CS 1538: Introduction to Simulation

Background Survey

Name: _____

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Background

1. Why are you taking this class?

Data Structures

2. Briefly describe queues and stacks. In what way are they similar? In what way are they different?

3. A palindrome is a string that reads the same in either direction, e.g. "civic". Write a function that, given a string input, determines whether it is a palindrome ("civic") or a word whose second half is a repeat of the first half (e.g. "mama") or both (e.g. "babbab") or neither.

- You **may not** assume that the input string is an array of characters. Instead, you need to use some interface function calls:
  - *GetLetter()* returns the next unread letter
  - *GetLength()* returns the length of the string
- You **may** assume that library functions for queue and stack are in place (i.e. you can call Enqueue, Dequeue, Push, Pop, etc.).
- You may write the code in pseudocode.

Probability

4. Consider a (possibly loaded) die. Suppose this die has been tossed 100 times and the following outcomes are observed (i.e. the number of spots on the side of the die that faces upwards):

Outcome	Frequency
1	17
2	16
3	17
4	18
5	17
6	15

- Based on the trials above, give an estimate for the *probability **distribution*** of the possible outcomes:

- Based on the trials above, would you conclude that the die is fair? Justify your answer in one or two sentences:

- Let X be a random variable that represents the possible outcomes from the die toss. Using the distribution you defined in the first question above, what is the expected value of X?

5. Suppose there are 12 pastries in a box. They are either topped with powdered sugar or sprinkles; and they are either filled with apple pie filling or with cream. The breakdown of the box content is as follows:

Topping	Filling	Number
Powder	Apple	1
Powder	Cream	6
Sprinkles	Apple	3
Sprinkles	Cream	2

- If I pick one blindly at random, what is the chance that I would get a pastry with sprinkles and cream filling?

- Suppose I got one with powdered sugar on top, what is the chance that it has apple filling?

6. Below are three sequences of numbers. Each sequence was generated from a different random number generator (generating random integers between 1 and 10). Rank these sequences from most random (1) to least random (3). If results are equally random, give them the same ranking. If it is not possible to determine the randomness of one or more sequences, explain why.

_____ 3, 4, 3, 4   _____ 5, 4, 6, 5   _____ 3, 8, 5, 1

Statistical Models

7. Describe the following four distributions. You don't need to write down the exact equations, but you may:
   • Describe the relevant parameters of the distribution (that is, how can one specify the distribution?)
   • Draw a graph of the general shapes of the distributions
   • Discuss what real-world scenarios each distribution could model

   1. Bernoulli Distribution
   2. Binomial Distribution
   3. Normal (Gaussian) Distribution
   4. Uniform Distribution

Use the next page if you need more space.