LAB 10/24

1. Write a program to approximate the value of **π** using the formula:

$$\frac{2}{\pi}=\underbrace{\frac{\sqrt{2}}{2}}_{term1}\cdot\underbrace{\frac{\sqrt{2+\sqrt{2}}}{2}}_{term2}\cdot\underbrace{\frac{\sqrt{2+\sqrt{2+\sqrt{2}}}}{2}}_{term3}\cdot\underbrace{\frac{\sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2}}}}}{2}}_{term4}\cdot\cdots\cdots$$

stop when the difference between old result and new result with new term is smaller than 1E-15. Please use do{}while(); to complete it and show the answer to the 15th decimal place.

note:

You can use sqrt() function in math.h.

π = 3.141592653589792

2. Please write programs to let user input x and print out the results. Stop when the added or subtracted term is less than 10^{-15} and show the answer to the 10th decimal place. Additionally, you have to repeat your program and stop when user input **^D or ^Z**. Please use do{}while(); or while() to complete it.

$$\arccos x=\pi-\sqrt{2(x+1)}\sum_{n=0}^{\infty}\left(\frac{(2n)!}{2^{3n}(n!)^2}\right)\frac{(x+1)^n}{(2n+1)},\quad\forall|x|\le 1$$

note:

You can use sqrt() function in math.h and the result of **π** in problem 1.

Example:

arccos(0.9) = 0.4510268118

arccos(0.1) = 1.4706289056

3. Write a program which print out the following table using for loop.
Numbers in the table are how many steps needed from (x, y), where x and y is read from the keyboard.
(You just can use one loop to finish the main part, please do not use nested loop and if/else.)
Hint: You can try to use ternary operator.

Example:

```
0 0
      0  1  2  3  4  5  6  7  8  9 10
-----------------------------------
 0 |  0  1  2  3  4  5  6  7  8  9 10
 1 |  1  2  3  4  5  6  7  8  9 10 11
 2 |  2  3  4  5  6  7  8  9 10 11 12
 3 |  3  4  5  6  7  8  9 10 11 12 13
 4 |  4  5  6  7  8  9 10 11 12 13 14
 5 |  5  6  7  8  9 10 11 12 13 14 15
 6 |  6  7  8  9 10 11 12 13 14 15 16
 7 |  7  8  9 10 11 12 13 14 15 16 17
 8 |  8  9 10 11 12 13 14 15 16 17 18
 9 |  9 10 11 12 13 14 15 16 17 18 19
10 | 10 11 12 13 14 15 16 17 18 19 20
```

```
5 5
      0  1  2  3  4  5  6  7  8  9 10
-----------------------------------
 0 | 10  9  8  7  6  5  6  7  8  9 10
 1 |  9  8  7  6  5  4  5  6  7  8  9
 2 |  8  7  6  5  4  3  4  5  6  7  8
 3 |  7  6  5  4  3  2  3  4  5  6  7
 4 |  6  5  4  3  2  1  2  3  4  5  6
 5 |  5  4  3  2  1  0  1  2  3  4  5
 6 |  6  5  4  3  2  1  2  3  4  5  6
 7 |  7  6  5  4  3  2  3  4  5  6  7
 8 |  8  7  6  5  4  3  4  5  6  7  8
 9 |  9  8  7  6  5  4  5  6  7  8  9
10 | 10  9  8  7  6  5  6  7  8  9 10
```

```
3 7
      0  1  2  3  4  5  6  7  8  9 10
-----------------------------------
 0 | 10  9  8  7  6  5  4  3  4  5  6
 1 |  9  8  7  6  5  4  3  2  3  4  5
 2 |  8  7  6  5  4  3  2  1  2  3  4
 3 |  7  6  5  4  3  2  1  0  1  2  3
 4 |  8  7  6  5  4  3  2  1  2  3  4
 5 |  9  8  7  6  5  4  3  2  3  4  5
 6 | 10  9  8  7  6  5  4  3  4  5  6
 7 | 11 10  9  8  7  6  5  4  5  6  7
 8 | 12 11 10  9  8  7  6  5  6  7  8
 9 | 13 12 11 10  9  8  7  6  7  8  9
10 | 14 13 12 11 10  9  8  7  8  9 10
```