to solve each of the following types of problems, determine whether the search should proceed forward or backward with reason :

(i) water – jug problem (ii) block world 3

OR

(A2) Represent the following information as an equivalent semantic network :—
Shiva is a Tiger.
Tiger eat men.
Anil is man.
All men are human.
All tigers are animals. 3

(B1) What are different characteristics of PROLOG ? Explain. 3

OR

(B2) Write a PROLOG script for generating family relationship : Sibling and Cousin. 1.5 + 1.5

(C1) Discuss the factor affecting search problems in AI. 4

OR

(C2) Consider the following knowledge base :

$\forall x : \forall y$ cat (x) /\ fish (y) $\Rightarrow$ likes_to_eat (x , y)

$\forall x$ calico (x) $\Rightarrow$ cat (x)

$\forall x$ tuna (x) $\Rightarrow$ fish (x)

tuna (Charlie) tuna (Herb)

calico (Puss)

Convert these well formed formula (WFF) into a Prolog program. 4

5. (A1) Write a short note on Rule Based systems. 3

OR

(A2) Discuss Certainty factor its dominance in AI. 3

(B1) Consider the following set of Prepositions :—

Patient has spots

Patient has measles

Patient has high fever

Paient has Rockey Mountain Spotted Fever

Patient has previously been innoculated against measles.

Patient has recently bitten by a tick.

Patient has an allergy.

Create a network that defines the causal connection among these nodes. 3

OR

(B2) Elaborate Inductive Reasening. 3

(C1) What is non–monotonic reasoning ? Briefly explain the key issues addressed by non–monotonic reasoning. 4

OR

(C2) Write a note on

(i) Circumscription (ii) Truth Maintanance system. 4

6. (A1) Explain the block architecture of rule based expert system in detail. 3

OR

(A2) Discuss briefly the expert system shell. 3

(B1) Explain how learning occurs using Artifical Neurla Networks. 3

OR

(B2) Discuss any two application areas of expert systems. 3

(C1) Would it be reasonable to apply Samuel's rote – learning procedure to chess ? Why (not) ? 4

OR

(C2) Explain the following learning techniques in detail with suitable example :—

(i) Learning by anology (ii) Induction learning. 4