

You may not discuss this assignment with anyone but me. You must email me a copy of your program (as an attachment, not pasted into the email body) and answers to the questions posed prior to 3:00pm 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.

Another type of bet that can be made is a *field* bet. This can be made on any roll of the dice. If a player places a field bet, they win if the roll is 2, 3, 4, 9, 10, 11 or 12. They lose if any other number comes up.

Pass line and field bets both pay even money (*i.e.*, you win the same amount that you bet).

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 write a simulation of pass line and field 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 (*i.e.*, the number of games played),
- 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),
- g) Determines the probability of winning a field bet (assume a field bet is made on every roll of the dice).

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).

Sometimes a statement in MATLAB is too long to write on a single line. In the event that you need to break up a statement over two or more lines, you can use the syntax

```
x = (some really long MATLAB statement that you need ...
    to continue onto the next line)
```

Use a sequence of three dots (...) to break the line and continue to the next one.

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 your 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. Leave off the ; from your statements to monitor the variables in your program.
- The data file is quite large. You should design your own small set of 20-30 dice rolls and use this to test your program until you are certain it works, then change over to the real data file. Make sure you add the ; back to your statements before running the large data file.