UMBC
AN HONORS UNIVERSITY IN MARYLAND

CMSC 201 Fall 2015
Homework 1 – Constructing Algorithms

Assignment: Homework 1 – Constructing Algorithms
Due Date: Tuesday, September 8th, 2015 by 8:59:59 PM
Value: 4% of final grade

Homework 1 is an exercise in thinking algorithmically, and consists of writing out simple algorithms in English. This homework is similar to the "Explaining a Peanut Butter & Jelly Sandwich to an Alien" exercise we did in class.

Instructions

For each question below, write out a series of *clear*, *ordered* steps that *fully* solve the problem given. Make sure to number each step, and to keep individual steps simple.

For example, the following is what we are looking for:

1. Get a bag of bread and open it.
2. Reach into the bag and remove two slices of bread.

Something like this, however, is not acceptable and will lose you points:

Grab a bag of bread and take some out, then open the jar of jelly and stick the spoon in the jelly, and then put the jelly on the bread, and then put the knife in the peanut butter and put peanut butter on the other piece…

You should also avoid breaking steps into excessively small pieces:

1. Get a bag of bread.
2. Untwist the twist tie on the bag of bread.
3. Open the bag of bread.
4. Reach into the bag of bread.
5. Grab two slices of bread.
6. Remove the two slices of bread you grabbed.

When you are writing your solutions, you can use loops (which we discussed in class during Lecture 2). For example, if we wanted to make five peanut butter and jelly sandwiches, we might use this:

1. For each sandwich:
2. Get a bag of bread and open it.

…

13. Put the two pieces of bread together, jelly side to peanut butter side.
14. Repeat for next sandwich until you've made 5 sandwiches.

Homework 1 should be completed on the GL server. Use emacs to create and complete the hw1.txt file. This will be the file that you submit. If you have already completed Lab 1, you should make sure to place the hw1.txt file inside a **`HW1`** folder (which is itself under the **`Homeworks`**, which is under the **`201`** directory).

Finally, some of the questions may use words you aren't very familiar with. If this is the case, please look at the Explanations section directly after the list of questions.

Questions

Question 1

You need to decide whether the number 7 is a prime number or not. What steps do you take?

Question 2

Now you are going to have to decide in some given number (not necessarily 7) is a prime number or not. What steps do you take?
(Hint: You need to make your answer from Question 1 more general. How would you test if 11 is a prime number? What is different from when you tested 7?)

Question 3

You are given a word, and need to decide if it is a palindrome or not. What steps do you take?

Question 4

You have a stack of one thousand notecards, and each notecard has a number on it. You need to find the card with the highest number on it. What steps do you take?
(Hint: "Look through the cards and find the highest number." is not a solution. How do you determine which of two numbers is higher? How do you keep track of (i.e., "store") the highest number you've found so far?)

Question 5

You are given a number and need to compute its factorial. What steps do you take?

Explanations

Prime numbers

A prime number is a number that can only be evenly divided by itself and the number 1. For example, the number 5 is a prime number, because it cannot be easily divided by 2, 3, 4, or any numbers other than 1 and 5.
The number 12 is *not* a prime number, because 2 x 6 = 12, and because 3 x 4 = 12. (The number 13 is also a prime number, because it cannot be divided by 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, or 12. It can only be divided by 1 and itself.)

Palindromes

A palindrome is a word that is the same forward as it is backwards. For example, “Anna” is a palindrome. (The first and last letters are ‘a’ and the second and second-to-last letters are ‘n’.) Other examples include words like “kayak” and “redder”.
However, the word “moon” is *not* a palindrome. (The first letter of the word is ‘m’ while the last letter is ‘n’.) The words “racecars” and “computer” are also not palindromes.

Factorials

A factorial is the product of a number and all the numbers below it. In other words, if we have a number *n*, we need to multiply all the numbers from 1 to *n* together. For example, to calculate the factorial of the number 8 we multiply 1 x 2 x 3 x 4 x 5 x 6 x 7 x 8 to get 40,320 as our answer.

Submitting

NOTE: How to submit is covered in Lab 1. If you have not completed Lab 1, you should do so before completing this part of the homework.

Once your hw1.txt file is complete, it is time to turn it in with the **`submit`** command.

You must be logged into your GL account, and you must be in the same directory as the hw1.txt file. To double check this, you can type **`ls`**.

```
linux1[3]% ls
hw1.txt
linux1[4]%
```

To submit your hw1.txt file, we use the **`submit`** command, where the class is **`cs201`**, and the assignment is **`HW1`**. Type in **`submit cs201 HW1 hw1.txt`** and press enter.

```
linux1[4]% submit cs201 HW1 hw1.txt
Submitting hw1.txt...OK
linux1[5]%
```

If you don't get a confirmation like the one above, check that you have not made any typos or errors in the command.

You can double-check that your homework was submitted by using the **`submitls`** command. Type in **`submitls cs201 HW1`** and hit enter. (You'll see your own username, of course.)

```
linux1[5]% submitls cs201 HW1
total 21
drwx------   2 mneary1 rpc  2048 Aug 30 19:01 .
drwx------ 507 mneary1 rpc 18432 Aug 30 16:15 ..
-rw-r--r--   1 k38     rpc   167 Aug 30 19:01 hw1.txt
linux1[6]%
```

And you're done!