

You may not discuss this assignment with anyone but me. You must email me a copy of your program and answers to the questions posed prior to 5:00pm on the due date. I will run your program, so do not copy it into a Word document.

The most common type of bet made in a craps game is the pass line bet. The pass line rules are given by the algorithm below:

```
IF      come-out roll = 2, 3, 12 -> Shooter Loses
ELSE IF come-out roll = 7, 11   -> Shooter Wins
ELSE
    point = come-out roll value
    Shooter rolls until the point is rolled (Shooter Wins)
    or a 7 is rolled (Shooter Loses)
```

The shooter controls the dice for as long as they win. Once they lose, the dice pass to the next shooter.

On the course website, there is a data file that contains a long list of random dice rolls where each roll is the result of 2 6-sided dice. For simplicity, the last number in the list is a 7.

In this assignment, you will perform a Monte-Carlo simulation of pass line betting in a craps game. In particular, you should write a program that does the following:

- a) Determines the number of dice rolls,
- b) Determines the number of come out rolls,
- c) Determines the number of shooters,
- d) Determines the probability of the shooter winning,
- e) Determines the probability of the shooter loosing,
- f) Determines the probability of the shooter hitting a point, (*i.e.*, the number of times a point is hit divided by the number of times a point is established).

For items d) and e), compute these probabilities relative to the entire pool of dice rolls (*i.e.*, don't compute the probabilities of the individual shooters).

Once your program is working, answer the following questions:

- 1) Why is it convenient for the last number in the data file to be a 7?
- 2) How large is the house's advantage over the shooter (*i.e.*, what is the difference between items d) and e) above)?
- 3) How does this advantage compare with the exact value? You can look up this value online.
- 4) Does a Monte-Carlo simulation reasonably replicate the probabilities involved?
- 5) Use the house advantage you computed above to determine the casino's annual profit from pass line betting. Assume that the casino has 40 tables and \$1,000,000 is bet at each table per month.

HINTS:

- Don't try and write the entire program all at once. Build it in stages and add new features gradually. Use WRITE statements to monitor the variables in your program.
- The data file is quite large and your program will take about 5 minutes to process it. You should design your own small set of 20-30 dice rolls and use this to test your program. Make sure you comment out any WRITE statements in your loops before running the large data file.