CSci 5511 Fall 2004

1st Midterm Exam

Monday October 11
75 minutes == 75 points
open book and notes

1. *15 points*
   Propose an admissible (and not trivial, i.e. $h(n) = 0$ is not a valid answer) heuristic for the Missionaries and Cannibals problem. Assume there is one boat which can carry a maximum of 2 people, and that in the initial state the same number of missionaries and cannibals are on one side of the river. Explain why your heuristics is admissible.

2. *15 points*
   Suppose you want to use A* with a heuristic function $h(n)$ which may under or overestimate the true cost of reaching the goal from state n. You know, however, that any overestimate is limited to no more than 10% of the true cost. Is there anything you can do to guarantee that the algorithm will find the optimal solution (if a solution exist)? If yes, explain how. If not, explain why not. Be precise.

3. *20 points*
   Answer these questions on search algorithms:

   1. What kind of search does Greedy Best-First Search emulate when used with $h(n) = -2 \times g(n)$? Explain your reasoning. Show how the search works using a simple example.
   2. Can you make A* behave like Breadth-First Search? If yes, explain how. If not, explain why not. Be precise and explain what you will use for $g(n)$ and for $h(n)$.

4. *15 points*
   Answer these questions briefly but precisely.

   1. Would using a pattern database be a reasonable heuristics for solving Traveling Salesperson Problems? Explain why (or why not)
   2. How would simulated annealing work if the temperature T is always fixed at 0?
   3. Explain briefly how a ridge in the search space may appear to be a local maximum to a hill-climbing algorithm.

TURN TO THE NEXT PAGE FOR MORE QUESTIONS

5. *10 points*
   Write a function, `add-dupl`, to duplicate all occurrences of a given element in a list. It should work like this:

```
(add-dupl 3 '(2 3 4 1 3)) ==> (2 3 3 4 1 3 3)
(add-dupl 3 '(2 3 3 1)) ==> (2 3 3 3 3 1)
(add-dupl 5 '(2 3 4 1 3)) ==> (2 3 4 1 3)
```

   Assume the list is a flat list, and the element to be duplicated is atomic (either a number or a symbol).

YOU REACHED THE END OF THE EXAM