CS4700 Foundations of Artificial Intelligence
Fall 2015
Assignment 1 (120 pts total)
Due Monday, September 28, 10pm CMS.

You can discuss the hwk with other students but you need to write up the solution in your own words. Also, you can consult the textbook and the lecture slides but you are not allowed to search for a solution on-line.

1. **General AI (15 pts.)** Exercise 1.4 of Russell & Norvig (3rd edition).

2. **General AI (15 pts.)** Exercise 1.8 of Russell & Norvig.

3. **General AI (15 pts.)** Exercise 1.9 of Russell & Norvig.

4. **General AI (15 pts.)** Exercise 1.11 of Russell & Norvig.

5. **Agents (20 pts.)** Exercises 2.2 of Russell & Norvig.

6. **Uninformed search (20 pts.)** In the water-jug puzzle, we are given a 3-liter jug, named *Three*, and a 4-liter jug, named *Four*. Initially, *Three* and *Four* are empty. Either jug can be filled with water from a tap, *T*, and we can discard water from either jug down a drain, *D*. Water may also be poured from one jug into the other. There is no additional measuring device. We want to find a sequence of operations that will leave precisely two liters of water in *Four*. (First, convince yourself that this can be done!)

   a) **(10 pts.)** Formulate the water-jug problem as state-space search problem. That is, define the set of states, the operators, the start state, the goal test, and the path cost.

   b) **(10 pts.)** Draw a graph of all the distinct state-space nodes that are within three moves of the start node (state), label each node by its state description, and show at least one path to each node in the graph, by labeling each arc by the name of the appropriate operator. In addition to these nodes, draw also all of the nodes and arcs (properly labeled) on the path to the solution.

7. **Commonsense reasoning (20 pts.)** Read the review article by Ernest Davis and Gary Marcus on Commonsense Reasoning linked from course web page. Answer the following:

   a) **(5 pts.)** Give two examples of human reasoning that would not be commonsense.

   b) **(5 pts.)** On p. 93, Winograd Schemas are discussed (see footnote a). See http://cs.nyu.edu/faculty/davise/papers/WS.html for a list of examples. Compose two examples of your own, with answers. If there is some chance the answer could be obtained with some Google searches, show why that is not the case. See example 28, about whether uncles tend to be “older” or not, in the list on the web page.

   c) **(5 pts.)** The article discusses the phenomenon of “long tailed distributions” underlying many AI domains. Explain how this “helps” and how this hinders progress in AI. In particular, how does this issue relate to commonsense reasoning.

   d) **(5 pts.)** A good example of the risk of a household robot without commonsense sweeping up the cat is given on page 101. Give another example of the risk a household robot without commonsense could pose.