CS 101: Computer Programming and Utilization, Autumn 2020
Lab 2

Instructions for Lab2:

This lab is divided into **3** parts. **Part A** concentrates on some common drawing using simplecpp and the usage of turtlesim specifically. **Part B** gives a c++ flavor using simplecpp. **Part A** and **Part B** are compulsory. Follow the submission guidelines mentioned at the end of Part B. **Part C** is optional and is meant for enhancing your programming skills.

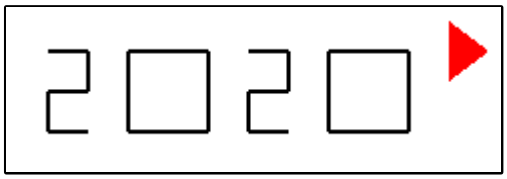
Note: You are not allowed to share code. Show the demo to your TA during the lab session, via screen share.

Folks, don't forget the semicolon!

PART A: Turtlesim!

Q1. ***Welcome, 2020 freshies!*** Write a program using simplecpp to draw the year "2020" as shown below. (You can use repeat statements for drawing the number 20 again.) You're not supposed to draw the box around 2020.

Sample Output:

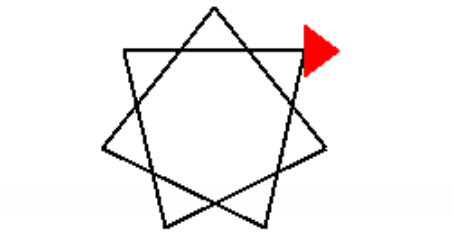


`Filename: year.cpp`

Q2. *Rewrite the Stars:* Write a program using ***simplecpp*** to draw a 7-pointed star (also called a heptagram) where the length of each edge is 100 units. Use the repeat command.

Filename for code: **`pointedstar.cpp`**

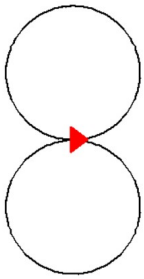
Sample output:



Q3. Draw an eight using ***simplecpp***.
Hint: An eight can be drawn in the same manner as 1 circle, reposition the turtle and draw another circle. (polygon of a large number of sides)

Filename for code: **`eight.cpp`**

Sample output:



PART B: Use of variables!

Q4. Draw a T using repeat statements.
Write a program that reads in a number n using cin. It should print out the letter T using '*' characters with each line in the T having width n. Further, the length of the horizontal bar should be 3n, and that of the vertical bar 2n. Look at the sample output for clarity.
Note: To print characters on a new line write '**\n**' in the cout statement. For example:
cout << "hello" << "\n" << "bye"; will print **hello** on the first line and **bye** on the 2nd line.

Note: Use **cin** statement for input
Sample Input: 3

Sample output:

```
*********
*********
*********
   ***
   ***
   ***
   ***
   ***
   ***
```

Filename for code: **`Tee.cpp`**

Q5. Write a program that prints a zig-zag pattern. The pattern is as follows: the first line prints 5 space-separated **'*'** characters. The second line starts after 2 spaces, and prints 5 space-separated **'*'** characters. Accept a number **`'n'`** from the user using **`'cin'`**. The number of zig-zag lines to be printed should be **`'2*n'.`** Look at the example provided below. **Note**:To put space between the two characters, Use **`cout << " ";`**
Filename: zigzag.cpp

Sample Input:
4

Sample Output:

```
*  *  *  *  *
   *  *  *  *  *
*  *  *  *  *
   *  *  *  *  *
*  *  *  *  *
   *  *  *  *  *
*  *  *  *  *
   *  *  *  *  *
```

Submission Guidelines:
Show the demo to your TA during the lab session, via screen share.
Optional:
You can submit the 5 compulsory programs and any other optional programs you've attempted on Bodhitree (**cs101.bodhi.cse.iitb.ac.in**)
Create a folder "rollNumber_Lab2" (e.g. 180100091_Lab2) as its name and put all the **`.cpp`** files (no other files) in it. Compress the folder (**zip**) and upload it on Bodhitree.

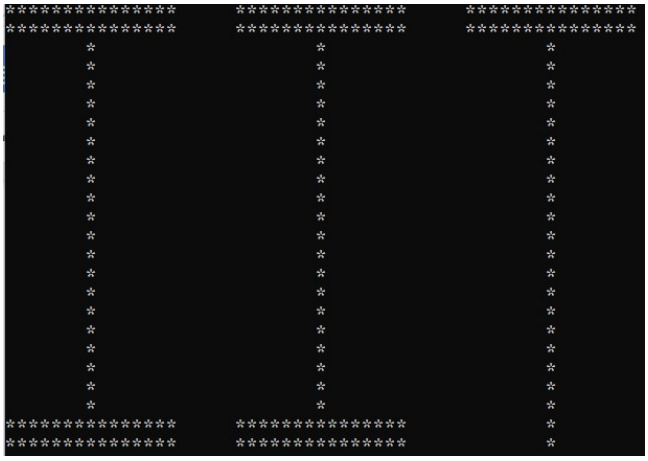
(Optional) PART C:

Challenge Problems:

Q6. Write a program that prints IIT using '*'. Adjust the sizes of your I and T as you want.

The only requirement is that their heights must be the same.
Filename: IIT.cpp

Sample Output:



Q7. Draw a half pyramid using the character **`*.`** Your program should take input **`n`** using **`'cin'`** and draw a half pyramid with **`n`** rows. Given is an example half pyramid for **`n=5.`**
[Hint: You've to use a counter variable, say **`i`**. Make the counter 0 before starting the repeat **`()`** loop and increase it inside the `repeat()` loop. At **i**th row, you should print the character **`* i`** times using a nested loop.] **Filename: half-pyramid.cpp]**

```
*
**
***
****
*****
```

`Q8.` Write a program that accepts three coefficients **`'a', 'b', 'c'`** as input from the first line. Then do the following 3 times: accept a value **`'x'`** and print the evaluation of the quadratic polynomial **`'aX`**^{2} **`+ bX + c'`** at the point **`'x'`**.
Filename: polynomial.cpp

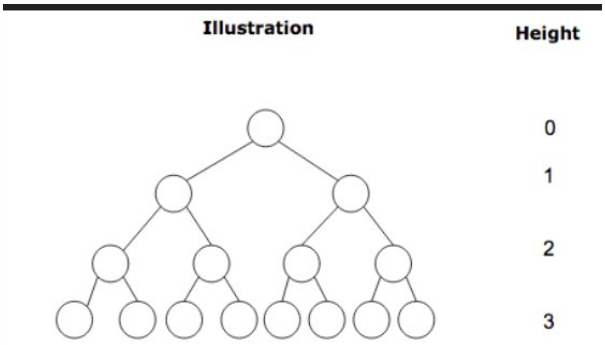
Sample Input
3 5 1
3
1
0

Sample Output
43
9
1

Q9. Can you draw a complete binary tree of height 3 using simplecpp?

It is not necessary for you to show the circles. Just connecting the vertices is enough.

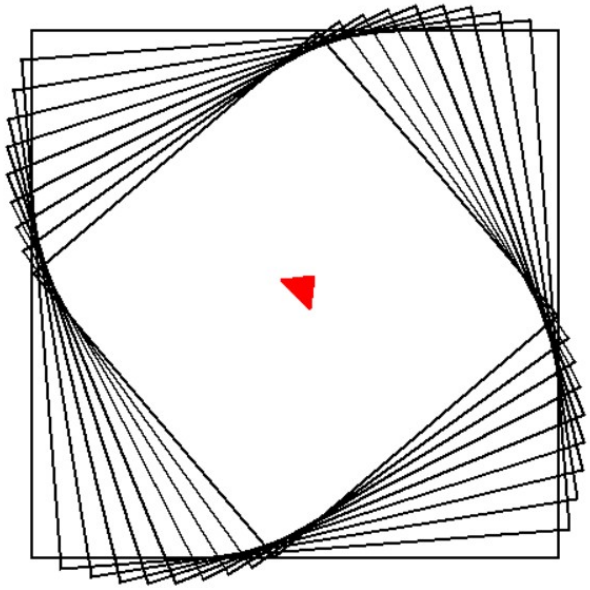
Output :



Filename for code: **`binarytree.cpp`**

Q10. Can you draw the following figure?

Take the side of the biggest square to be 400.

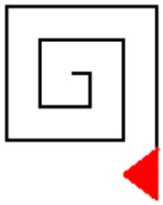


Note : For this, you'll need to declare float/double type variables instead of int.

Hint : There is rotation and shrinking going on simultaneously.

Filename for code: **`rotsquare.cpp`**

Q11. Can you draw the following figure?



Filename for code: **`spiral.cpp`**