NATIONAL UNIVERSITY OF COMPUTER & EMERGING SCIENCES ISLAMABAD

Programming Fundamentals (CS118)

FALL 2020 ASSIGNMENT # 3

Due Date: (Friday, 20th Nov 2020 at 11:59 pm)

Instructions

Submission: Combine all your work (solution folder) in one .zip file. Use proper naming convention for your submission file. Name the .zip file as **SECTION_ROLL-NUM_03.zip** (**e.g. A_20i0412_03.zip**). Submit .zip file on Google Classroom within the deadline. Failure to submit according to the above format would result in deduction of 10% marks. Submissions on the email will not be accepted.

Plagiarism: Plagiarism cases will be dealt with strictly. If found plagiarized, both the involved parties will be awarded zero marks in this assignment, all of the remaining assignments, or even an **F grade** in the course. Copying from the internet is the easiest way to get caught!

Deadline: The deadline to submit the assignment is Friday, 20th Nov 2020 at **11:59 PM**. Late submission with marks deduction will be accepted according to the course policy shared earlier. Correct and timely submission of the assignment is the responsibility of every student; hence no relaxation will be given to anyone.

This assignment is related to loops. You can use any concepts that have been taught in class such as: conditions, loops and functions. You are not allowed to use pointers, arrays or any other advanced programming concepts.

Comments: Comment your code properly. Write your name and roll number (as a block comment) at the beginning of the solution to each problem.

Tip: For timely completion of the assignment, start as early as possible.

Question1: Write a C++ program that inputs any vowel (upper or lower case) from the user and display it using *

For example:

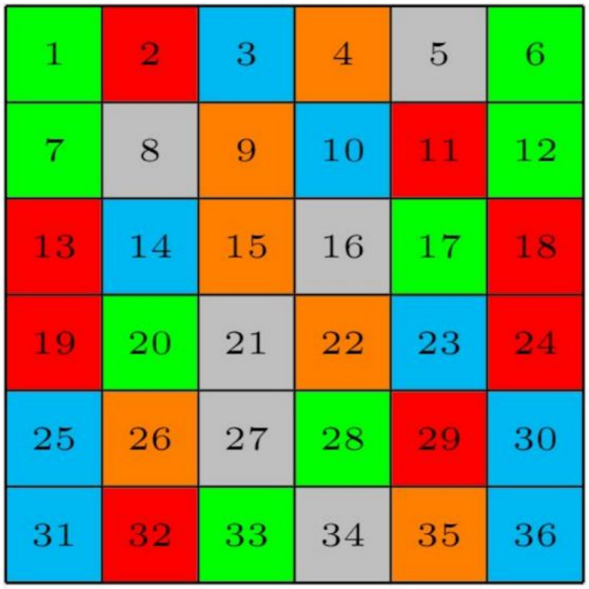
Output:

Please enter a vowel: A

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

Question2: You are given a grid as shown in the figure below. You can determine the color and number of each square from the grid. Write a C++ program that inputs two numbers within the grid range (if not in range, you can ask the user to enter again). Your program will determine if the two squares entered in this grid have the same color or not and display the appropriate message. Your goal is to reveal all the squares(match all the squares), that means you will keep on asking the user to enter two numbers from the range unless all the squares are correctly identified. Once a square is correctly identified, make sure that the user does not repeat the numbers of the revealed squares. If he does, give him a warning and ask to enter values again (You can give max of 3 warnings, on the forth warning you will end the program, even if the grid is not completely revealed). On each iteration you will make sure that the numbers entered do not match with any of the correctly guessed squares.

Note: You cannot use arrays to store the matrix information.



🟩 1	🟥 2	🟦 3	🟧 4	⬜ 5	🟩 6
🟩 7	⬜ 8	🟧 9	🟦 10	🟥 11	🟩 12
🟥 13	🟦 14	🟧 15	⬜ 16	🟩 17	🟥 18
🟥 19	🟩 20	⬜ 21	🟧 22	🟦 23	🟥 24
🟦 25	🟧 26	⬜ 27	🟩 28	🟥 29	🟦 30
🟦 31	🟥 32	🟩 33	⬜ 34	🟧 35	🟦 36

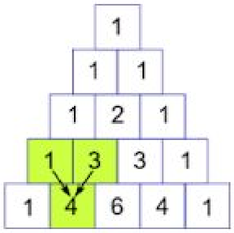
Question3: Write a C++ program that solves one of the following summation problems depending on user's choice, but instead of computing it to infinity, you will ask the user to enter the upper limit of n.

$$\sum_{n=1}^{\infty}\left(\frac{1}{2}\right)^{n}=\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\cdots \qquad \frac{1}{2},\frac{1}{4},\frac{1}{8},\frac{1}{16},\ldots$$

$$\sum_{n=1}^{\infty}\frac{n}{n+1}=\frac{1}{2}+\frac{2}{3}+\frac{3}{4}+\frac{4}{5}+\cdots \qquad \frac{1}{2},\frac{2}{3},\frac{3}{4},\frac{4}{5},\ldots$$

$$\sum_{n=1}^{\infty}\frac{1}{n}=1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\cdots \qquad 1,\frac{1}{2},\frac{1}{3},\frac{1}{4},\ldots$$

Question4: Figure 1 shows a pascal's triangle. To build the triangle, start with 1 at the top, then continue placing numbers below it in a triangular pattern. Each number is the sum of the numbers directly above. Source: https://www.mathsisfun.com/pascals-triangle.html



The total number of k-combinations from an n-element set relates to Pascal's triangle.

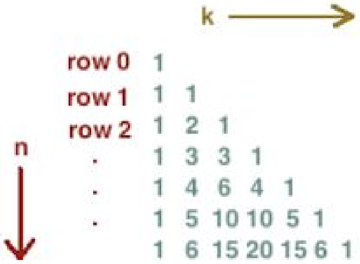
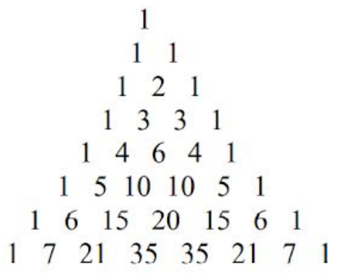


Figure 1

Figure 1 (a): Write a C++ program to print the pascal triangle by using "nested while loop". The program will take a number of rows as input from the user. The output of the program should be as in the following pattern (e.g., if you enter the number of rows = 7).

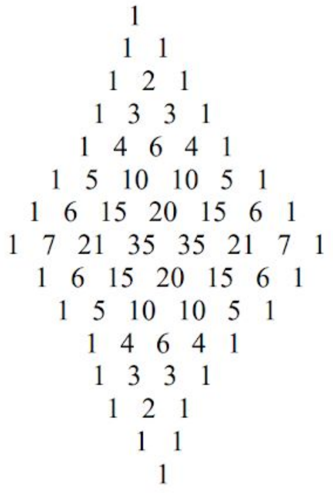
Example Output: Enter the number of rows: 7



```
              1
            1   1
          1   2   1
        1   3   3   1
      1   4   6   4   1
    1   5  10  10   5   1
  1   6  15  20  15   6   1
1   7  21  35  35  21   7   1
```

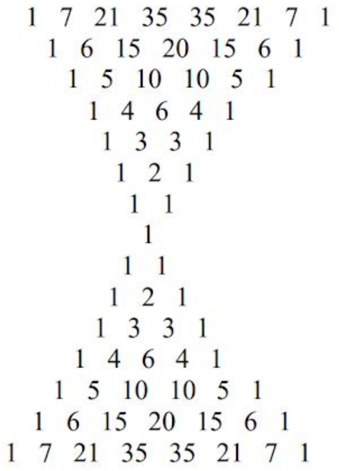
(b): Then use “nested while loops” to print the pascal and invert of the pascal triangle. The program will take a number of rows as input from the user. The output of the program should be as in the following pattern e.g., if you enter the number of rows = 7.

Example Output: Enter the number of rows: 7



```
              1
            1   1
          1   2   1
        1   3   3   1
      1   4   6   4   1
    1   5  10  10   5   1
  1   6  15  20  15   6   1
1   7  21  35  35  21   7   1
  1   6  15  20  15   6   1
    1   5  10  10   5   1
      1   4   6   4   1
        1   3   3   1
          1   2   1
            1   1
              1
```

(c): Write a C++ program to print the pascal triangle and invert of the pascal triangle by using “nested for loops" only. The program will take a number of rows as input from users. Then use “nested for loops" to print the pascal triangle. The output of the program should be as in the following pattern if you enter the number of rows = 7.



```
1   7  21  35  35  21   7   1
  1   6  15  20  15   6   1
    1   5  10  10   5   1
      1   4   6   4   1
        1   3   3   1
          1   2   1
            1   1
              1
            1   1
          1   2   1
        1   3   3   1
      1   4   6   4   1
    1   5  10  10   5   1
  1   6  15  20  15   6   1
1   7  21  35  35  21   7   1
```

Question5: Compose a C++ program that takes the order from the user and calculate the bill accordingly. System should also add some discount on the respective bill that exceeds the limit of the payment. The discount should be added according to the following table:

Within 1000	**5%**
1000 - 1500	**10%**
1500 - 2000	**15%**
2000 - 2500	**20%**
2500 - 3000	**30%**
Above 3000	**50%**

You are required to display the Menu of the restaurant as following

```
***********welcome to main menu***************

Press 1 to select TAKEAWAY
press 2 to select DINE IN
press 3 to select DELIVERY
press 0 to exit

which category you want to choose: 1

***********welcome to takeaway menu***************

_____PRESS 1 FOR BURGER_____
_____PRESS 2 FOR PARATHA ROLL _____
_____PRESS 3 FOR PAKISTANI FOOD _____
_____PRESS enter END ORDER _____
_____PRESS 0 FOR MAIN MENU _____

which category you want to choose: 1
Select burger type:
   1) Mack___________699
   2) Zinger___________599
   3) Hot___________449
   4) Patty Burger___________699
   5) To end order
   6) To exit burger category

Burger option: 4

_____PRESS 1 FOR BURGER_____
_____PRESS 2 FOR PARATHA ROLL _____
_____PRESS 3 FOR PAKISTANI FOOD _____
_____PRESS enter END ORDER _____
_____PRESS 0 FOR MAIN MENU _____

which category you want to choose: 2
Select paratha roll type:
   1) platter___________299
   2) cheese___________349
   3) crispy___________399
   4) double trouble___________699
   5) To end order
   6) To exit paratha roll category

Paratha roll option: 3
```

```
_____PRESS 1 FOR BURGER_____
_____PRESS 2 FOR PARATHA ROLL _____
_____PRESS 3 FOR PAKISTANI FOOD _____
_____PRESS enter END ORDER _____
_____PRESS 0 FOR MAIN MENU _____

which category you want to choose: 2
Select paratha roll type:
   1) platter___________299
   2) cheese___________349
   3) crispy___________399
   4) double trouble___________699
   5) To end order
   6) To exit paratha roll category

Paratha roll option: 6

_____PRESS 1 FOR BURGER_____
_____PRESS 2 FOR PARATHA ROLL _____
_____PRESS 3 FOR PAKISTANI FOOD _____
_____PRESS enter END ORDER _____
_____PRESS 0 FOR MAIN MENU _____

which category you want to choose: 3
Select Pakistani food type:
   1) Haleem___________199
   2) Nihaari___________199
   3) Daal___________149
   4) Ghosht___________249
   5) To end order
   6) To exit pakistani food category

Pakistani food option: 6

_____PRESS 1 FOR BURGER_____
_____PRESS 2 FOR PARATHA ROLL _____
_____PRESS 3 FOR PAKISTANI FOOD _____
_____PRESS enter END ORDER _____
_____PRESS 0 FOR MAIN MENU _____

which category you want to choose: ↲
```

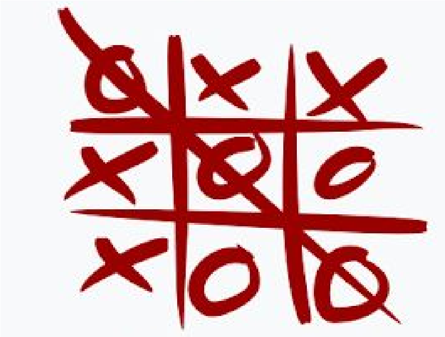
********Now the order is complete and you should calculate the bill. That is just the total amount and the discounter amount*******

Hint: cin.ignore() can be helpful

Note: The menu is the same for Dine in and delivery.
For DINE IN, you will include 16% GST charges to your bill
For Delivery you will charge flat 200 to your bill

Every time the user is back to the MAIN MENU and select a different option, previously placed order will be maintained and just the additional charges will be added (no extra charges on takeaway, 16% on dine in and 200 Rs for delivery)

Question6: **Tic-tac-toe** (**noughts and crosses** or **Xs and Os)** is a paper-and-pencil game for two players, *X* and *O*, who take turns marking the spaces in a 3×3 grid. The player who succeeds in placing three of their marks in a horizontal, vertical, or diagonal row is the winner.



For this question you will have to write a C++ program to develop a tic tac toe game that can be played on your system. Demo: https://www.google.com/search?q=tic+tac+toe

You will display two options to the user:

1. Single player game (vs. computer)
2. 2-player game

Depending on the choice made by the user, you will start your game. For the two player game you will have two players: player1 and player2. Mark for player1 will be X and for player2 will be O. Your program will ask player 1 to enter a position where he wants to place his mark.

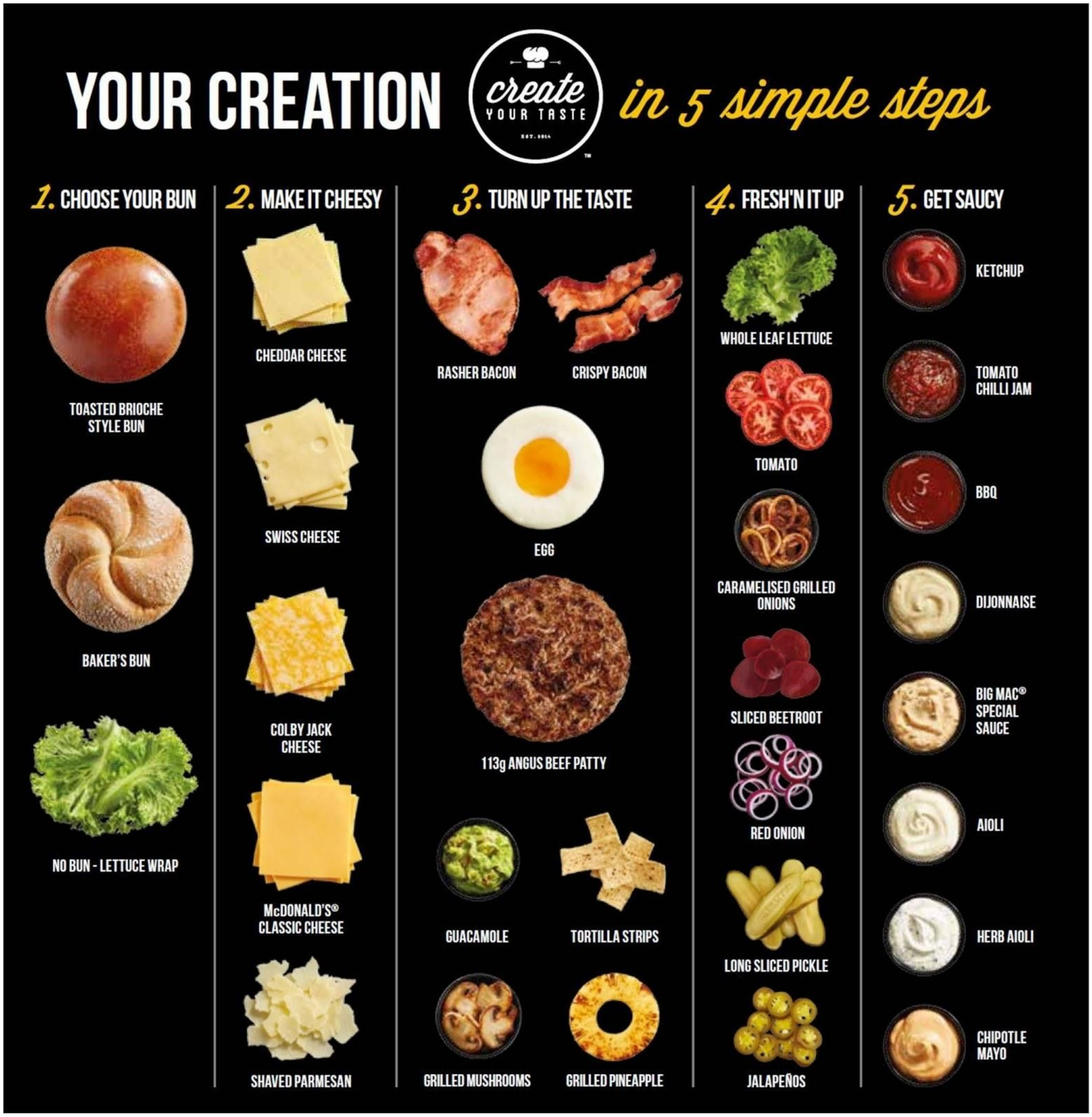
```
_____|______|___
_____|______|___
     |      |
```

Valid positions will be 1,2,3,4,5,6,7,8,9. Whatever is the input of player1, you will make sure that no mark is already placed at that position. Same is for player2. For each turn you will check if there is a win yet. If not, then you will continue with the game else you will display the appropriate message.

For a Single player game, you will have two players but this time one of them will be a computer. Your program will ask player 1 to enter a position where he wants to place his mark. Valid positions will be 1,2,3,4,5,6,7,8,9. Whatever is the input of player1, you will make sure that no mark is already placed at that position. For computer player you will generate a random number from 1 to 9 and place the computer's sign there but again make sure that no mark is already placed at that position. If there is a mark present, you will again generate the position. For each turn you will check if there is a win yet. If not, then you will continue with the game else you will display the appropriate message.

Question7: Welcome to your burger shop!

Write a C++ code to develop a software for your burger shop that takes orders for a tasty burger from the user, in just 5 steps. Attached below is the menu that you are going to display to the user in a nice attractive format.
First of all you will ask the user to enter the number of burgers he wants to order. Foreach burger the user can only add one type of bun to the burger. Any number of cheeses, 1 item from the category "turn up the taste", maximum 3 from fresh'n it up and any number of sauces. If the user presses 0 then you are going to skip that category (user can not skip "choose your bun" and "turn up the taste").



Each element from the “choose your bun” costs .72$
Each element from the “make it cheesy” costs .5$
Each element from the “turn up the taste” costs 1.2$
Each element from the “fresh’N it up” costs .2$
Each element from the “get saucy” costs .3$

After taking the input from the user. Total cost will be displayed for the burger in $.

Question8:

Happy Numbers: A number is called a happy number, if you start with the given number and arrive at 1 by repeating the following process (as illustrated in the below example): (a) compute the sum of the squares of given number digits (b) if the resultant value is 1, then the number is happy number, else execute point (a) for the newly produced number.

Note that if a number is not a happy number, there will be an endless loop to this execution.

Goal: In this question, you are required to write C++ code that checks whether the number entered by the user is a happy number or not for 10 cycles/iterations only.

Example: Assume a number 19

Number	**Computation**	**Result**	**cycle/iterations**
19	$\mathbf{1}^{2} + \mathbf{9}^{2}$	82	1
82	$\mathbf{8}^{2} + \mathbf{2}^{2}$	68	2
68	$\mathbf{6}^{2} + \mathbf{8}^{2}$	100	3
100	$\mathbf{1}^{2} + \mathbf{0}^{2} + \mathbf{0}^{2}$	1	4