IIT PALAKKAD

COMPUTER SCIENCE AND ENGINEERING
Indian Institute of Technology, Palakkad
CS2180: Artificial Intelligence Lab
Lab 2 (Environment I)

11 Jan, 2019

Time: 3 hrs

1. The environment contains numbers from $1, 2, \ldots, n^2-1$ and an empty space E (see the diagram below for the case $n = 4$).

1	2	3	4
5	6	E	7
8	9	10	11
12	13	14	15

Now the empty space E can be moved up, down, left or right (and of course in the corners some of these moves are valid while some others are not). Implement a class which

   (a) Can be initialized with a given start state i.e., position of the empty space. [25]

   (b) Takes the actions up, down, right, left as input and then updates the next state of the puzzle. [15]

   (c) Can display the state at any given time. [10]

   Note: This is an example of a ***dynamic deterministic control task.***

2. Consider a road of length $3\,kms$. The time (in minutes) at which vehicles enter the road, and their preferred speed (m/s) are given in the input file 'arrival'. Write a program which

   (a) Outputs the times (in minutes) at which each vehicle leaves the road. [20]

   (b) Assume that the local governing body has enforced a rule which states that every vehicle on the road should reduce their preferred speed by a factor of $\max\left(0.001, 1 - \frac{(n-1)}{100}\right)$ when there are n vehicles on the road. Under this constraint, output the times (in minutes) at which each vehicle leaves the road. [10]

   Note: The vehicles are allowed to overtake. This is an example of a ***dynamic event driven system without any control.***

3. Consider a top secret defense area modelled in the form of a $n \times n$ grid. Each cell in the grid is monitored by a sensor. Sensors that are turned *ON* can detect the presence of an intruder in their respective grid. Whereas, sensors that are OFF will not be able to detect intruders. Consider a scenario in which an intruder is moving at random from one grid to another grid every minute, i.e., with equal probability to adjacent positions. Also, consider a security agent that switches *ON* only k out of the n^2 sensors (sampled uniformly at random) at every minute. The remaining $n^2 - k$ sensors are turned *OFF*. Given the initial position of the intruder in the $n \times n$ grid, output his location when he is detected by a sensor. [10]

   Note: This is an example of ***partially observable dynamic system with control.***

End of paper