# Search and Planning

Exercise 1 (8 points)

A very distracted robot R has two dates (X0;X1) on the same night. Additionally, it has made reservations at two restaurants (Re3; Re9). However, it has sent the wrong address to its dating partners, and as a result: (1) X0 that was meant to be at Re9 is at Re3, whose food does not meet the taste of X0 and (2) X1 that was meant to be at Re3 is at Re9. Therefore, the robot must find a way to have dinner with X0 in Re9 and with X1 in Re3. Obviously, the robot has to be careful because the two partners should never see each other. Fortunately, both X0 and X1 like shopping and S8 is a wonderful shopping mall, where they can spend one hour having fun (especially with robot credit card in their hands). The robot has a car that allows it to drive the dates at each of the three locations in the environment. The figure shows the initial state.
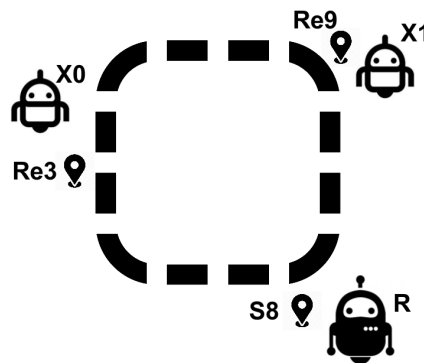
(a) Model the problem in PDDL by defining the problem and domain file, taking into account only the actions to be done by the robot.

(b) Define a plan that achieves the goal.

(c) Show the forward planning process, by describing 4 steps in a state space exploration (for each step, you have to show the current state, the applicable actions and the state resulting from the application of each applicable action); at each step you have to choose only one successor state, according to the above presented plan.

(d) Discuss the backward planning procedure. Show the first step of backward planning, starting from the goal, by specifying the actions that would lead to the goal and the states that would allow them to be executed.

Exercise 2 (4 points)

Discuss the difference between state-space and plan-space planning. Describe the basic approach to plan space planning (POP).

Exercise 3 (4 points)

Describe the Iterative Deepening Search (IDS) algorithm. What are the properties of IDS (completeness, optimality, time and space complexity).