CSCI 1300 CS1: Starting Computing
Ashraf, Cox, Spring 2020
Homework 4
Due: Saturday, February 15, by 6 pm
(5 % bonus on the total score if all three parts are submitted by 11:59 pm February 14)

Objectives

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

You can find hw4 note: loop on Moodle.

Submissions

- **Conceptual reviews(mcq)**. There are a few multiple-choice questions to check your conceptual understanding. Don't forget to complete them!
- **C++ files**. All files should be named as specified in each question, and they should compile and run on Cloud 9 to earn full points. TAs will be grading styles of your code and comments. Please see the style guide on Moodle and the summary note on Moodle. At the top of each file, write your name with the following format:

```
// CS1300 Spring 2020
// Author: Punith Sandhu
// Recitation: 123 – Favorite TA
// Homework 4 - Problem # …
```

- **Code runner**. 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.

Plan for this week

Questions 1 - 3 are considered as recitation questions. You should be able to finish at least 3 questions during the recitation time. If you're able to finish them earlier, then continue working on the other questions and complete the homework before the deadline.

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 code runner on Moodle 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 code runner on Moodle 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 select 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 code runner on Moodle and paste your solution in the answer box!

Question 4(10pt): Dream house

You have graduated from CU Boulder and have a great job! You moved to Seattle and decided to save money to buy a house. Write a program to determine how many months it will take you to save enough money to make the down payments given the following assumptions:

- The portion of the cost needed for a down payment is 25% (0.25)
- Since you just graduated, the current saving is 0
- Assume you invest your current savings wisely. At the end of each month, you receive additional funding, *currentSaving* * r / 12 where r = 0.04. (r is an annual rate, so we divided it by 12)
- At the end of each month, your savings will increase by the return of the investment and the portion of the salary.

Your program asks:

1. The starting annual salary (in `double`)
2. The portion of the salary you save each month for a down payment (in `double`)
3. The cost of your dream house (in `double`)

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

```
Enter your annual salary:
120000
Enter the percent of your salary to save, as a decimal:
.10
Enter the cost of your dream home:
1000000
Number of months: 183
```

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

Question 5(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 Moodle and paste your solution in the answer box!

Question 6(15pt): Print an alphabetical triangle

Write a program that takes the height of the triangle, then it prints the triangle like 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 Moodle 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.

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 **conceptual reviews(mcq)**
2. Complete the code **Homework 4 CodeRunner**
3. Submit one zip file to **Homework 4 zip file submission**. The zip file should be named, **hmwk4_lastname.zip**. It should have the following 6 files:
    - **sumEven.cpp**
    - **zootopia.cpp**
    - **dreamHouse.cpp**
    - **printCollatz.cpp**
    - **countMatches.cpp**
    - **printTriangle.cpp**

Homework 4 points summary

Criteria	**Pts**
Conceptual reviews (MCQ)	10
CodeRunner (problem 1 - 6)	60
C++ file submission (compiles and runs, style and comments)	30
Recitation attendance (Feb10-Feb 14)*	-30
Total	100
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 Moodle.