

MCA 4th Semester Examination, 2012

ARTIFICIAL INTELLIGENCE

PAPER— CS/MCA/402

Full Marks : 70

Time : 3 hours

Answer any five questions

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

1. (a) Write a prolog program to insert an element to the end of a list.
- (b) Write a Prolog program to calculate the number of elements in a list.
- (c) Write a Prolog program to find the factorial of a number n .

5 + 5 + 4

(Turn Over)

2. A farmer with his wolf, goat and cabbage arrives at bank A of the river they wish to cross. There is a boat at the bank A of river, which the farmer only can row. The boat can carry only two things including rower at a time. If the wolf is ever left with the goat, the wolf will eat the goat. Also if the goat is left alone with cabbage the goat will eat the cabbage.

(a) Solve this problem.

(b) Formulate the problem as state space search problem.

(c) Draw the implicit state space search graph.

(d) Implement and solve the problem optimally using Depth-First search technique. Is it a good idea to check the repeated states ? $3 + 3 + 3 + 5$.

3. (a) Discuss the performance of A^* algorithm when heuristic function either underestimate or overestimates the value of states.

(b) Prove that if a heuristic is consistent, it must be admissible. Construct an admissible heuristic that is not consistent. 7 + (4 + 3)

(a) Iterative Deepening A^* (IDA*) uses the cost function ($g + h$) to determine how much further to explore the search space (as opposed to iterative deepening depth-first search which used the depth of the tree). How much does IDA* increment the search cut-off after each iteration ?

(b) Critically compare Depth-first search, breadth first search, depth limited search, iterative deepening search and bidirectional search. 4 + 10

(a) What is Manhattan distance ? Is Manhattan distance admissible ? Explain with an example.

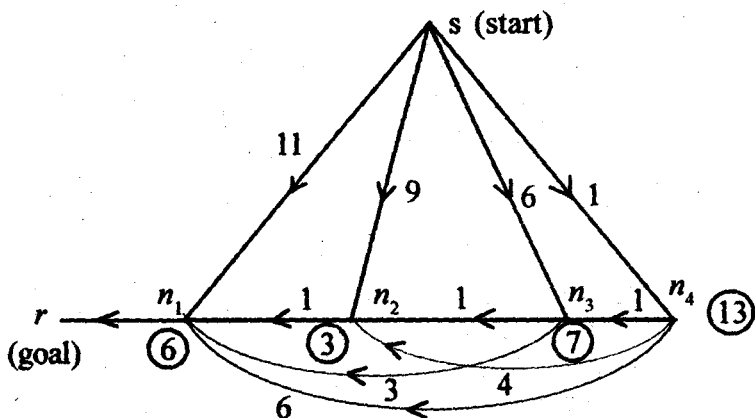
(b) Write a Prolog program to delete a particular letter from a list L . For example if

$$L = [a \ b \ a \ c \ a \ e]$$

and 'a' is the letter then the output will be

$$LI = [b \ c \ e].$$

6. (a) Algorithm A* is run on the search graph shown in the following figure. Trace the execution of the algorithm *indicating* the sequence in which nodes get selected for expansion.



- (b) By tracing, you reach an optimal solution, why?
- (c) Is it possible to change the heuristic values of some or all nodes, so that A* will output a non-optimal path to this search graph? If so, change the heuristic values and give the output solution path in this case. Otherwise, give reasons why it is not possible.

5 + 3 + 6

7. (a) Write a prolog program to reverse a given list.
- (b) Write a prolog program to delete last three elements from a list.

7 + 7

