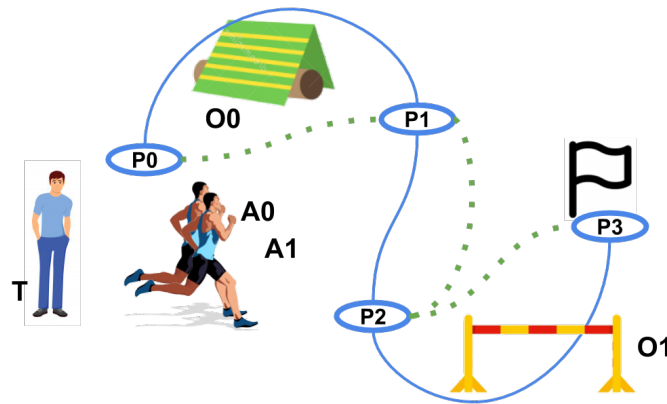


Search and Planning

Exercise 1 (8 points)

Two athletes $A0, A1$ and trainer T are preparing for a competition in the training setting shown in the figure. They start in $P0$ and they have to be all in $P3$ in order to finish a trial. Connections among places are highlighted by two paths: the athlete path (solid) and the trainer path (dotted). $A0, A1$ can only use the athlete path and they must jump over the first obstacle $O0$, and then crouch and pass underneath the second $O1$. T instead, can only walk the trainer path. Agents cannot move simultaneously, only one agent can move at each step from one place P_i to the next place in the path. Moreover, the trainer has to stay one or more steps ahead, to check the performance of the athletes, thus $A0$ and $A1$ must never anticipate T (i.e. they are allowed to be only in places already visited by T). Athletes and trainer can be all together in the same location of the training path. For example, if T is in $P2$ then $A0, A1$ can be in $P0, P1$ or $P2$. The athletes can take steps in arbitrary order (i.e. they can always agree on who makes the next step).



- Model the problem in PDDL by defining the problem and domain file.
- Define a plan that achieves the goal of having the athletes and the trainer in $P3$, given the initial configuration in the figure with all the agents in $P0$; show each state in the plan, by specifying the initial state and the changes caused by each action.
- Draw the first 5 levels of the tree generated by forward search, showing all the actions applicable at each of the states that are traversed in the plan found in (b), without further expanding the states that do not belong to the plan.

Exercise 2 (4 points)

Discuss the notion of local search, in particular describe genetic algorithms and provide an example.

Exercise 3 (4 points)

Define the notion of *belief state* and make an example. Discuss how the uncertainty on the state affects the representation of plans and the planning process.