Homework **Fall 2014**
COMP150 AML - Learning, Planning and Acting in Complex Environments
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Homework Assignment 2

The goal of this assignment is to get you familiarized with the RDDL system and simulator as reviewed in class.
The assignment is due by Wednesday October 22, 1:30pm - in hardcopy (in class) and electronically (via provide).

1 Background

For this assignment you will need to obtain a copy of the RDDL code. There are two options for this. You can get the RDDL simulator code directly from the site linked on the web page. Alternatively, we have packed the code for you in a way that makes this assignment easier. In particular the course web page has a zip file which includes the system. Instructions for using this pre-packaged form to change the policy and run the simulator are in the README file.

In addition, the course web page includes a few more files:

- The README file
- The elevators domain file (a copy from the distribution for your convenience).
- An elevator instance that we picked for this assignment. The elevator instance includes 10 floors and 2 elevators and, in the initial state, one elevator is at the bottom floor whereas the other elevator is at the top floor.
- A random policy (modified from the original distribution).
- A description of the interfaces for use in policy construction.
- An example policy for the elevators domain (where you can see the interfaces exercised).
- A template policy file for you to fill in.

2 Your Task

1. Use the given client-server code to run and evaluate the performance of the random policy (which is supplied on the course web page) on the given instance in the elevator domain. This records the results in a corresponding log file. Note that horizon ($h = 200$) and discount ($\gamma = 1$ i.e., no discount) are specified in the instance. For evaluation use 30 runs and calculate the average and standard deviation in the total reward.

2. Implement the following “round robin” policy in your own policy file, compile it, and evaluate it in the same manner. In particular, each elevator goes in a loop following its current direction until it hits the top or bottom floor where it changes direction. Whenever the elevator is at a floor where there is a person waiting to go in the same direction the elevator opens the door so as to let them in. The elevator keeps on moving in its current direction even if it is empty and regardless of where people are waiting in the current state. Although the instance mentioned above has only two elevators you should design your algorithm so that it works for any number of elevators.

3. Implement your own heuristic policy for the same task and evaluate it. Try to get the best policy you can within a reasonable amount of time. Can you beat the round robin policy? As in the previous task, although the instance mentioned above has only two elevators, you should design your algorithm so that it works for any number of elevators.

4. After implementing and evaluating the 3 policies perform some exploratory experiments to see how the algorithms behave with changing instance characteristics. In particular, produce a few variant instances where you change the number of floors, the number of elevators and arrival rates and evaluate the algorithms on these.

   Write a brief report with your results on the given instance (3 averages ± standard deviations) and any observations you have for the domain and policies. In addition comment on the relationship between the performance of the policies and whether (and how) it changes with changing instance characteristics.

3 Submitting Your Assignment

- You should submit the following items both electronically and in hardcopy:
  (1) Your code for the assignment which includes the two policy files in items 2 and 3 (please write clear code and document it as needed).
  (2) The report from item 4.

- **Please submit a hardcopy** in class.

- **Please submit electronically using provide**: Put all the files from the previous item into a zip or tar archive, for example call it `myfile.zip`. Then submit using
  `provide comp150aml a3 myfile.zip`.