Handout 22

Preparing for the final exam

The final exam has two parts:

- In the first part you write answers on paper. For this part you cannot use any notes.
- In the second part you write code with the computer. For this part you can use the class notes and your previous code (but you cannot use the internet).

Here are some practice problems to consider. Some are easier than others.

22.1 Practice writing functions

1. Write a function that sorts an array using the "swap sort" method.
2. Write a function that sorts an array using the "search sort" method.
3. Write a function that computes the average of the numbers in an array.
4. Write a function that computes the product of the numbers in an array.
5. Write a function that gives out a random number between -4 and 6.
6. Write a function that fills an array with random numbers that are each between 0 and 1.
7. Write a function that fills an array (with two slots) with a random location in the unit square.
8. Write a function that fills an array (with two slots) with a random location inside the unit circle.
9. Write a function that computes the distance between two points.
10. Write a function that takes in a positive integer n and returns the sum $1+2+3+\cdots+n$.
11. Write a function that gets a positive integer from the user. If the user inputs a non-positive integer the function should ask the user to try again.

12. Write a function that takes in an array and prints out the contents to the screen.
13. Write a function that takes in two numbers and prints out their sum to the screen.

22.2 Practice coding problems

1. Given a list of 100 integers, print them out to the screen in the reverse order from how they were typed in.
2. Given a list of 100 integers, print out to the screen all of the numbers that are divisible by either 2 or by 3, but are not divisible by both.
3. Given a list of 100 integers, print out all of the odd ones, in increasing order.
4. Given a list of 100 integers, count how many are multiples of 2, how many are multiples of 3, how many are multiples of 5, and how many are of "other type."
5. Given a list of 100 digits, figure out which digit appeared the least number of times and which digit appeared the most number of times.
6. Given a list of 100 numbers, tell me how many of them are in each of the following categories:
   - negative or zero,
   - between 0 and 1 (inclusive),
   - between 1 and 2 (inclusive),
   - etc,
   - between 9 and 10 (inclusive),
   - greater than 10.
7. Given two points in the xy plane determine whether
   - they are both inside the unit circle,
   - one is inside the unit circle, or
   - both are outside the unit circle.
8. Given two points in the xy plane, determine whether they are in the same quadrant or not. (You can assume that they do not lie on either of the axes.)
9. Write a program that takes in an input n and computes $\sqrt{n}$ using bisection search. The error needs to be less that 1/10000.
10. Write a program that generates 1000 random points in side the unit circle. On average, how far away from $(0, 0)$ are the points?
11. Write a program that randomly rolls a 12-sided die.
12. Write a program that generates 100 random positive integers. What percentage of them are prime?

13. You are given three positive numbers that are supposed to represent the lengths of the sides of a triangle. Determine which of the following is the case:

    - the triangle is acute,
    - the triangle is a right triangle,
    - the triangle is obtuse,
    - the triangle is impossible.

14. Given a 10-digit integer, determine if it is a palindrome or not.

15. Write a program that "randomly sorts" an array by repeatedly choosing two entries and swapping if appropriate. How many of these random moves is needed to "mostly" sort an array with 10 numbers?