CS2180 Artificial Intelligence Lab (Jan-May 2023)

Department of Computer Science and Engineering
Indian Institute of Technology Palakkad

Mid-sem Exam (14 Mar 2023 2-4pm)

General instructions

- Solutions are to be typed in the `.ipynb` file provided and uploaded in the lab course page in Moodle before 4pm.
- Your code should be well commented and should be compatible with python3.

1 Monty Hall Game (4 marks)

Recall the Monty Hall game discussed in Assignment 1. Consider the variant of the game where there are n boxes with $n \geq 3$ and the host reveals the contents of $n-2$ boxes. Is it to your advantage to switch your choice in order to get the gift? How does this advantage change with n?

2 Area and π Estimation (6 marks)

(a) Write a function `generatePoint(m,n)` that takes as arguments two integers m, n and returns a pair of numbers (x, y) such that $x, y \in_R [m, n]$. Here, $[m, n]$ denotes the set of all real numbers between m and n (including m and n) and $x, y \in_R [m, n]$ denotes that both x and y are picked uniformly at random from $[m, n]$.

(b) Each point (x, y) returned by `generatePoint(0,1)` may be interpreted as a point chosen at random from the unit square whose bottom left vertex is $(0, 0)$. Write a function that estimates the area of the region under the curve $y = x^2$ in this unit square.

(c) Write a function that estimates the value of π using `generatePoint(0,1)`. Hint: you may want to estimate the area of the circle with center $(1/2, 1/2)$ and radius $1/2$.

3 Erdős Number Computation (10 marks)

The Erdős number of a scientist X describes the "collaborative distance" between the mathematician Paul Erdős and X. Paul Erdős himself is assigned an Erdős number of zero. Scientists who have coauthored a research paper with Erdős have Erdős number 1, scientists who have collaborated with scientists having Erdős number 1 but not with Erdős have an Erdős number of 2, and so on. That is, a scientist has a finite Erdős number, say $i \geq 1$, if and only if she has collaborated with a scientist having Erdős number $i - 1$ but not with anyone who has an Erdős number less than $i - 1$.

Write a program that takes a csv file as input and displays the Erdős number of all scientists in it. Each line in the csv file is of the form Scientist 1,Scientist 2 indicating that these two scientists have collaborated. Example: The entry `Alon,Erdos` indicates that Erdős and Alon have a research paper together. You may use the following code block to read from a csv file.

```
import csv

with open('collab.csv') as csvfile:
    csvreader = csv.reader(csvfile)
```

Here, `with open('collab.csv') as csvfile:` opens the CSV file named `collab.csv` and creates a file object named csvfile. The with statement ensures that the file is properly closed after the code block completes or in case of an error. `csvreader = csv.reader(csvfile)` creates a CSV reader object named `csvreader` which can be used to iterate over the rows of the CSV file. For example,

```
for row in csvreader:
```

iterates over each row in the CSV file Each row is treated as a list of strings representing the columns in the CSV file. That is, `row[0]` denotes the first column and `row[1]` denotes the second column.