CSCI 1300 CS1: Starting Computing
Fleming, Naidu, Quigley, Fall 2020
Homework 4
Due: Saturday, September 26, by 6 pm
(5 % bonus on the total score if all three parts are submitted by 11:59 pm September 25)

Objectives

- Understand loops
- Understand C++ loops: while loops, for loops, do-while loops

Submissions

- **C++ files**. All files should be named as specified in each question, and they should compile and run on VSCode to earn full points. TAs will be grading the style of your code and comments. Please see the *Style Guide* file on Canvas and *H4 Background* file on Canvas, both in the Week 5 Module. At the top of each file, write your name with the following format:

  ```
  // CS1300 Fall 2020
  // Author: Punith Sandhu
  // Recitation: 123 – Favorite TA
  // Homework 3 - Problem # ...
  ```

  When you are finished with all the questions, zip all files. Submit the zip file under the assignment **H4_zip** on Canvas.

- **Code Runner**. The correctness of your program will be graded by Code Runner. You can modify your code and re-submit (press “Check” again) as many times as you need to, until the assignment due date. You can find Code Runner on the page titled **H4-CodeRunner** in the Week 5 Module.

Questions

Question 1(5pt): Sum even positive numbers
Write a program that asks for the end value (as `integer`), and computes the sum of the even numbers from 0 to the value entered, inclusive.

Expected output 1 (**bold** is user input)

```
Enter a positive number:
10
Sum: 30
```

The file should be named as `sumEven.cpp`. Don't forget to head over to the H4-CodeRunner on Canvas and paste your solution in the answer box!

Question 2(5pt): Print Collatz sequence
The Collatz conjecture defines a sequence as follows: if `n` is an even number, then the next value is `n/2`. If n is odd, then the next value is `3n+1`. The sequence is conjectured to always reach 1 regardless of the starting number.

Write a program that takes a starting number n and prints the entire sequence, starting with n and ending with 1. Each number should be printed on a new line.

Expected output example (**bold** is user input)

```
Enter a positive number:
10
10
5
16
8
4
2
1
```

The file should be named as `printCollatz.cpp`. Don't forget to head over to the H4-CodeRunner on Canvas and paste your solution in the answer box!

Question 3(10pt): Zootopia


The Zootopia Police Department is recruiting new officers and has come up with an innovative equation to hire. They define `hireScore` as a weighted sum of `agility`, `strength`, and `speed`.

```
hireScore = 1.8 * agility + 2.16 * strength + 3.24 * speed
```

The candidates for this hiring season are foxes, bunnies, and sloths. Chief Bogo has requested you to write a program that takes in these attributes and processes a `hireScore` for the candidate.

The program should provide a menu to choose the anthropomorphic animal. The menu should have the following options:

1. Fox
2. Bunny
3. Sloth
4. Quit

Once an animal is selected, the program should ask the two of the characteristics based on the animal

1. For fox, take input for `agility` and `strength`
2. For bunny, take input for `agility` and `speed`
3. For Sloth, take input for `strength` and `speed`

Note: You must prompt the user for agility, strength, and speed **in that order**, while also *skipping* the attribute *prompt that does not apply* to the particular animal.

Write a program to compute the `hireScore` based on the inputs using the weighted sum formula. When you compute the `hireScore`, one of the three characteristics would be 0. The computed `hireScore` should be displayed on the screen. The menu will run in a loop, continually offering Bogo four options until he chooses to quit. If the choice is not between 1 - 4, then it prints "`Invalid option`". When Bogo selects option 4, it prints "`Good bye!`"

Expected output (**bold** is user input)

```
Select a numerical option:
=== menu ===
1. Fox
2. Bunny
3. Sloth
4. Quit
1
Enter agility:
10.5
Enter strength:
20.1
Hire Score: 62.316
Select a numerical option:
=== menu ===
1. Fox
2. Bunny
3. Sloth
4. Quit
2
Enter agility:
10.1
Enter speed:
30.0
Hire Score: 115.38
Select a numerical option:
=== menu ===
1. Fox
2. Bunny
3. Sloth
4. Quit
10
Invalid option
Select a numerical option:
=== menu ===
1. Fox
2. Bunny
3. Sloth
4. Quit
4
Good bye!
```

The file should be named as `zootopia.cpp`. Don't forget to head over to the H4-CodeRunner on Canvas and paste your solution in the answer box!

Question 4(15pt): Count matches

A substring refers to a string that is a continuous segment of a larger string. The list of all substrings of the string, "`apple`", would be:

- "`apple`",
- "`appl`", "`pple`",
- "`app`", "`ppl`", "`ple`",
- "`ap`", "`pp`", "`pl`", "`le`",
- "`a`", "`p`", "`p`", "`l`", "`e`"
- ""

Write a program that asks for two strings: a string where the substring is searched and substring whose occurrences is to be found. Then, it displays the number of matches.

Expected output 1 (**bold** is user input)

```
Enter the search string:
mississippi
Enter the substring to be searched:
si
Number of occurrences: 2
```

Expected output 2 (**bold** is user input)

```
Enter the search string:
mississippi
Enter the substring to be searched:
ipp
Number of occurrences: 1
```

The file should be named as `countMatches.cpp`. Don't forget to head over to the code runner on Canvas and paste your solution in the answer box!

Question 5(15pt): Print an alphabetical triangle

Write a program that takes the height of the triangle (integer > 0), and prints an alphabetical triangle, using lowercase English alphabets, as shown below.

Expected output 1 (**bold** is user input)

```
Enter the height:
4
abcd
efg
hi
j
```

Expected output 2 (**bold** is user input)

```
Enter the height:
10
abcdefghij
klmnopqrs
tuvwxyza
bcdefgh
ijklmn
opqrs
tuvw
xyz
ab
c
```

The file should be named as `printTriangle.cpp`. Don't forget to head over to the code runner on Canvas and paste your solution in the answer box!

Extra credit Question (10pt): Print diamond

Write a program that takes the side length of the diamond, then it prints the diamond like below. To get the extra credit, please submit the *diamond.cpp* file in your H4_zip submission.

Expected output 1 (**bold** is user input)

```
Enter the length:
4
   *
  ***
 *****
*******
 *****
  ***
   *
```

Expected output 2 (**bold** is user input)

```
Enter the length:
2
 *
***
 *
```

Homework 4 checklist

Here is a checklist for submitting the assignment:

1. Complete the code **H4-CodeRunner on Canvas**
2. Submit one zip file to **H4_zip file submission**. The zip file should be named, **hmwk4_lastname.zip**. It should have the following 6 files:
    - **sumEven.cpp**
    - **printCollatz.cpp**
    - **zootopia.cpp**
    - **countMatches.cpp**
    - **printTriangle.cpp**
    - **diamond.cpp (if doing the extra credit problem)**

Homework 4 points summary

Criteria	**Pts**
CodeRunner (problem 1 - 6)	50
C++ file submission (compiles and runs, style and comments)	15
Recitation attendance (Sep 14-Sep 18)*	-30
Total	65
5% early submission bonus	+5%
Extra credit: print diamond	+10 pt

* If your attendance is not recorded, you will lose points. Make sure your attendance is recorded on Canvas.