EASTERN UNIVERSITY OF SRI LANKA

Third Examination in Science – 2002/2003

CS 304- Artificial Intelligence

First semester (June, 2003)

Time: 2 hours

Answer All Questions

Q1) Consider the following problem:

A farmer has to cross a river with his fox, goose, and grain. His boat can only carry himself and one of his possessions, though. An unguarded fox will eat the goose and unguarded goose will eat the grain.

(a). Using a suitable state representation show how you would encode the initial state, the goal state and unsafe states.

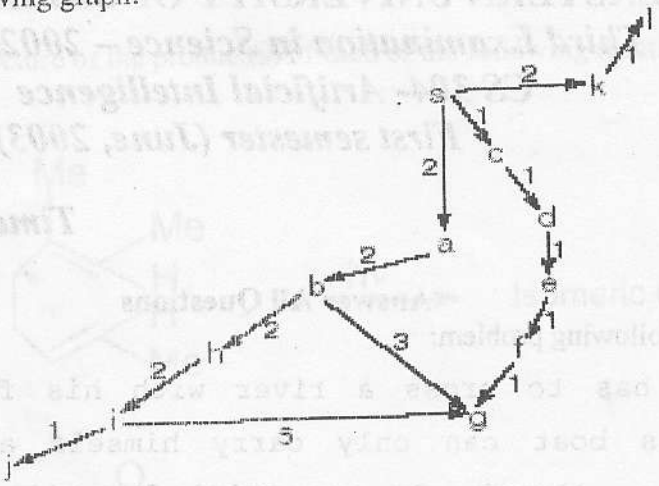
(b). Write down all the rules that might be applied to a state.

(c). Write down a breadth-first search tree in order to find a solution to this problem.

(d). Write down a solution to the problem guessing from the above tree, but as a sequence of rules that apply from a state to another.

(e). Suppose that the farmer has a rabbit and a bundle of carrots in addition to the above, and assume his boat can carry himself and no more than two of his possessions. Then show how you would represent unsafe states bearing in mind that unguarded fox will eat the rabbit too, and unguarded rabbit will eat the grain and the carrot. State briefly how you would find out such a problem will have a solution or not.

Q2) Consider the following graph:



Suppose the neighbours are given by the following relations:

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neighbours(s, [a, c, k]).
neighbours(a, [b]).
neighbours(b, [h ,g]).
neighbours(c, [d]).
neighbours(d, [e]).
neighbours(e, [f]).
neighbours(f, [g]).
neighbours(g, []).
neighbours(h, [i]).
neighbours(i, [j]).
neighbours(j, []).
neighbours(k, [l]).
neighbours(l, []).
```

Suppose the heuristic estimate of the distances to *g* is:

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h (a, 2).   h (b, 3).   h (c, 4).   h (d, 3).
h (e, 2).   h (f, 1).   h (g, 0).   h (h, 4).
h (i, 5).   h (j, 6).   h (k, 5).   h (l, 6).
h (s, 4).
```

Write down an A* algorithm to find a path from a given node to another. Applying your algorithm find out a path from *s* to *g*, and explain why this algorithm selected nodes in that order on the path from *s* to *g*.

Q3) Consider the following story:

Fido is a dog. Fido does not bark. Fido wags its tail. Dog is an animal. Mowser mews. Anybody that mews is a cat. Cat is an animal. A dog that wags its tail is friendly. Nobody will be afraid of anybody who is friendly and does not bark.

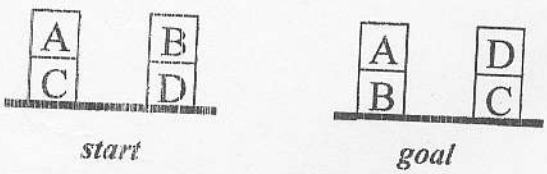
(a). Translate the story into predicate calculus expressions, and then translate them to clausal form.

(b). Using resolution refutation prove that there exist a cat and a dog such that the cat is not afraid of the dog.

(c) Represent the fact that Dogs bark as a predicate calculus expression, and change it to clausal form. Now prove that Fido is not a dog, and state briefly how you would handle such a situation in representing a general fact like "dogs bark" and a special fact like "Fido does not bark" which may cause a contradiction.

Q4) List down the five-main components of which most planning systems comprise. Express the **STRIPS** style operators **STACK, UNSTACK, PICKUP** and **PUTDOWN** in a more computation compatible form using clear definitions P (Precondition), D (Delete) and A (Add) and the predicates

The following figure shows a start state and a goal state to which the blocks should be transformed from the start state.



start *goal*

Describe briefly the goal stack planning method to change the arrangements, and state clearly the advantages and disadvanteaged of this method.

Solve the problem described by the above figure by your method.