

## Math 3607: Homework 3

Due: 11:59PM, Monday, February 1, 2021

1. (**Guess-The-Number**) Write the following game in which a user is to guess the integer randomly generated by the computer. In the program:

- User inputs the lower and the upper bounds of the range.
- The program generates a random integer within the specified range and stores it in a variable.
- Use a `while`-loop for repeated guessing.
  - If the user guessed a number larger than the generated number, print out "Your guess is too high. Try again!".
  - If the user guessed a number smaller than the generated number, print out "Your guess is too low. Try again!".
  - If the user guessed the number correctly, print out "Congratulations!" and terminate the program.

Below is an example run of the program.

```
>> guess
Enter the lower bound: 1
Enter the upper bound: 100
Guess a number: 50
Your guess is too low. Try again!
Guess a number: 75
Your guess is too low. Try again!
Guess a number: 87
Your guess is too high. Try again!
Guess a number: 81
Your guess is too low. Try again!
Guess a number: 84
Your guess is too high. Try again!
Guess a number: 82
Congratulations!
```

2. (**Gap of 10**, Lecture 5) Simulate the tossing of a *biased* coin whose tails is 3 times more likely to be showing than its heads, until the gap between the number of heads and that of tails reaches 10.
3. (**Construction of Arrays**) Do the following problems <sup>1</sup>.

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<sup>1</sup>Reference Keys:

- **LM**: *Learning MATLAB, Problem Solving, and Numerical Analysis Through Examples* (Overman)
- **NCM**: *Numerical Computing with MATLAB* (Moler)
- **FNC**: *Fundamentals of Numerical Computation* (Driscoll and Braun)

- **LM 3.1–3**(b,c,e,g)
- **LM 3.1–4**(c,e)
- **LM 3.1–5**(d,f)

Please read the notes at the beginning of Section 3.1 exercises on p. 382. In addition, pay attention to **Note** found at the end of individual problems, if there is any.

4. Do **LM 3.1–16**.

5. Do **LM 3.2–7**.

For this problem, assume that  $A$  is already stored in MATLAB and simply provide MATLAB statements generating  $B$ ,  $C$ , and  $D$ ; use of the *Code Examples* environment is recommended. (Obviously, in the development stage, you may define  $A$  so that you can check your work.)

6. (**Birthday Problem**, Lecture 7) In a group of  $n$  randomly chosen people, what is the probability that everyone has a different birthday?

- Find this probability by hand.
- Let  $n = 30$ . Write a script that generates a group of  $n$  people randomly and determines if there are any matches.
- Modify the script above to run a number of simulations and numerically calculate the sought-after probability. Try 1000, 10000, and 100000 simulations. Compare the result with the analytical calculation done in the previous part.