LAB 04

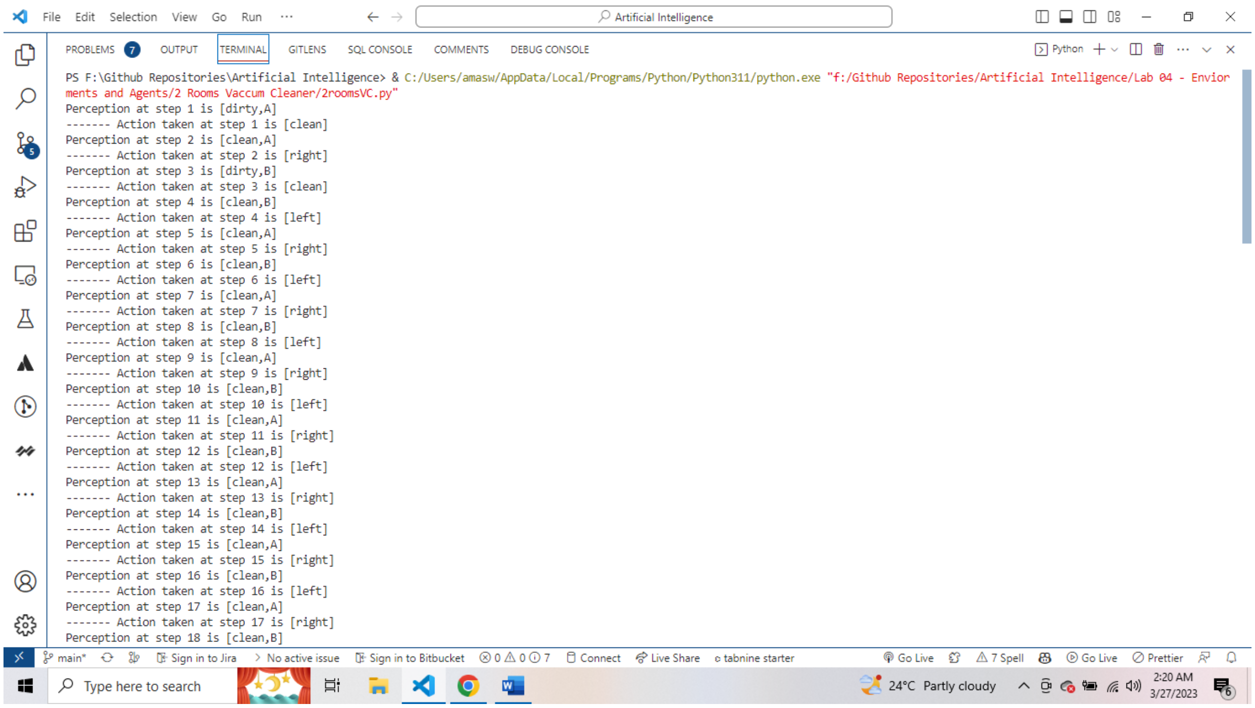
AGENTS AND ENVIRONMENTS

1. Run the two room vacuum cleaner agent program and understand it. Convert the program to a Three room environment.

Two Room Environment:

```
from abc import abstractmethod

# Environment Class
class Environment(object):
    @abstractmethod
    def __init__(self, n):
        self.n = n
    def executeStep(self, n=1):
        raise NotImplementedError('action must be defined!')
    def executeAll(self):
        raise NotImplementedError('action must be defined!')
    def delay(self, n=100):
        self.delay = n

# Room Class
class Room:
    def __init__(self, location, status="dirty"):
        self.location = location
        self.status = status

# Abstract Agent Class
class Agent(object):
    @abstractmethod
    def __init__(self):
        pass
    @abstractmethod
    def sense(self, environment):
        pass
    @abstractmethod
    def act(self):
        pass

# Vaccum Cleaner Agent Class
class VaccumAgent(Agent):
    def __init__(self):
        pass
    def sense(self, env):
        self.environment = env
    def act(self):
        if self.environment.currentRoom.status == 'dirty':
            return 'clean'
```

```python
        elif self.environment.currentRoom.location == 'A':
            return 'right'
        else:
            return 'left'

# Environment Class
class TwoRoomVaccumCleanerEnvironment(Environment):
    def __init__(self, agent):
        # Constructor
        self.r1 = Room('A', 'dirty')
        self.r2 = Room('B', 'dirty')
        self.agent = agent
        self.currentRoom = self.r1
        self.delay = 1000
        self.step = 1
        self.action = ""
    def executeStep(self, n=1):
        for _ in range(0, n):
            self.displayPerception()
            self.agent.sense(self)
            res = self.agent.act()
            self.action = res
            if res == 'clean':
                self.currentRoom.status = 'clean'
            elif res == 'right':
                self.currentRoom = self.r2
            else:
                self.currentRoom = self.r1
            self.displayAction()
            self.step += 1
    def executeAll(self):
        raise NotImplementedError('action must be defined!')
    def displayPerception(self):
        print("Perception at step %d is [%s,%s]" % (
            self.step, self.currentRoom.status, self.currentRoom.location))
    def displayAction(self):
        print(
            "------- Action taken at step %d is [%s]" % (self.step, self.action))
    def delay(self, n=100):
        self.delay = n

# Test Program
if __name__ == '__main__':
    vcagent = VaccumAgent()
    env = TwoRoomVaccumCleanerEnvironment(vcagent)
    env.executeStep(50)
```



```
PS F:\Github Repositories\Artificial Intelligence> & C:/Users/amasw/AppData/Local/Programs/Python/Python311/python.exe "f:/Github Repositories/Artificial Intelligence/Lab 04 - Envior
ments and Agents/2 Rooms Vaccum Cleaner/2roomsVC.py"
Perception at step 1 is [dirty,A]
------- Action taken at step 1 is [clean]
Perception at step 2 is [clean,A]
------- Action taken at step 2 is [right]
Perception at step 3 is [dirty,B]
------- Action taken at step 3 is [clean]
Perception at step 4 is [clean,B]
------- Action taken at step 4 is [left]
Perception at step 5 is [clean,A]
------- Action taken at step 5 is [right]
Perception at step 6 is [clean,B]
------- Action taken at step 6 is [left]
Perception at step 7 is [clean,A]
------- Action taken at step 7 is [right]
Perception at step 8 is [clean,B]
------- Action taken at step 8 is [left]
Perception at step 9 is [clean,A]
------- Action taken at step 9 is [right]
Perception at step 10 is [clean,B]
------- Action taken at step 10 is [left]
Perception at step 11 is [clean,A]
------- Action taken at step 11 is [right]
Perception at step 12 is [clean,B]
------- Action taken at step 12 is [left]
Perception at step 13 is [clean,A]
------- Action taken at step 13 is [right]
Perception at step 14 is [clean,B]
------- Action taken at step 14 is [left]
Perception at step 15 is [clean,A]
------- Action taken at step 15 is [right]
Perception at step 16 is [clean,B]
------- Action taken at step 16 is [left]
Perception at step 17 is [clean,A]
------- Action taken at step 17 is [right]
Perception at step 18 is [clean,B]
```

Three Room Environment:

```
from abc import abstractmethod

# Environment Class
class Environment(object):
    @abstractmethod
    def __init__(self, n):
        self.n = n
    def executeStep(self, n=1):
        raise NotImplementedError('action must be defined!')
    def executeAll(self):
        raise NotImplementedError('action must be defined!')
    def delay(self, n=100):
        self.delay = n

# Room Class
class Room:
    def __init__(self, location, status="dirty"):
        self.location = location
        self.status = status

# Abstract Agent Class
class Agent(object):
    @abstractmethod
    def __init__(self):
        pass
    @abstractmethod
    def sense(self, environment):
        pass
    @abstractmethod
    def act(self):
        pass

# Vaccum Cleaner Agent Class
class VaccumAgent(Agent):
    def __init__(self):
        pass
    def sense(self, env):
        self.environment = env
    def act(self):
        if self.environment.currentRoom.status == 'dirty':
            if self.environment.currentRoom.location == 'A':
                return 'right'
            elif self.environment.currentRoom.location == 'B':
                return 'middle'
            elif self.environment.currentRoom.location == 'C':
                return 'left'
        else:
            return 'clean'

# Environment Class
class TwoRoomVaccumCleanerEnvironment(Environment):
    def __init__(self, agent):
        # Constructor
        self.r1 = Room('A', 'dirty')
        self.r2 = Room('B', 'dirty')
        self.r3 = Room('C', 'dirty')
        self.agent = agent
        self.currentRoom = self.r1
        self.delay = 1000
        self.step = 1
        self.action = ""
    def executeStep(self, n=1):
        for _ in range(0, n):
            self.displayPerception()
            self.agent.sense(self)
            res = self.agent.act()
            self.action = res
            if res == 'clean':
                self.currentRoom.status = 'clean'
            elif res == 'right':
                self.currentRoom = self.r2
            elif res == 'middle':
                self.currentRoom = self.r3
            elif res == 'left':
                self.currentRoom = self.r1
            self.displayAction()
            self.step += 1
    def executeAll(self):
        raise NotImplementedError('action must be defined!')
    def displayPerception(self):
        print("Perception at step %d is [%s,%s]" % (
            self.step, self.currentRoom.status, self.currentRoom.location))
    def displayAction(self):
        print(
            "------- Action taken at step %d is [%s]" % (self.step, self.action))
    def delay(self, n=100):
        self.delay = n

# Test Program
if __name__ == '__main__':
    vcagent = VaccumAgent()
    env = TwoRoomVaccumCleanerEnvironment(vcagent)
    env.executeStep(5)
```

2. Convert the environment to a ‘n’ room environment where n >= 2

```
from abc import abstractmethod

class Environment(object):

    @abstractmethod
    def __init__(self, n):
        self.n = n

    def executeStep(self, n=1):
        raise NotImplementedError('action must be defined!')

    def executeAll(self):
        raise NotImplementedError('action must be defined!')

    def delay(self, n=100):
        self.delay = n


class TwoRoomVaccumCleanerEnvironment(Environment):
    def __init__(self, agent):
        self.r1 = Room('A', 'dirty')
        self.r2 = Room('B', 'dirty')
        self.agent = agent
        self.currentRoom = self.r1
        self.delay = 1000
        self.step = 1
        self.action = ""
    def executeStep(self, n=1):
        for _ in range(0, n):
            self.displayPerception()
            self.agent.sense(self)
            res = self.agent.act()
            self.action = res
            if res == 'clean':
                self.currentRoom.status = 'clean'
            elif res == 'right':
                self.currentRoom = self.r2
            else:
                self.currentRoom = self.r1
            self.displayAction()
            self.step += 1

    def executeAll(self):
        raise NotImplementedError('action must be defined!')

    def displayPerception(self):
        print("Perception at step %d is [%s,%s]" % (
            self.step, self.currentRoom.status, self.currentRoom.location))
    def displayAction(self):
        print(
            "------- Action taken at step %d is [%s]" % (self.step, self.action))
    def delay(self, n=100):
        self.delay = n


class Room:
    def __init__(self, location, status="dirty"):
        self.location = location
        self.status = status


class Agent(object):
    @abstractmethod
    def __init__(self): pass
    @abstractmethod
    def sense(self, environment):
        pass
    @abstractmethod
    def act(self):
        pass


class VaccumAgent(Agent):
    def __init__(self):
        pass
    def sense(self, env):
        self.environment = env
    def act(self):
        if self.environment.currentRoom.status == 'dirty':
            return 'clean'
        if self.environment.currentRoom.location == 'A':
            return 'right'
        return 'left'


if __name__ == '__main__':
    vcagent = VaccumAgent()
    env = NRoomVaccumCleanerEnvironment(vcagent, 5)
    env.executeStep(50)
```

3- Does the agent ever stop? If no, can you make it stop? Is your program rational?

No, the agent does not stop until all the rooms are clean. We can make it stop by modifying the executeAll() method by adding a condition to check if all the rooms are clean before terminating the loop. The program is rational as it cleans the dirty rooms while minimizing the total score.

4- Score your agent, -1 points for moving from a room, +25 points to clean a room that is dirty, and -10 points if a room is dirty. The scoring will take place after every 1 second.

We can modify the executeStep() method to score the agent after every second based on the action it takes. The scoring is -1 point for moving from a room, +25 points for cleaning a room that is dirty, and -10 points if a room is dirty.

5- Convert the agent to a reflex-based agent with a model. Afterwards, take the sensors away from the agents, i.e., now the agent cannot perceive anything. Does your agent still work? If so, then why?

The reflex-based agent with a model can be created by modifying the act() method to include a model that maps the current room state to an action. The model-based agent will work even if the sensors are taken away because it uses a model to determine the actions based on the current room state. However, if the environment changes, and the model is not updated accordingly, the agent may not perform optimally.