Lab Assignment 5
Loops and conditionals

COL 100

3 April 2021

1 Find the output

The following program snippets are executed. Without writing a program, write the output after execution:

1.
```
void main() {
    unsigned char var=0;
    for(var=0;var<=255;var++) {
        printf("%d ",var);
    }
}
```

2.
```
void main() {
    int tally;
    for(tally=0;tally<10;++tally) {
        printf("#");
        if(tally>6)
            continue;
        printf("%d",tally);
    }
}
```

3.
```
void main() {
    int i,j,charVal='A';
    for(i=5;i>=1;i--) {
        for(j=0;j< i;j++)
            printf("%c ",(charVal+j));
        printf("\n");
    }
}
```

2 Ramanujan Number

The British mathematician G. H. Hardy once visited Indian mathematician Srinivasa Ramanujan in the hospital. He recalled their conversation:
"I remember once going to see him when he was ill at Putney. I had ridden in taxi cab number 1729 and remarked that the number seemed to me rather a dull one, and that I hoped it was not an unfavorable omen. "No," he replied, "it is a very interesting number; it is the smallest number expressible as the sum of two cubes in two different ways."

The two different ways are: $1729 = 1^3 + 12^3 = 9^3 + 10^3$
Such numbers are called Hardy-Ramanujan numbers.
Taking two numbers as input, write a program to find all Hardy-Ramanujan numbers between the two.

2.1 Example

2.1.1

Input:

```
1000 2000
```

Output:

```
1729
```

2.1.2

Input:

```
2 5000
```

Output:

```
1729
4104
```

3 Christmas Tree

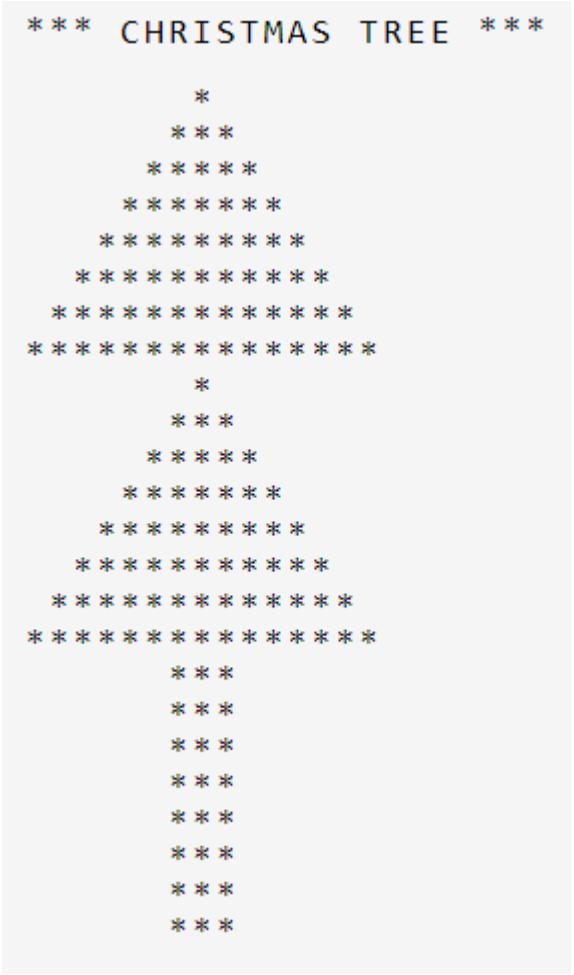
Write a code to create a Christmas tree pattern like the figure shown below. Take the number of sections of the tree, and the size of each section as input. Assume the length of the trunk to be the same as that of each section.

Example

Input:

```
2 8
```

Output:



4 Binary and Decimal Interconversion

Write a program to convert a binary number to its decimal form and vice versa. Take the type of conversion you want to do as input (1 for bin to dec, 2 for dec to bin)

4.1 Example

4.1.1

Input:

```
1 1011
```

Output:

```
11
```

4.1.2

Input:

```
2 22
```

Output:

```
10110
```

5 Inverted Pyramid

Write a code which should read a positive integer n and generates an inverted pyramid as shown below. Examples for n = 1, 2, 3, 4 are given below.

n=1	n=2	n=3	n=4
1	212	32123	4321234
	2	323	43234
		2	434
			4

6 Babylonian algorithm

Babylonian algorithm is an ancient method to find square root of a positive integer n. The square root of a number can be found out iteratively according to the steps given below:

1. Make an initial guess say, b.
2. At every step the program computes the next guess as an average of previous guess and $\frac{n}{previous\ guess}$, say g.
3. Repeat step (2) till the difference between n and the square of your guess becomes less than or equal to 0.001.

7 Day of the week

Write a program to compute the day of the week for a given date according to the Zeller's rule. This rule is applicable only for Gregorian calendar. The equation is defined as below:

$$F = k + \frac{(13 * m - 1)}{5} + D + \frac{D}{4} + \frac{C}{4} - 2 * C$$

where,

k is the day of the month.
m is the month number.
D is the last two digits of the year.
C is the first two digits of the year.

F can be either negative or positive. Divide F by 7 in such a way that the greatest multiple of 7 is less than F. The remainder will correspond to the day of the week as defined below:
0 – Sunday, 1-Monday ..... 6-Saturday.

Note that, the rule assumes the counting of the month as follows: 1-March, 2-April. 12-February

The program takes the date of the month as integer, the month of a year as an integer (according to Zeller's rule) and a year as three inputs and outputs the day of the week as an integer. Ignore the decimal places as and when required, for example if the integer division turns out to be 20.75 then take 20, similarly if it is 5.2 then take 5.

Example:

Input

```
1
2
1983
```

Output

```
5
```

Input

```
2
1
2004
```

Output

```
2
```

8 Second largest number

Find the second largest number among the given numbers given by the user without using array.

8.1 Example

8.1.1

Input:

```
5
78 89 23 44 56
```

Output:

```
78
```

8.1.2

Input:

```
2
88 88
```

Output:

```
Second largest number does not exist.
```

Submission and other logistics

Submit at least 4 code solutions(.c files of 4 questions) as a zip file on Gradescope (to your respective group's course). Additionally, add screenshots in the same submission showing the execution of your code on your terminal with outputs for some given inputs. Submit only one .c file for each question. Use separate .c files for each new question. Please name your .c files as per the question number (q1.c, q2.c, ... etc). Following this naming convention will help TAs to figure out where to look the answers easily. You can also submit more than 4 or all questions to increase your chances of full marks.

Example: To zip folder 'a5' as 'a5.zip':

```
zip -r a5.zip a5
```

It is highly **recommended** that you name the code files and variables in those code files with proper names as per the question to easily identify them. Comments in your codes are also highly **recommended** and makes life easier for everyone.
You can check **2nd Chapter** in NASA's C style guide for styling recommendations.
You can work either individually or with another student of your group for the assignment.
only one submission on gradescope is enough for a team but you need to **add your teammate** on gradescope after submission.
Follow these steps for adding your team member
Note: you can change your team for future assignments