

Conventional Course Fall 2021

COMP-111 (Section 04) Programming Principles I

Programming Assignment 3

Made by Ivan Kosiakov (U214N1534)

Problems

Problem 1

Suppose that the tuition for a university is \$10,000 this year (year 1) and increases 5% every year. Write a program that computes the tuition in x years from now, with x being a number given by the user. In addition, the program should compute the total cost of y years' worth of tuition starting from now, with y being a number given by the user. Finally, the program should display the tuition for x years along with the total tuition cost at the end of each year. Your program will terminate when the user enters 0.

Here is a sample run:

```
Welcome to the tuition calculator!

1 Compute the yearly tuition in x years from today
2 Compute the total tuition cost for y years from today
3 Compute yearly tuition and total tuition cost at the end of each year, for x years
0 Quit program

Enter choice: 1
You want to know the yearly tuition in how many years from today? 2
The yearly tuition after 2 years from today will be 11025

Enter choice: 2
You want to know the total tuition cost after how many years from today? 2
The total tuition cost after 2 years from today will be 20500

Enter choice: 3
How many years you want to consider starting from today? 3

Year      Tuition      Total Tuition Cost at the End of Year
1         10000      10000
2         10500      20500
3         11025      31525

Enter choice: 0
Goodbye!
```

```
Microsoft Visual Studio Debug Console
Welcome to the tuition calculator!

1 Compute the yearly tuition in x years from today
2 Compute the total tuition cost for y years from today
3 Compute yearly tuition and total tuition cost at the end of each year, for x years
0 Quit program

Enter your choice: 1
You want to know the yearly tuition in how many years from today? 2
The yearly tuition after 2 years from today will be 11025

Enter your choice: 2
You want to know the total tuition cost after how many years from today? 2
The total tuition cost after 2 years from today will be 20500

Enter your choice: 3
How many years you want to consider starting from today? 3

Year      Tuition      Total Tuition Cost at the End of Year
1          10000      10000
2          10500      20500
3          11025      31525

Enter your choice: 0
Goodbye!
C:\Users\krop-\source\repos\Programming Principles\Assignment3\Problem1\Debug\Problem1.exe (process 6824) exited with code 0.
Press any key to close this window . . .
```

Pic. 1. Try to enter integers. Code compiled successfully.

```
Microsoft Visual Studio Debug Console
Welcome to the tuition calculator!

1 Compute the yearly tuition in x years from today
2 Compute the total tuition cost for y years from today
3 Compute yearly tuition and total tuition cost at the end of each year, for x years
0 Quit program

Enter your choice: 5
You entered invalid number. Try again!
Enter your choice: 1
You want to know the yearly tuition in how many years from today? 2
The yearly tuition after 2 years from today will be 11025

Enter your choice: 0
Goodbye!
C:\Users\krop-\source\repos\Programming Principles\Assignment3\Problem1\Debug\Problem1.exe (process 22536) exited with code 0.
Press any key to close this window . . .
```

Pic. 2. Try to enter invalid number in selector. Program shows an error, but code compiled successfully.

```
Microsoft Visual Studio Debug Console
You want to know the yearly tuition in how many years from today? 1
The yearly tuition after 1 years from today will be 10500

Enter your choise: 2
You want to know the total tuition cost after how many years from today? -2
You entered invalid number. Try again!

You want to know the total tuition cost after how many years from today? 0
You entered invalid number. Try again!

You want to know the total tuition cost after how many years from today? 1
The total tuition cost after 1 years from today will be 10000

Enter your choise: 3
How many years you want to consider starting from today? -2
You entered invalid number. Try again!

How many years you want to consider starting from today? 0
You entered invalid number. Try again!

How many years you want to consider starting from today? 1

Year      Tuition      Total Tuition Cost at the End of Year
1          10000          10000

Enter your choise: 0
Goodbye!
C:\Users\krop-\source\repos\Programming Principles\Assignment3\Problem1\Debug\Problem1.exe (process 11084) exited with code 0.
Press any key to close this window . . .
```

Pic. 3. Try to enter a negative value or zero in functions. Program shows an error, but code compiled successfully.

Problem 2

Write a program that displays 10 numbers per line, all numbers from 100 to 1000 that are divisible by 5 and 6.

```
Microsoft Visual Studio Debug Console
120 150 180 210 240 270 300 330 360 390
420 450 480 510 540 570 600 630 660 690
720 750 780 810 840 870 900 930 960 990

C:\Users\krop-\source\repos\Programming Principles\Assignment3\Problem2(F)\Debug\Problem2.exe (process 17508) exited with code 0.
Press any key to close this window . . .
```

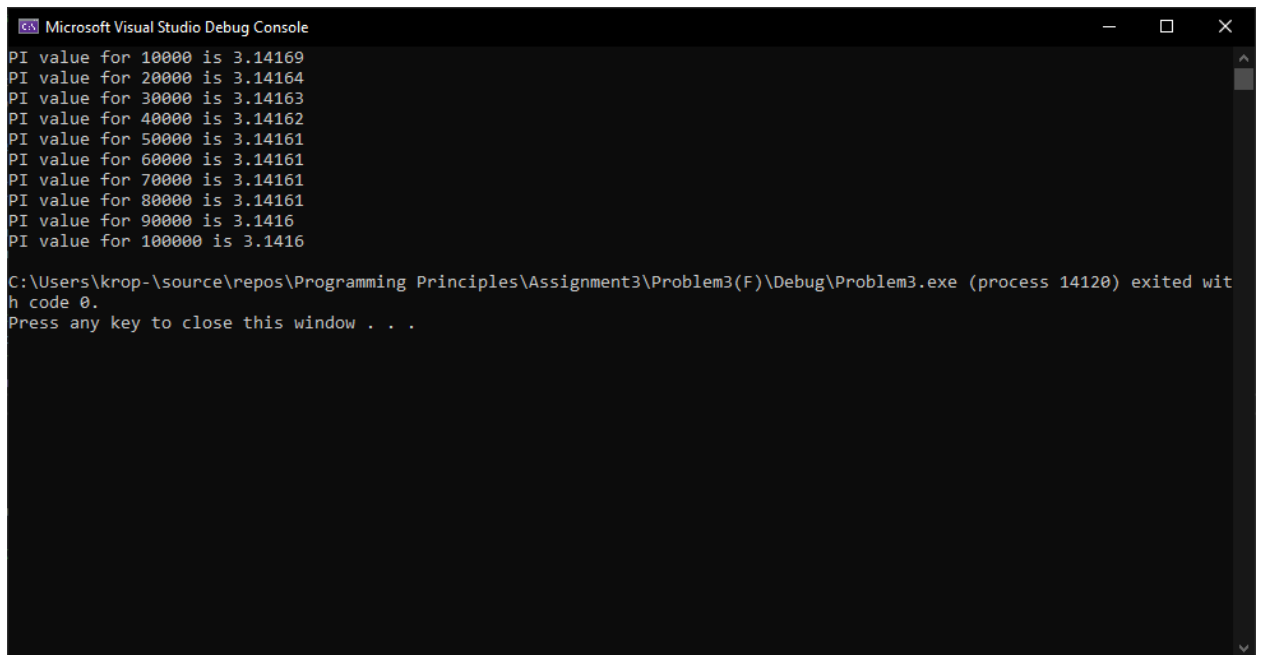
Pic. 1. Code compiled successfully.

Problem 3

You can approximate π by using the following series:

$$\pi = 4 \left(1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} + \frac{1}{13} - \dots - \frac{1}{2i-1} + \frac{1}{2i+1} \right)$$

Write a program that displays the π value for $i=10000, 20000, \dots, 100000$



```
Microsoft Visual Studio Debug Console
PI value for 10000 is 3.14169
PI value for 20000 is 3.14164
PI value for 30000 is 3.14163
PI value for 40000 is 3.14162
PI value for 50000 is 3.14161
PI value for 60000 is 3.14161
PI value for 70000 is 3.14161
PI value for 80000 is 3.14161
PI value for 90000 is 3.1416
PI value for 100000 is 3.1416
C:\Users\krop-\source\repos\Programming Principles\Assignment3\Problem3(F)\Debug\Problem3.exe (process 14120) exited with code 0.
Press any key to close this window . . .
```

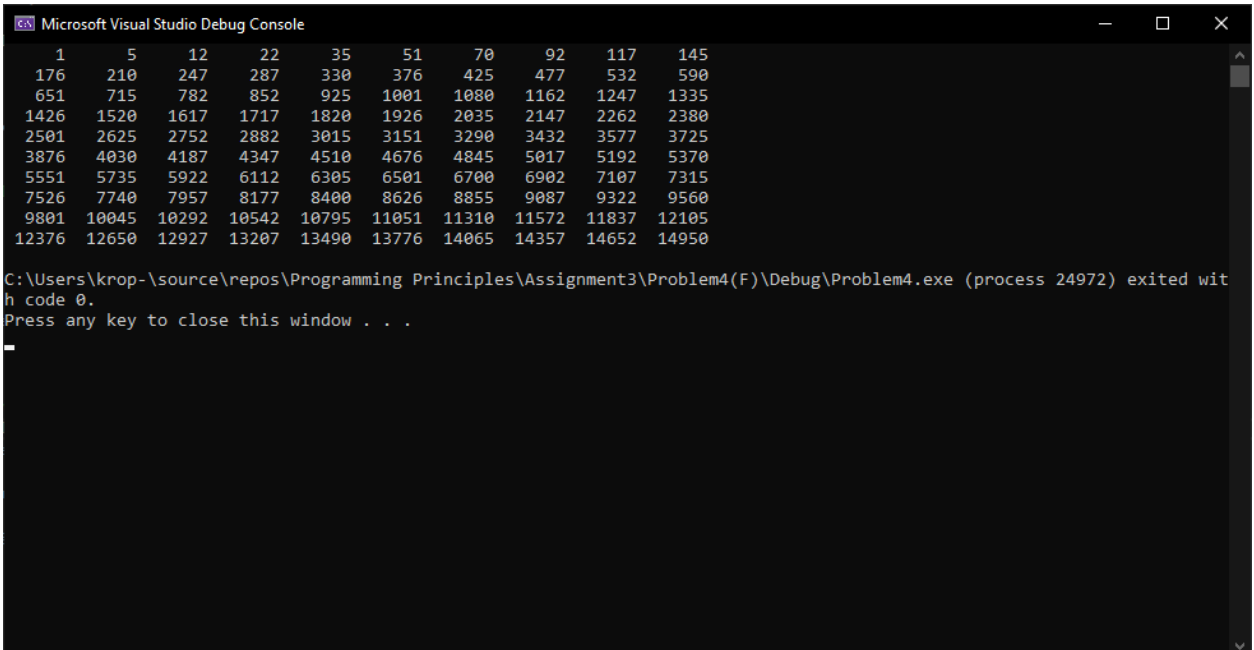
Pic. 1. Code compiled successfully.

Problem 4

A pentagonal number is defined as $n(3n-1)/2$ for $n=1, 2, \dots$, and so on. The first few numbers are 1,5,12, 22, ...Write the following function that returns a pentagonal number:

```
int getPentagonalNumber(int n)
```

Write a test program that displays the first 100 pentagonal numbers with 10 numbers on each line.



```
Microsoft Visual Studio Debug Console

1    5    12   22   35   51   70   92   117  145
176  210  247  287  330  376  425  477  532  590
651  715  782  852  925  1001 1080 1162 1247 1335
1426 1520 1617 1717 1820 1926 2035 2147 2262 2380
2501 2625 2752 2882 3015 3151 3290 3432 3577 3725
3876 4030 4187 4347 4510 4676 4845 5017 5192 5370
5551 5735 5922 6112 6305 6501 6700 6902 7107 7315
7526 7740 7957 8177 8400 8626 8855 9087 9322 9560
9801 10045 10292 10542 10795 11051 11310 11572 11837 12105
12376 12650 12927 13207 13490 13776 14065 14357 14652 14950

C:\Users\krop-\source\repos\Programming Principles\Assignment3\Problem4(F)\Debug\Problem4.exe (process 24972) exited with code 0.
Press any key to close this window . . .
```

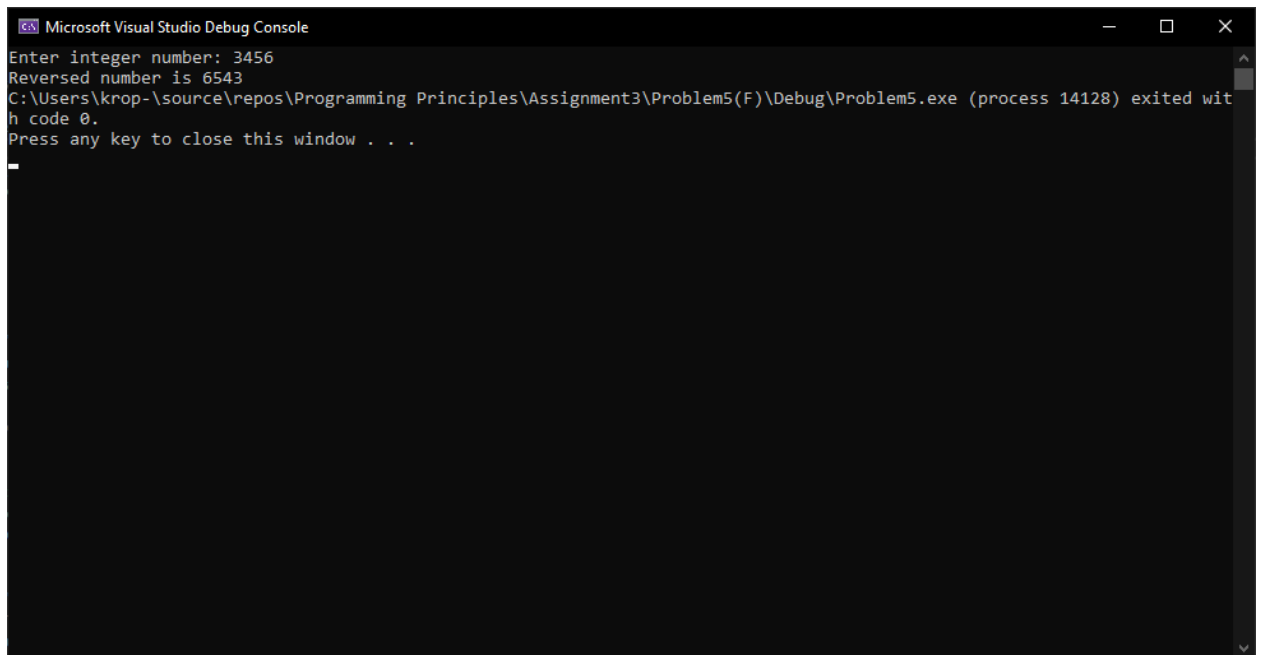
Pic. 1.Code compiled successfully.

Problem 5

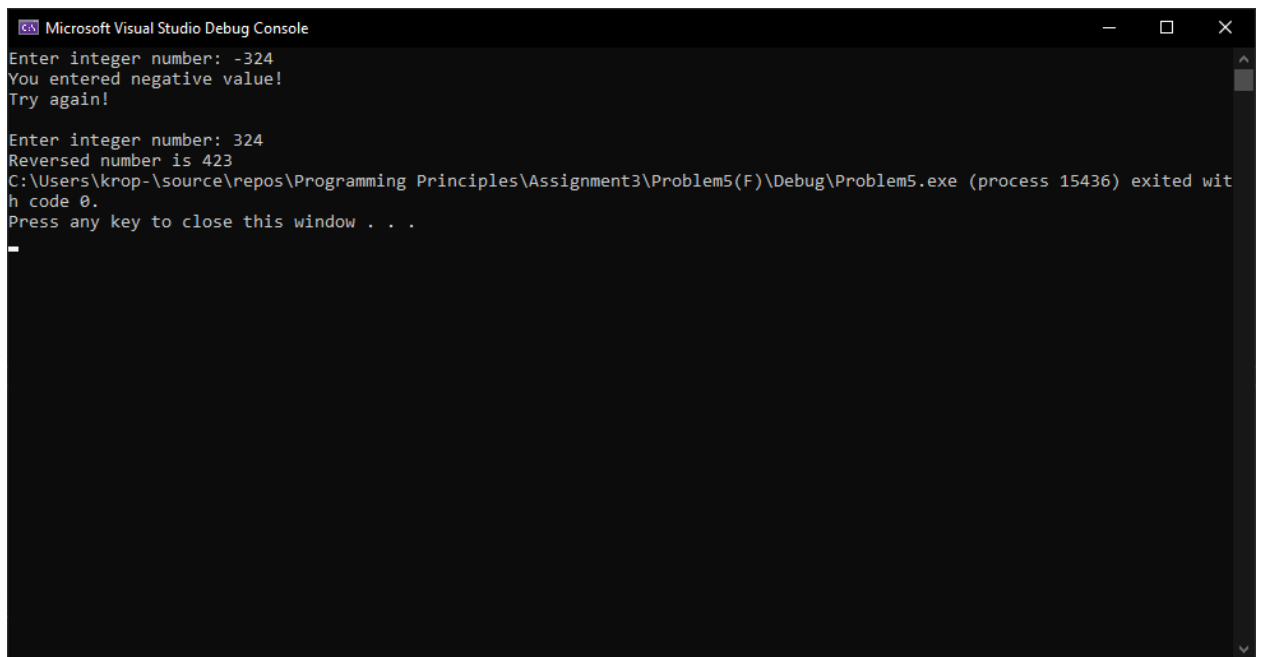
Write the following function to return the reverse of an integer number:

```
int reverse(int number)
```

For example, `reverse(3456)` returns 6543. Write a test program that prompts the user to enter an integer and displays its reversal.



Pic. 1. Try to enter integer numbers. Code compiled successfully.

A screenshot of the Microsoft Visual Studio Debug Console window. The window has a title bar with the Visual Studio logo and the text "Microsoft Visual Studio Debug Console". The console output shows the following text: "Enter integer number: -324", "You entered negative value!", "Try again!", "Enter integer number: 324", "Reversed number is 423", "C:\Users\krop-\source\repos\Programming Principles\Assignment3\Problem5(F)\Debug\Problem5.exe (process 15436) exited with code 0.", and "Press any key to close this window . . .". The window has standard Windows window controls (minimize, maximize, close) in the top right corner.

```
Microsoft Visual Studio Debug Console
Enter integer number: -324
You entered negative value!
Try again!
Enter integer number: 324
Reversed number is 423
C:\Users\krop-\source\repos\Programming Principles\Assignment3\Problem5(F)\Debug\Problem5.exe (process 15436) exited with code 0.
Press any key to close this window . . .
```

Pic. 2. Try to enter negative numbers. Program asks for re-entering a value. Code compiled successfully.

Problem 5

Write the following function that tests whether or not a point is within a rectangle centered at (0,0):

```
void pointInRectangle(double width, double height, double x, double y, bool &inRectangle)
```

Write a test program that prompts the user to enter the dimensions of a rectangle and the coordinates of a point and displays the appropriate message depending on whether or not the point is within the rectangle. The process is repeated until the user enters 0 for the width and 0 for the height. Your program should do error checking on the width and height.

```
Microsoft Visual Studio Debug Console
Enter width and height of a rectangle : 6 6
Enter the two coordinates of the point: 1 3
Point is within a rectangle

Enter width and height of a rectangle : 6 6
Enter the two coordinates of the point: 7 5
Point is NOT withing a rectangle

Enter width and height of a rectangle : 0 0

Goodbye!
C:\Users\krop-\source\repos\Programming Principles\Assignment3\Problem6(F)\Debug\Problem6.exe (process 12316) exited with
code 0.
Press any key to close this window . . .
```

Pic. 1. Try to enter integer numbers. Code compiled successfully.

```
Microsoft Visual Studio Debug Console
Enter width and height of a rectangle : -6 -6
You entered negative value! Try again!

Enter width and height of a rectangle : 6 -6
You entered negative value! Try again!

Enter width and height of a rectangle : -6 6
You entered negative value! Try again!

Enter width and height of a rectangle : 0 0

Goodbye!
C:\Users\krop-\source\repos\Programming Principles\Assignment3\Problem6(F)\Debug\Problem6.exe (process 572) exited with
code 0.
Press any key to close this window . . .
```

Pic. 2. Try to enter negative values for rectangle. Program asks for re-entering a value. Code compiled successfully.


```
Microsoft Visual Studio Debug Console
Enter width and height of a rectangle : 10 10
Enter the two coordinates of the point: -16 -10
Point is NOT withing a rectangle

Enter width and height of a rectangle : 6 6
Enter the two coordinates of the point: -3 -1
Point is within a rectangle

Enter width and height of a rectangle : 0 0

Goodbye!
C:\Users\krop-\source\repos\Programming Principles\Assignment3\Problem6(F)\Debug\Problem6.exe (process 15448) exited with code 0.
Press any key to close this window . . .
```

Pic. 3. Try to enter negative values for coordinates of point. Code compiled successfully.