IIT PALAKKAD

COMPUTER SCIENCE AND ENGINEERING
Indian Institute of Technology, Palakkad
CS2180: Artificial Intelligence Lab
Lab 3

25 Jan, 2019

Time: 3 hrs

1. The connection of the road network is specified as a matrix M (filename is "road.txt"). There are 10 sites indexed as $(0, 1, \ldots, 9)$. Entry $M(i, j)$ denotes the length of the road between site i and j in *kms* (the roads are uni-directional). The roads are uni-directional (i.e., there could be a road from A to B, but not from B to A). If the entry is 0, it means no connection. Vehicles depart from a source and then take a path (filename "vehicle.txt"). The time of departure (in minutes) is given in filename "time.txt", n^{th} vehicle departs at time instance n. The speed (in kmph) of the vehicle in a road is given by the formula $e^{0.5x}/(1+e^{0.5x}) + 15/(1+e^{0.5x})$, where x is the number of vehicles ahead in a given road. If there are n vehicles in the road, then for the first vehicle $x = 0$, second vehicle $x = 1$, and for the last vehicle $x = n-1$. The time taken to travel the road is dist/speed. Implement a function that takes time as input and reports the position of various vehicles at that given time. [20]

2. There is an under-powered car stuck in the bottom of a 1-dim valley. It needs to find its way to the top. The car has three actions namely $A = \{-1, 0, +1\}$ which means accelerate backward, no acceleration and accelerate forward, respectively. A chosen action is applied for a fixed duration of time, after which a new action is chosen. The ranges for position and velocity are $[-1.2, 0.5]$ and $[-0.07, 0.07]$, respectively. The car is needs to reach the top on the right, i.e., position of 0.5. The dynamics is according to the equations:

$$v_{n+1} = v_n + 0.001a_n - 0.0025\cos(3p_n)$$

$$p_{n+1} = p_n + v_n$$

   (a) Implement a function which takes in the current position and action and outputs the position and velocity at the next step. [25]

   (b) Implement a random agent which at each time instant chooses one of the three actions uniformly at random. Plot $\{(p_n, v_n), n \geq 1\}$ produced by the random agent. Take the initial position to be -0.5, and initial velocity to be 0. [15]

   (c) Implement another agent which accelerates in the direction of the current velocity. Plot $\{(p_n, v_n), n \geq 1\}$ produced by this agent. Take the initial position to be -0.5, and initial velocity to be 0. [10]

3. Read the text file "speeches.txt"

   (a) Compute the next word probabilities. [10]

   (b) Based on the next word probabilities, write down a code that will produce random text of length 5000. [10]

   (c) Compute the next word probability from the previous task and show that it converges to the next word probabilities calculated from the original text. [10]

End of paper