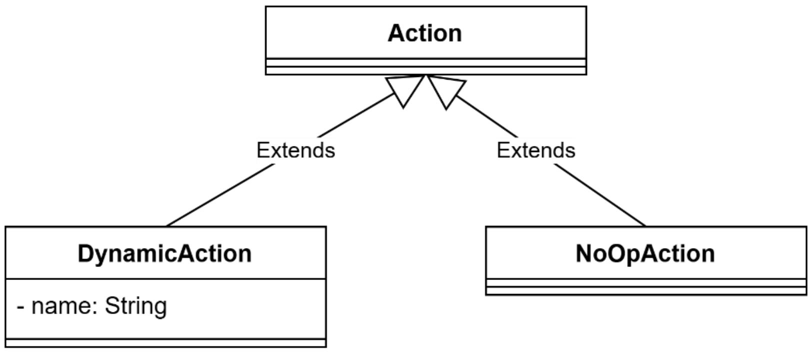
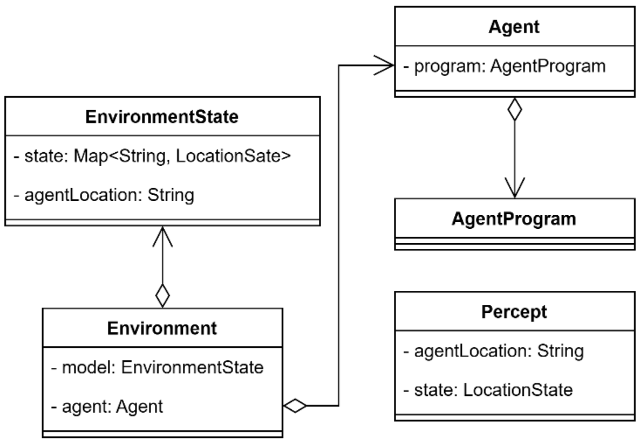
Lab #1: Intelligent Agents

The main aim of the lab is to implement a simple reflex agent and a model-based agent for a vacuum cleaner (single agent).

For a given class diagram as follows:



DynamicAction represents for **SUCK**, **LEFT**, and **RIGHT** actions. NoOpAction represents for **NO_OP** action. Other classes:



Task 1: Implement the method named ***execute()*** in **AgentProgram** class for an **agent** working in the 2 squares [A, B] environment:

In **AgentProgram.java**:

```java
public Action execute(Percept p) {//Percept: location and status/state
      //TODO
      return null;
}
```

Pseudocode is described in the following figure.

```
function REFLEX-VACUUM-AGENT([location,status]) returns an action
    if status = Dirty then return Suck
    else if location = A then return Right
    else if location = B then return Left
```

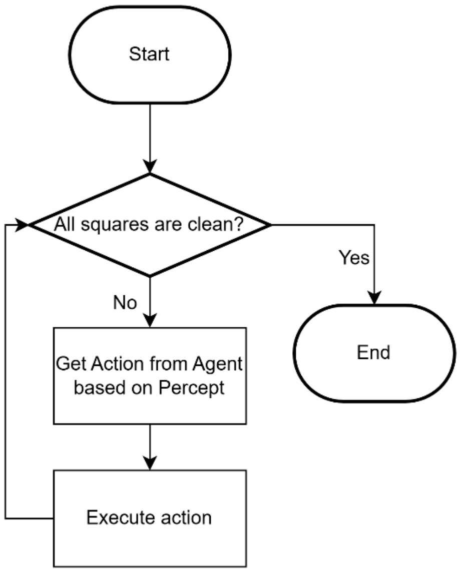
Then, implement the following methods in **Enviroment.java**: **Environment** has an **EnvironmentState** object as a model for tracking the states of locations in the environment.

```java
// add an agent into the environment
public void addAgent(Agent agent, String location) {
	// TODO
}

// Update environment state when the agent does an action
public EnvironmentState executeAction(Action action) {
	// TODO
	return envState;
}

// get percept<AgentLocation, LocationState> at the current location where the agent is in.
public Percept getPerceptSeenBy() {
	// TODO
	return null;
}

// This method is described in the following figure
public void run() {
// TODO
}
```



Implement ***isClean()*** method in **EnvironmentState** class

```
// Check whether all locations are clean.
     public boolean isClean() {
          // TODO
     }
```

Test: TestSimpleReflexAgent.java

```
//Environment with [A=CLEAN, B=DIRTY]
Environment env = new Environment(Environment.LocationState.CLEAN, 
Environment.LocationState.DIRTY);
Agent agent = new Agent(new AgentProgram());
env.addAgent(agent, Environment.LOCATION_A);//Add an agent at location A

env.run();
```

The output is as follows:

```
Environment state: 
     {A=CLEAN, B=DIRTY}
Agent Loc.: B  Action: SUCK
Environment state: 
     {A=CLEAN, B=CLEAN}
```

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Task 2: Expand the above vacuum cleaner according to the following requirements:

- Agent actions: **SUCK, LEFT, RIGHT, UP, DOWN**
- Environment: 4 squares including **A, B, C, D**
- State of each location: **CLEAN, DIRTY**
- If the current cell is DIRTY, then action **SUCK** is invoked
- If the current cell is **CLEAN**, then pick a random action (**UP, DOWN, LEFT, RIGHT**), and perform the move action (if can’t move there (i.e., the agent cannot move UP or LEFT if it is at A), then will remain in the same cell).
- Performance measure (score):
  - For action SUCK: + 500 points;
  - If the agent can't move: - 100 points;
  - For other actions: - 10 points each;

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Task 3: Expand the above vacuum cleaner according to the following requirements:

- Environment is an **m × n grid** (the room is divided into a discrete number of cells)
- There exist a number of dirt and obstacles in the environment. Dirt and obstacles (walls) are **randomly placed** in the cells at a given rate. Therefore, the number of obstacles will be m*n*DIRT_RATE (suppose `DIRT_RATE = 0.2; WALL_RATE = 0.1`)

- At each step:
  - if the current cell is **DIRTY**, then action **SUCK** is invoked
  - if the current cell is **CLEAN**, then pick a **random action** (***UP, DOWN, LEFT, RIGHT***), and perform the move action (if can't move there (i.e., because of obstacle), then will remain in the same cell).
  - For example, if the action is UP, then the agent will move up 1 cell.
- Performance measure (score):
  - For action **SUCK**, + 500 points;
  - If the agent can't move (because of obstacle) - 100 points;
  - For other actions: - 10 points each;

Implement necessary methods to simulate the reflex agent using the above description.