

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**FACULTY OF APPLIED SCIENCE**  
**COMPUTER SCIENCE DEPARTMENT**  
**JULY EXAMINATIONS 2005**

**SUBJECT:** ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS  
**CODE:** SCS4101

**INSTRUCTION TO CANDIDATES**

Answer any five questions. Paper contains Seven questions.

**Time: 3 hours**

**QUESTION ONE**

In the algorithm for the uniform cost search, the cost of the arc from node  $i$  to node  $j$  is denoted by  $c(i,j)$ . The cost of a path from the start node to any node  $i$  is denoted  $g(i)$ .

The algorithm is as follows:

- i) Put the start node,  $s$ , on a list, called OPEN, of unexpanded nodes. If the start node is a goal node, a solution has been found. Otherwise, set  $g(s) = 0$ .
- ii) If OPEN is empty, no solution exists.
- iii) Select from OPEN a node  $i$  such that  $g(i)$  is minimum. If several nodes qualify, choose node  $i$  to be a goal node if there is one; otherwise, choose among them arbitrarily. Move node  $i$  from OPEN to a list, CLOSED, of expanded nodes.
- iv) If node  $i$  is a goal node, a solution has been found.
- v) Expand node  $i$ . If it has no successors, go to (2).
- vi) For each successor node  $j$  of node  $i$ , compute  $g(j) = g(i) + c(i,j)$  and place all the successor nodes  $j$  in OPEN.
- vii) Go to (2).

Explain this algorithm on the traveling salesman problem.

[10]

	A	B	C	D
A		4	6	10
B			7	10
C				5

Mileage chart

- b) Given the information:

Punch is a cat. All cats have four legs.

Write a knowledge base, and pose the relevant query to find out if Punch has four legs. [10]

### QUESTION TWO

Express the following in Prolog:

Brian owns Seaview. Seaview is a hotel. Brian is married to Mary. Brian employs Jane, and he employs Manuel. Employees are staff, and hotel owners are staff. Jones and Smith are guests. All staff serve all guests. [14]

Pose queries to find out

1. Who is a staff member [2]
2. Who is served by who [2]
3. Do any married people get served, or serve anyone [2]

### QUESTION THREE

Without using Prolog's built-in multiplication or exponential operations, define predicates for the following:

1.  $\text{mult}(x,y) = 0$ , when  $y=0$ ,  
     $= x+\text{mult}(x,y-1)$ , when  $y>0$  [10]
2.  $\text{exp}(x,y) = 1$ , when  $y=0$ ,  
     $= \text{mult}(x,\text{power}(x,y-1))$ , when  $y>0$  [10]

### QUESTION FOUR

write a specification for a predicate  $\text{position}(C,L,N)$  which is true if element C is at position N in the list L. [10]

what is the main advantage of each of the following representations over the others: frames, semantic networks and logic [10]

### QUESTION FIVE

from your experience with AI what are its shortcomings as a means of providing problem solutions? [10]

What area of research would you propose in AI as your contribution towards enhancing this field of study? [10]

**END OF QUESTION PAPER**