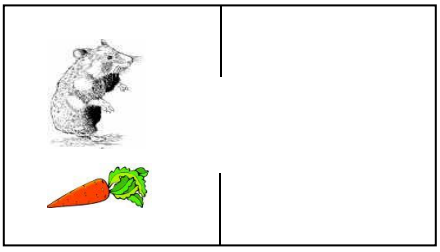
Dr. Susan Imberman Sample Midterm CSC 480

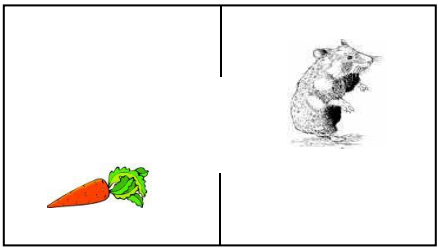
Name_____

For all questions write the answers inside the blue books. Any answers written on the question papers will not be accepted.

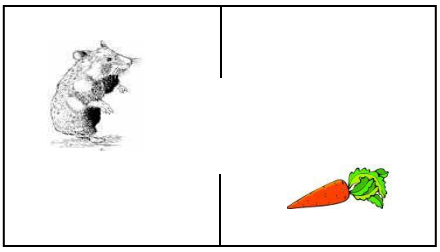
1. Hamlet the hamster has a deluxe, two room cage. There is an opening between the two sections of the cage.



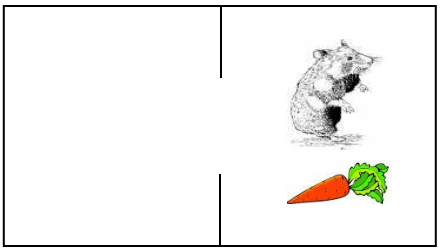
State 1



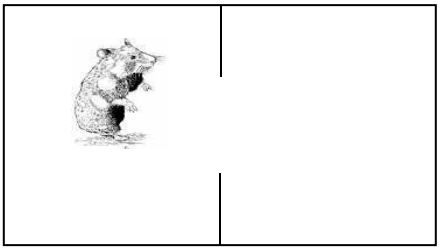
State 2



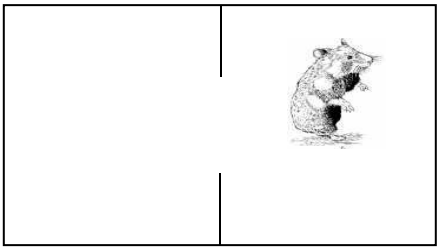
State 3



State 4



State 5



State 6

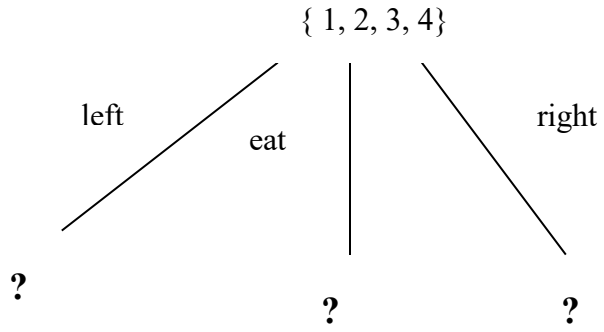
- Hamlet can move right, move left, and eat.
- When Hamlet eats, he doesn't stop until all the food is gone.
- If movement can bring him to the next room, it does so.
- Food can only be in one section of the cage
- Hamlet's goal is to find and eat all the food. Therefore the goal states are States 5 and 6.

a) (10 points)Assume Hamlet's world is accessible. This means he knows his current state, if he is in a goal state, and what each action does. If Hamlet is in State 3, find the shortest path to a goal state. Hamlet can check for repeated states, therefore any state that is repeated is not expanded further.

b) (2 points) What search method guarantees that Hamlet will find an optimal solution? Why?

c) (10 points) Assume the world is no longer accessible since Hamlet has gotten old and lost all of his perceptual abilities (he can't hear, see, or smell!). We now have a multistate problem. If we are given a set of initial states (State 1, State 2, State3, State 4) find a path Hamlet can take that will always guarantee he reaches his goal (State 5 or State 6 or both). Hamlet can check for repeated states, therefore any state that is repeated is not expanded further.

For example:



For each of the following multiple-choice questions select that answer that **BEST** completes the statement. (20 points)

3. A maze-navigating agent is “happy” when it has reached the end of the maze. This type of agent can **best** be described as a) utility based b) simple reflex c) intentional d) goal based e) nondeterministic

4. A sequence of actions causing you to move from one state to another is called a(n) a) problem formulation b) contingency problem c) path d) depth first search e) cost limited search.

5. The goal of a Turing test is to a) identify "thing A" as a computer or a human b)classify "Computer A" as being a computer as many times as "Human B" is classified as being a computer c) identify males and females d)see if Professor Imberman is intelligent e) identify a computer with 100% accuracy

7. A search algorithm that is complete a) searches the entire search space b) finds an optimal solution c) finds a solution d) has low search cost e) has no initial state

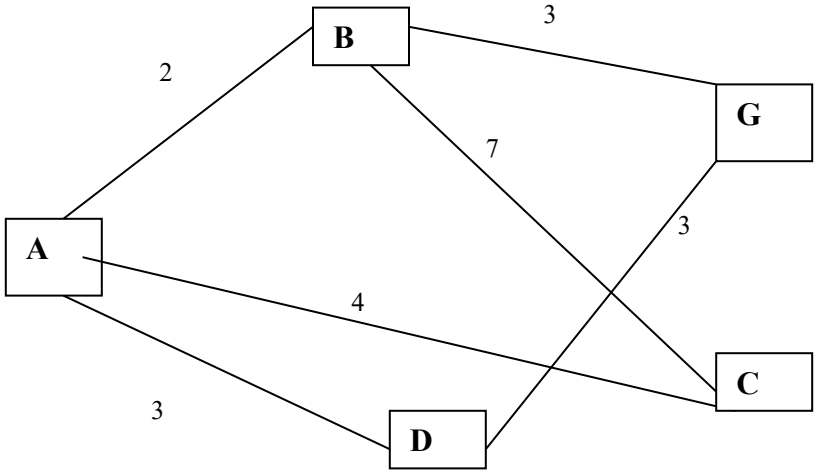
9. When the cost function in a cost limited search equals the depth of the search, cost limited search becomes equivalent to a)breadth first search b) A^* search c) iterative deepening d)greedy search e) heuristic search

10. Which of the following is **not** true of a simple lookup table agent? a) the number of percept sequences may be large b)tables can always be built within a small time period c)these agents are not autonomous d) they are effective for domains with a small number of percept sequences e) they can be implemented in simple reflex agents

12. a) (6 points) A softbot intelligent agent is designed to search the internet for the best priced digital camera. In class we discussed five different ways to describe an intelligent agent's environment. Discuss the softbot's environment using **only three** of these.

b) (8 points) Dr. Frankenimbermanstein has created an intelligent agent. The agent's job is to write computer programs, hence it is a computer programmer agent. Write a PEAS description for the computer programmer agent.

13. The following is a map of The Interesting College of the University of California (ICUC). The numbers represent the distances that students walk to get from building to building.



a) (10 points) Joe Thestudent wishes to walk from building A to building G. Since Joe is a freshman, he has no idea how to get there. He decides to use a uniform cost search taught to him by his brilliant, modest, computer science professor. Show how uniform cost search finds a solution for Joe. (In order to get full credit SHOW HOW THE FRINGE CHANGES!!)

b) (10 points) You are given that the straight line distance between each building and goal G is as follows:

Straight Line Distance
A to G = 8
B to G = 3
C to G = 2
D to G = 3

Show how greedy search finds a solution for Joe. (In order to get full credit SHOW HOW THE FRINGE CHANGES!!)

c) (3 points) Does greedy search guarantee an optimal solution? Why?

d) (4 point) How does greedy search differ from A^* search?

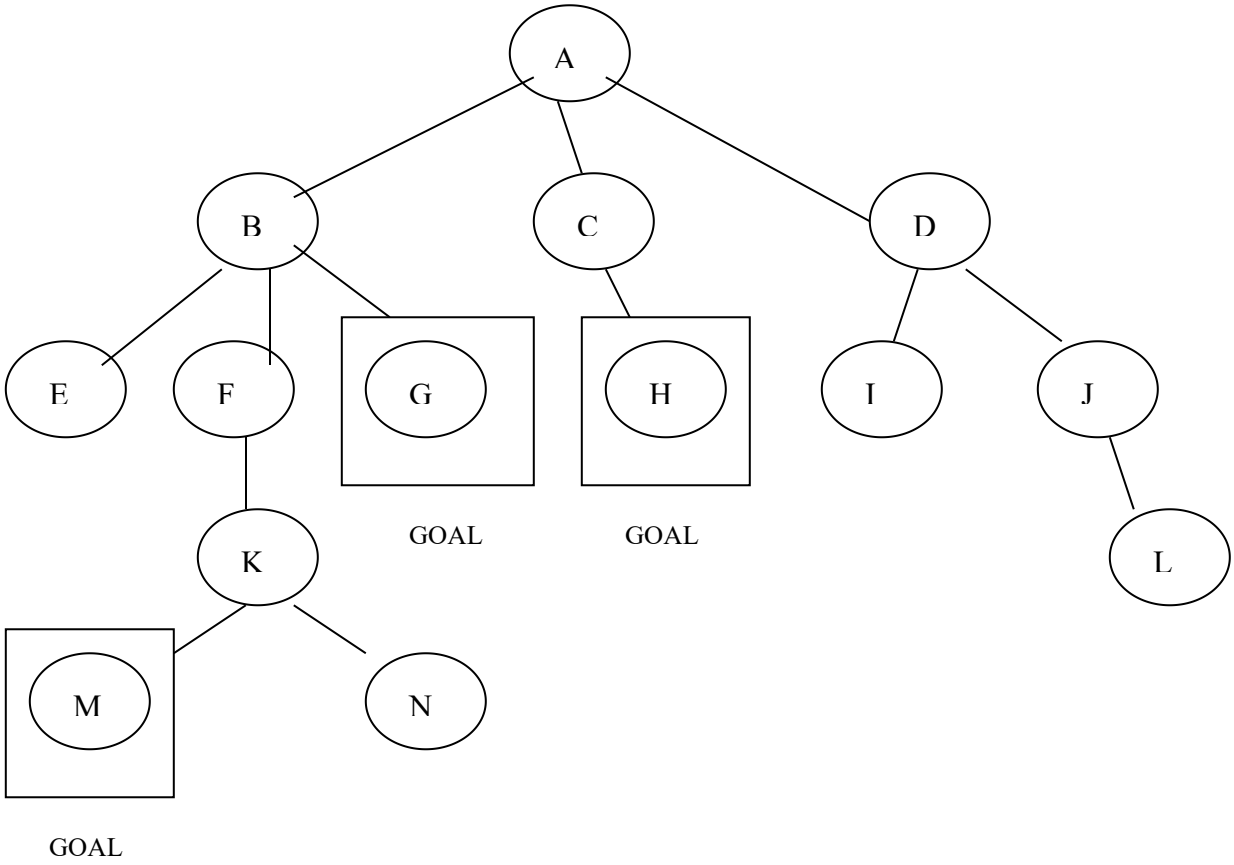
e) Why is straight line distance and admissible heuristic.

14. (10 points) In the 8 queens problem, the idea is to place 8 queens on a 8 X 8 chessboard so that no queen attacks another queen.

For the **8 queens** problem, compare breadth first search to depth first for each of the following criteria:

- Memory usage (3 points)
- Execution Time (2 points)
- Optimal solution? (3 points)
- Complete? (2 points)

15. (9 points) Given the following search space:



a) Which goal state would be found using depth first search from left to right?
b) Which goal state would be found using iterative deepening?
c) Which goal state would be found using breadth first search?

6. Tic tac toe is a children's game that is played as follows:
   1. One person is X the other is O
   2. X goes first
   3. Each person takes turns writing his mark on a 9 square playing board
   4. The person to be first to display 3 of his marks in a row wins.

Assume we are playing tic tac toe. The diagram shows the current state of the game. It is O's move. He is using minimax search to decide which path to choose in the game tree.

O is a **maximizing** player

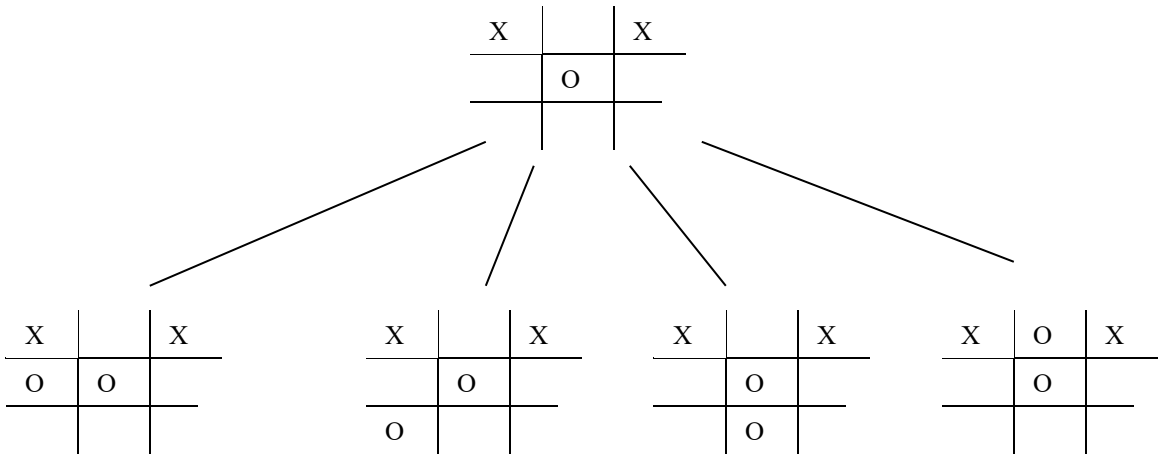
Taking into account symmetry, there are only 4 possible moves O can make

The evaluation function that O uses is:

$$E(n) = O(n) - X(n)$$

where O(n) stands for O's possible winning lines
and X(n) stands for X's possible winning lines

a) (8 points) Calculate the evaluation function to each of O's possible moves.
b) (2 points) Which choice does O make based on this evaluation function?
c) (2 points) Is this a good evaluation function? Why or why not? Is there a better move for O than the one minimax picks?



5. (10 points) The 4 queens problem can be solved using a genetic algorithm. We can represent the 4X4 chess board as a 4 element array with each cell containing the position of the queen in that column. For example, the array 4 1 3 4 represents the placement of queens as follows:

	Q		
		Q	
Q			Q

If the population has the following 4 individuals:

Individual A 4 1 3 4
Individual B 3 4 1 3
Individual C 3 1 2 3
Individual D 4 3 4 2

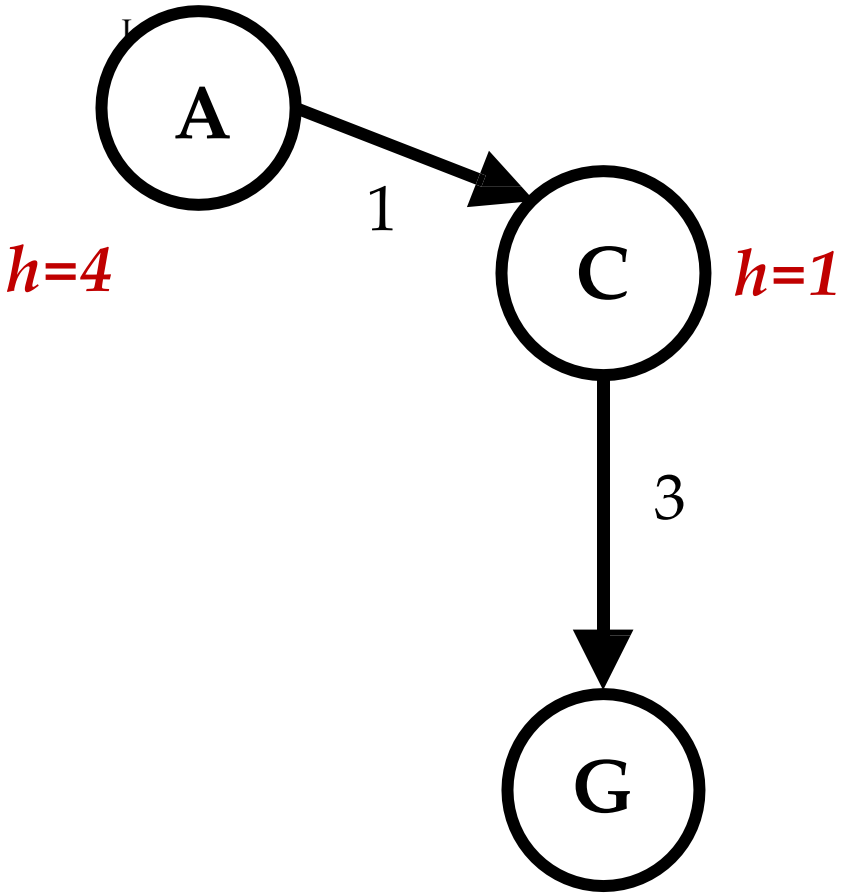
Which individuals survive into the next generation if we end up with the same number of individuals (4)? Show all work

- The fitness function you should use is the number of queens that are "safe", i.e. not being attacked, with an evaluation of 4 for the goal configuration. For example the fitness function for *4 1 3 4* evaluates to 1, since only the queen in the second column is safe. Hence *3 4 1 3* evaluates to 0, *3 1 2 3* evaluates to *0*, and *4 3 4 2* evaluates to *1*.
- Crossover occurs between queens 2 and 3
- There is no mutation
- Individual A mates with Individual B
- Individual C mates with Individual D

I. Explain how a search tree differs from a state graph.

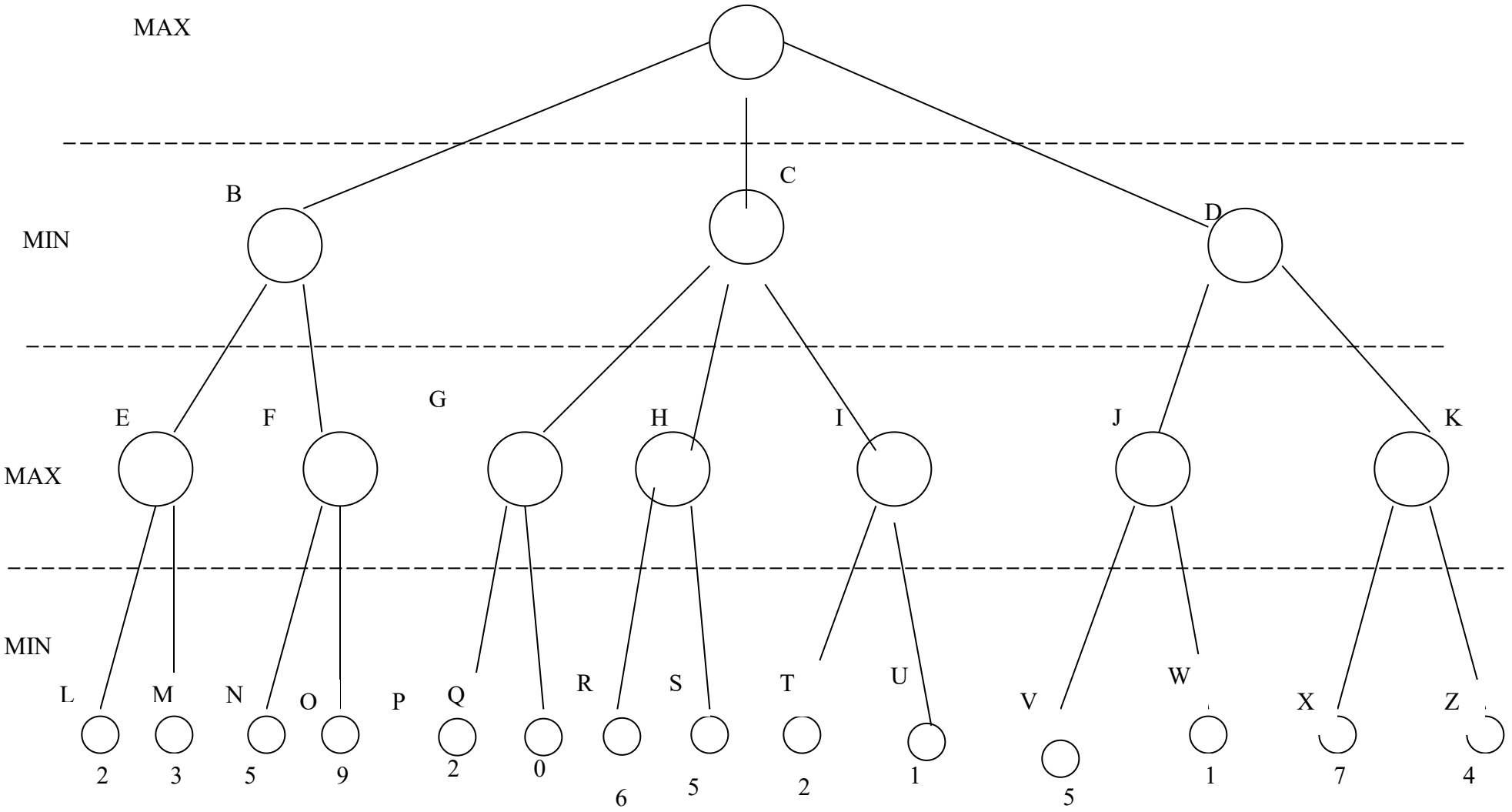
II. In games like chess, computer programs use an iterative deepening search strategy. Why?

III. Why wouldn't you use bidirectional search for the game of chess?



Given the graph above, is the heuristic function *h* consistent? Why or Why not?

6. (10 points) What path would the MINIMAX algorithm pick for player MAX? Show all work



6. (10 points) Which nodes would NOT be explored using Alpha Beta Minimax on the game tree below . Show all work for partial credit.