PDDL

This assignment is **individual**.
Deadline: The deadline is **January 8, 2024, 16:59** and it is strict.
Submission: Please, submit your solution in Canvas as a single text file.

1 PDDL

In this exercise, we are going to look into encoding a planning domain using PDDL. Consider the scenario where a student needs to attend some lectures at different KTH buildings. Let the lectures be taught at different times and, possibly, in different buildings. We are now concerned with the logistics associated with the attendance of these lectures. Furthermore, we want every student to be well-fed, so we expect them to be having lunch in between morning and afternoon lectures.

In the first problem you will explore, there are 4 buildings where the students can attend a lecture, one of which also has a restaurant inside. The lectures are divided following the time at which they are taught, either in the morning or in the afternoon. Before attending an afternoon lecture a student must have had lunch first.

The four basic actions to solve this problem are:

- **Move:** a person moves from a building to another;
- **Have lunch:** a person has lunch in a building with restaurant;
- **Attend morning lecture:** a student attends a morning lecture;
- **Attend afternoon lecture:** a student attends an afternoon lecture.

1.1 Defining the Domain

Download the package **student-life.zip** from Canvas. Your task is to complete the file **student-life-domain.pddl** to formalize the planning domain. The syntax used in the file is a standardized syntax used in state-of-the-art PDDL solvers, such as in this on-line editor and solver [2]. There are numerous examples of problems encoded in this syntax under the Import tab in this tool. There are also numerous tutorials on this syntax, for instance this one [1]. The relevant tab to explore there is PDDL Background.

Note that the file student-life-domain.pddl will only contain the definition of the *domain. The problem instance* including the definition of objects in the world, the initial state and the goal specification are given in a separate file. You can find one problem instance for the domain in this exercise in **problem-1.pddl**, illustrated in Figure 1.1).

In this scenario, we want to plan the day of a single student who has to attend a few lectures.

Your task is to complete only the code for each of the four actions, which involves writing the parameters, the precondition, and the effect. Note that each action comes with a comment that gives more details than the brief domain introduction above. All the predicates you are allowed to use are already given in the file. You will not need to define any requirements or functions. Figure 1.1 show the campus network and initial state of the objects in the world. Table 1.1 provides you with information regarding which teacher teaches which lecture.

You can use the above mentioned on-line editor and solver [2] to see whether your domain definition allows finding a solution to problem-1.pddl. It should one although it may not be most efficient (don't worry about that).

Please, submit your solution to Exercise 1.1. as a text file student-life-domain.pddl in PDDL1.1 assignment. Make sure that your submitted file does not contain syntax errors.

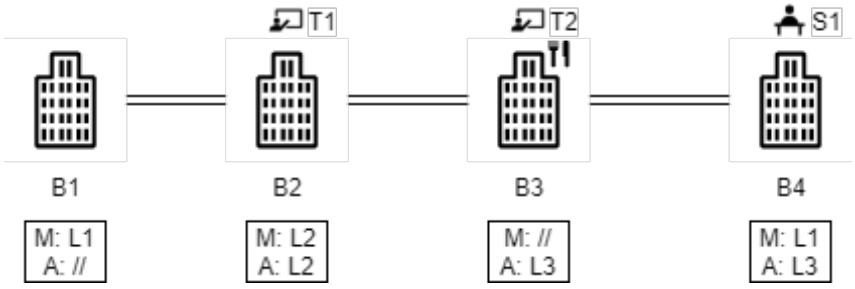

Figure 1.1: Campus set-up and initial conditions of the problem. B_i are the buildings: keep in mind that only the connections shown in the figure are available (i.e. in this set-up people can not move directly from B1 to B3). In the box below each building you can find information in regard to the lectures that take place in that specific building in the morning (M) or in the afternoon (A). T_i and S_i stand for teacher and student. Finally there is an icon showing which building also contains a restaurant.

Teacher	Lecture
T1	L1, L2
T2	L3

Table 1.1: Table showing which teacher T_i teaches which lecture L_i.

1.2 Designing a Problem

In the previous exercise, you defined the planning domain and tested it in a given problem instance. Now the task is to adapt problem-1.pddl in order to reflect the objects and initial conditions defined in Figure 1.2 and Table 1.2.

Your goal is to plan the day of four different students that need to attend different lectures: in Table 1.3 you can find the information regarding which lectures must be attended by each student. Furthermore, you should keep in mind that part of the goal is that both teachers and students should have lunch.

Submit your solution to Exercise 1.2 as a text file problem.pddl in PDDL1.2 assignment.

1.3 References

[1] A PDDL 2.1 tutorial, `https://www.cs.cmu.edu/afs/cs/project/jair/pub/volume20/fox03a-html/JAIRpddl.html`, Accessed: 2018-09-26

[2] An online PDDL editor and solver, `http://editor.planning.domains/`, Accessed: 2021-02-22

Teacher	Lecture
T1	L1, L3
T2	L2, L4
T3	L5, L6

Table 1.2: Table showing which teacher T_i teaches which lecture L_i.

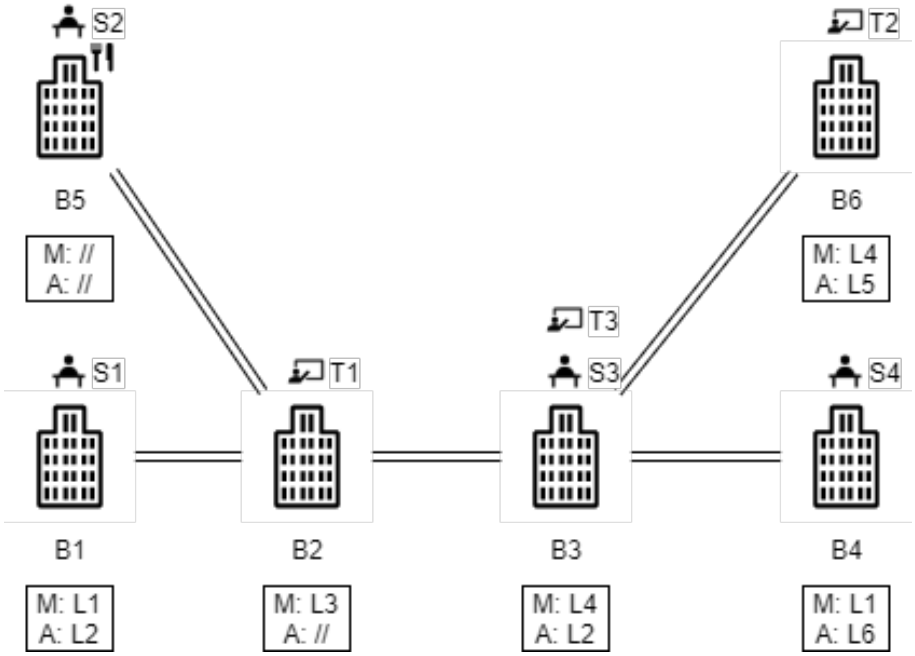

Figure 1.2: Campus set-up and initial conditions of the second problem to design.

Student	Lecture
S1	L1, L6
S2	L2, L3
S3	L4, L5
S4	L5, L1

Table 1.3: Table showing which student S_i must attend which lecture L_i.