CS 335: Search

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1 TASK

You must solve the problems in this homework. This homework has 120 points total. Undergraduates only need 100 points to obtain an A. Graduate students must get 120 points for an A.

1. Cats and Dogs. Three cats and three dogs are on one side of a river, along with a boat that can hold one or two animals. Find a way to get everyone to the other side without ever leaving a group of cats in one place outnumbered by the dogs in that place. The boat can only move if at least one animal is on board.
   - Formulate the problem precisely:States, Actions and Transitions. Draw a diagram of the complete state space (20pts)
   - Implement and solve the problem using a search algorithm (20pts). This means: write an algorihtm to solve the problem in pseudocode, then trace it –showing your results at each step– and show the final solution.
   - Why do you think people have a hard time solving this puzzle? (20pts)
2. Consider the state space where the start state is number 1 and each state k has two successors: Numbers $2k$ and $2k + 1$.
   - Draw the portion of the state space for states 1 to 15 (20pts)
   - Suppose the goal state is 11. List the order in which nodes will be visited for breadth first and depth-limited search with limit 3 (20pts)
   - Call the action going from k to $2k$ Left and the action going to $2k+1$ Right. Can you find an algorithm that outputs the solution to this problem without any search at all?(20pts)

2 MUST HAVE

- All drawings must be done in a computer. No hand-drawn or hand-written work.
- States can be represented by a vector by enclosing variables within $<$ and $>$. For example, a vacuum cleaner that knows the room it is in, and whether it is clean or dirty can have a state like $< Room : A, Dirty >$.
- Pseudocode must be well indented.
- Any reponse must be well funded. Explain your reasoning.

3 SUBMIT

ONE PDF (not Word (docx), Pages, Libre Office, text, etc.) with all of your answers. If you are working on Word, to make a PDF you should select "Save As" from the "File" menu and select PDF on the filetype drop down box.