

Assignment 6

SE1 Proseminar, winter 2007/2008

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Exercise 1

Implement the following command:

```
TransportItem <(xs,ys)> <(xd,yd)> <speed> [horizontal/vertical]
```

The parameter $\langle(xs,ys)\rangle$ represents the coordinates of the grid vertex where the transportation starts, and $\langle(xd,yd)\rangle$ are the coordinates of the grid vertex where the transportation ends. $\langle speed \rangle$ is a natural number indicating how many seconds it takes the robot to traverse one grid segment. We assume that x is the horizontal coordinate, y the vertical coordinate, and the point of coordinates $(0,0)$ is the lower-left corner of the floor. To execute the command, the system should first designate a transport robot to carry out the job. The robot must travel between its current position and the point $\langle(xs,ys)\rangle$, then continue (without stopping) from $\langle(xs,ys)\rangle$ to the point $\langle(xd,yd)\rangle$. In each travel, the robot should always try to move *toward* the target point. It will move *away* from the target point only to avoid colliding with a machine. The optional parameter of the command specifies the preferred direction of movement of the transport robot. If, for example, it is *horizontal*, then the robot should always move horizontally when it has a choice. In other words, the robot moves vertically only when this is strictly necessary (e.g., to avoid a machine, or to reach its destination). If the optional parameter is not present, then there is no preference (any free path can be used, on which the robot tries to move toward the target).

The selection of the transport robot should be done as follows:

- If no transportation robot is powered on, then the command must first power on such a robot. In this case, the initial coordinates of the robot are $(0,0)$.
- If one or more transportation robots were powered on before this command was issued (by PowerOn commands or a previous TransportItem command), then one of these robots is selected, which has a shortest free path in the grid between its current position and the starting point of the operation. The initial coordinates of the robot for this operation are given by its current position in the grid.

The command should output the following information:

- The id of the robot and its initial coordinates.
- The duration of travel between the initial coordinates and the starting point of the operation.
- The duration of travel between the starting and ending points given as parameters to the command.

After executing a TransportItem command, the robot remains at the destination point until it is selected to execute a subsequent TransportItem.

You should use the **Strategy** design pattern to implement the traveling preference.

Examples for the floor layout shown in Figure 1:

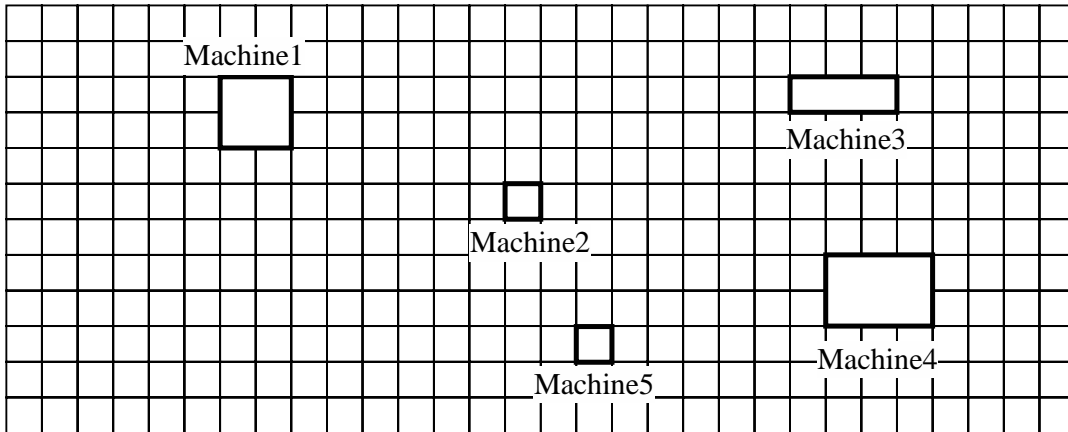


Figure 1. Example of layout

```
>TransportItem (6,3) (10,11) 2 vertical
Robot: TR1
Initial coordinates: (0,0)
Duration to the starting point: 18s
Duration of the transportation: 24s
```

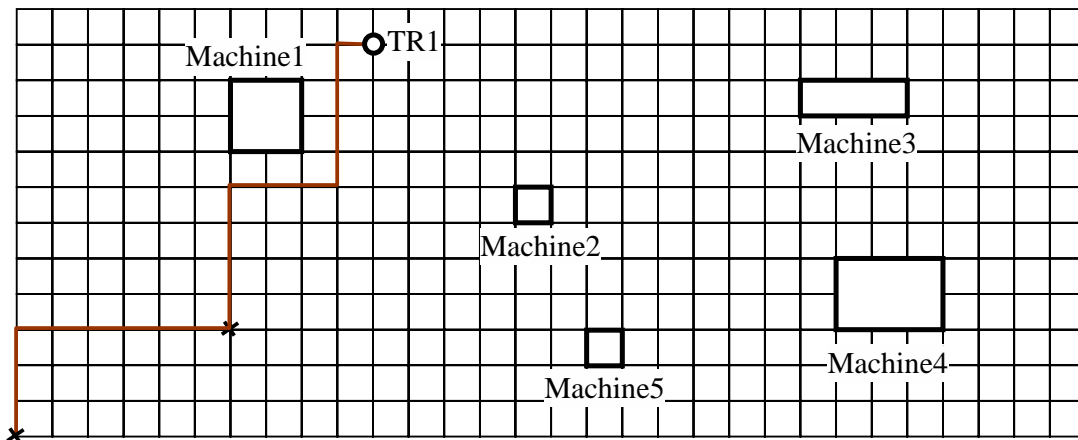


Figure 2. The robot path for the first command

```
>PowerOn TransportRobot
Id: TR2
Initial coordinates: (0,0)

>TransportItem (14,2) (22,3) 3 horizontal
Robot: TR1
Initial coordinates: (10,11)
Duration to the starting point: 45s
Duration of the transportation: 33s
```

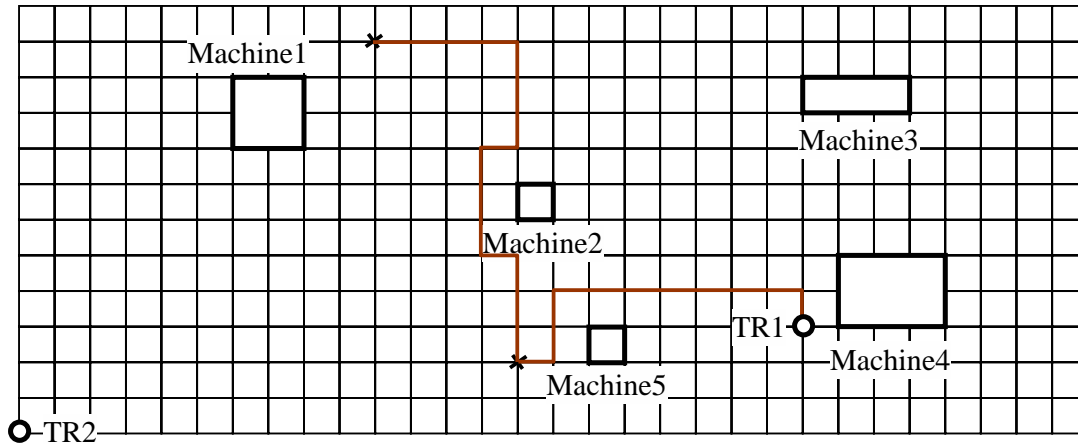


Figure 3. The robot path for the second command

```
>TransportItem (3,9) (9,9) 4 horizontal
```

```
Robot: TR2
Initial coordinates: (0,0)
Duration to the starting point: 48s
Duration of the transportation: 40s
```

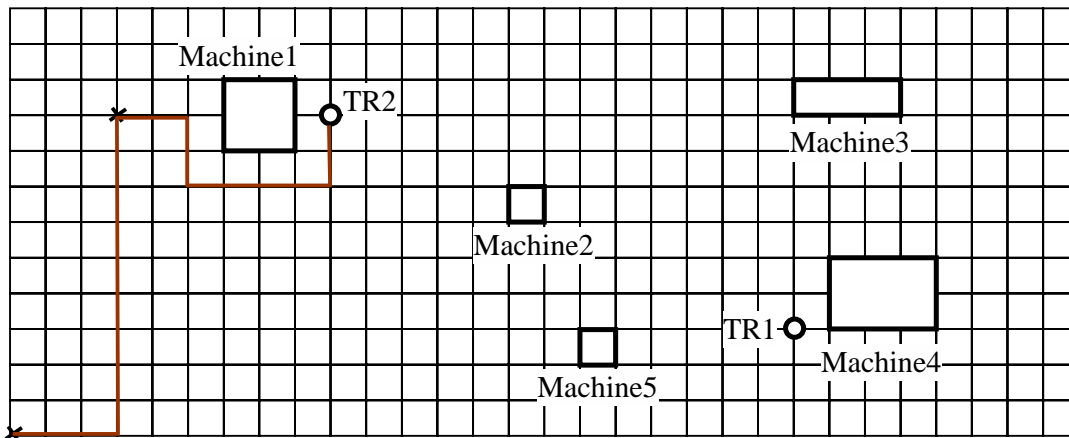


Figure 4. The robot path for the third command

The checking interface for this assignment should be the same as for the previous assignment.