عنوان البحث

Programming Applications [3]

كلـــــــــــية	: **الهندسة الالكترونية بمنوف**
القســـم/الشعبة	: **عام**
الفرقـة/المستوي	: **إعدادي**
اســـم المقـــرر	: Computer Languages
كـــود المقـــرر	: CSE 024
اســـم الطالب	: **عبد اللّه مصطفى سعد أحمد زهرة**
الرقـــم القومي	:
البريد الأكاديمي	: 1900227@el-eng.menofia.edu.eg
اشـــــــــراف	: **أ.د./ جمال محروس إسماعيل** : **أ.د./ عبير عبد العزيز العشرة**

Abstract

Computer software is a set of instructions written in a certain programming language to tell the computer to do a specific task and how to it.

There are four types of software, system software, application software, network software, and malware.

There are three types of computer languages, high-level like C++ and Python, assembly, and machine code.

The project shows an implementation of a big application contains five smaller programs.

Introduction

Software is a set of instructions that tell the computer to do a specific task and how to do it. There are four types of software, system software, application software, network software, and malware. The main types of software are System software which generally controls computer hardware and application software which includes the software running on top of the system software and adds more functionality to the computer[1]. The first piece of software is known to be written by Ada Lovelace in the 19th century for the planned

Analytical Engine[2].

Since the software is a set of instructions, computer languages are the way by which we write these instructions. Programming languages are mainly categorized into high-level, assembly and machine code. High-level computer languages like C, C++, C#, and Python are close to human unlike assembly language which is closer to machine[3].

Compilers are special software used to translate (compile) high-level language into assembly language[4], then assembly code is translated onto machine code to be executed[5].

Research Project Contents

Project Name: Programming Applications [3]

Project Details

A program written using C++ programming language allows the user to interact with it using dialogues, if statements, selections, and arrays.

It has 5 applications that allow the user to make calculations and comparisons and to draw a certain pattern depending on how many lines the user wants.

Project Solution

```
1. #include <iostream>
2. #include <cmath>
3. #include <algorithm>
4.
5. using namespace std;
6.
7.
8. void area()
9. {
10.  int sel; // the selector of the operation
11.
12.   // messages to the user to interact with the program
13.  cout << "Please, select of the following shapes to find its area:" << endl;
14.  cout << "       [1] Select 1 to calculate the area of a Circle" << endl;
15.  cout << "       [2] Select 2 to calculate the area of a Square" << endl;
16.  cout << "       [3] Select 3 to calculate the area of a Rectangle" << endl;
17.  cout << "Please, Enter Your Selection:" << endl;
18.  cin >> sel; // to enter a certain switch case
19.
20.
21.
22.          switch (sel)
23.          {
24.          case 1: // calculates the area of a circle
```

```
25.          {
26.          long double r; // redius of the circle
27.          cout << "Please, Enter the radius of the circle:" << endl;
28.          cin >> r;
29.          // the calculation of the area of the circle and the output
30.          cout << "The area of the circle = " << 3.14159 * pow(r, 2.0) << endl;
31.                  break;
32.          }
33.          case 2: // calculates the area of a square
34.          {
35.                  long double l;
36.                  cout << "Please, enter the side length of the square:\n";
37.                  cin >> l;
38.                  // the calculation and the output of the area of the square
39.                  cout << "The area of the square = " << pow(l, 2.0) << endl;
40.                  break;
41.          }
42.
43.
44.         case 3: // calculates the area of a rectangle
45.          {
46.                  long double width, height;
47.          cout << "Please, enter the width of the rectangle" << endl;
48.          cin >> width;
49.          cout << "Please, enter the height of the rectangle" << endl;
50.          cin >> height;
51.  // the calculation and the output of the area of the rectangle
52.          cout << "The area of the rectangle = " << width * height << endl;
53.          break;
54.          }
55.          }
56.          // end of the program
57.  }
58.
59.
60.  void summing() // the summing system
61.  {
62.  long double n, x, sum = 0;
63.
64.  cout << "Please, enter the number of numbers to calculate their sum and
     average:" << endl;
65.  cin >> n;
66.
67.  for (int i = 1; i <= n; i++) // to calculate the sum of the numbers
68.          {
69.                  cout << "Please, enter number " << i << endl;
70.                  cin >> x;
71.                  sum += x;
72.          }
73.           // the sum output
74.          cout << "The sum of the numbers = " << sum << endl;
75.
76.          // the calculation and output of the average
77.          cout << "The average of the numbers = " << sum / n << endl;
78.  }
79.
80.
81.
82.  void minimum()
83.  {
84.          int n, a[1000], mini;
```

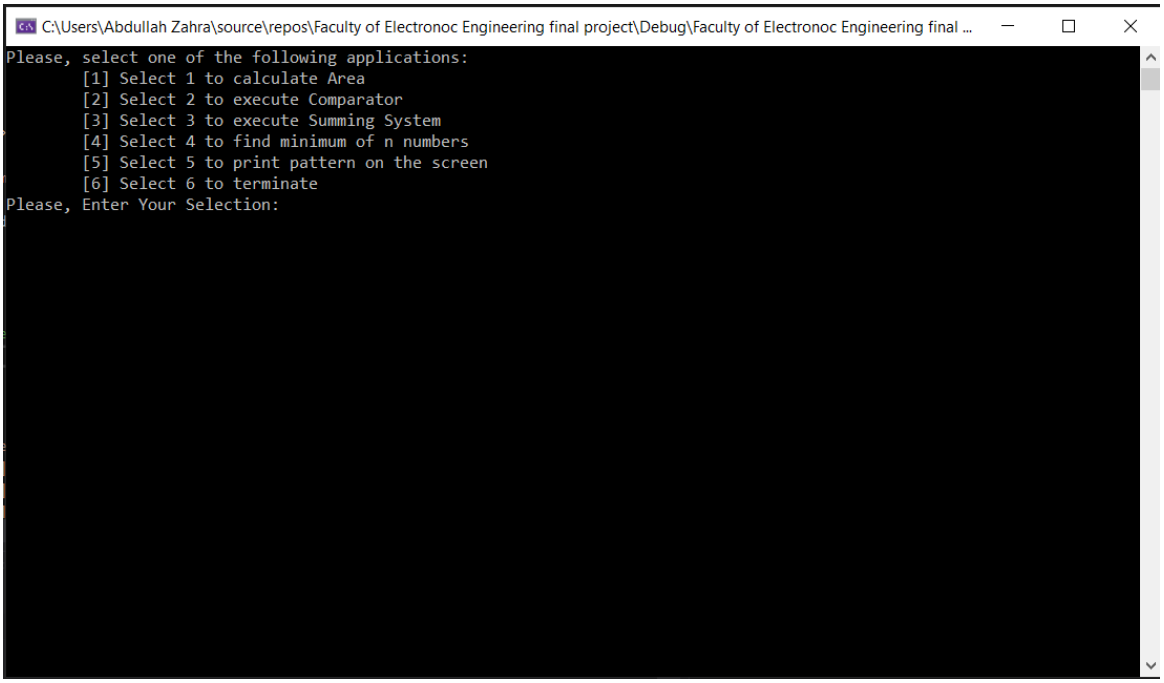
```
85.          cout << "Please, enter the number of values:" << endl;
86.          cin >> n;
87.
88.          cout << "Please, enter number 1" << endl;
89.          cin >> a[0];
90.
91.          mini = a[0];
92.          for (int i = 1; i < n; i++)
93.          {
94.                  cout << "Please, enter numbre " << i + 1 << endl;
95.                  cin >> a[i];
96.                  mini = min(mini, a[i]); // to calculate the minimum number so far
97.          }
98.          cout << "The minimum number = " << mini << endl;
99.  }
100.
101.
102.
103.
104.
105.
106. void pattern()
107. {
108.          int n;
109.          cout << "Please, enter the number of rows:" << endl;
110.          cin >> n;
111.          for (int i = 1; i <= n; i++)
112.          {
113.                  for (int j = 1; j <= (n-i); j++)
114.                  {
115.                          cout << " ";
116.                  }
117.                  for (int j = 1; j <= ((2 * i) - 1); j++)
118.                  {
119.                          cout << "*";
120.                  }
121.                  cout << endl;
122.          }
123. }
124.
125.
126.
127. int main()
128. {
129.          int selection=0; // to select a program to enter
130.          int again = 0; // we use this variable in each case to know when to
     terminate the program
131.
132.
133.          while (selection >= 0) // an infinte loop only terminated by the user
134.          {
135.          // messages to the user to interact with the program
136.          cout << "Please, select one of the following applications:" << endl;
137.          cout << "       [1] Select 1 to calculate Area" << endl;
138.          cout << "       [2] Select 2 to execute Comparator" << endl;
139.          cout << "       [3] Select 3 to execute Summing System" << endl;
140.          cout << "       [4] Select 4 to find minimum of n numbers" << endl;
141.          cout << "       [5] Select 5 to print pattern on the screen" << endl;
142.          cout << "       [6] Select 6 to terminate" << endl;
143.          cout << "Please, Enter Your Selection:" << endl;
144.
```

```
145.
146.
147.                cin >> selection; // to enter a certain switch case
148.
149.                if (selection == 6)
150.                {
151.                        cout << "Thank you." << endl;
152.                        break;
153.                }
154.
155.
156.
157.
158.
159.
160.
161.
162.
163.
164.
165.
166.
167.
168.                switch (selection)
169.                {
170.                case 1: // it goes to the area function
171.                {
172.                        area();
173.                        break;
174.                }
175.
176.                 case 2: // A simple comparator that compares three different
    integer numbers (x, y and z) to find the largest value.
177.                {
178.                        int x, y, z, maximum;
179.                        cout << "Please, enter the first number:" << endl;
180.                        cin >> x;
181.                        cout << "Please, enter the second number:" << endl;
182.                        cin >> y;
183.                        cout << "Please, enter the third number:" << endl;
184.                        cin >> z;
185.                        maximum = max(x, y); // first we compare the first two
    numbers using the max() function
186.                        maximum = max(maximum, z); // the we compare the largest
    of the first two numbers with the third number
187.
188.                        cout << "The largest number = " << maximum << endl;
189.                        break;
190.                }
191.                case 3: // A simple summing system that computes the sum and
    average of n numbers that input from the keyboard
192.                {
193.                        summing();
194.                        break;
195.                }
196.
197.                case 4: // A function called minimum( ) to compute and return the
    minimum value of n integer numbers that input from the keyboard
198.                {
199.                        minimum();
200.                        break;
```

```
201.                 }
202.
203.                 case 5: // A function to drow a pattern
204.                 {
205.                         pattern();
206.                         break;
207.                 }
208.                 }
209.
210.                 cout << "\nDo you want to continue?" << endl; // to tell the user
   to continue or to terminate
211.                 cout << "\t[1] Select 1 to select YES" << endl;
212.                 cout << "\t[2] Select 2 to select NO" << endl;
213.                 cin >> again;
214.                 if (again == 2)
215.                 {
216.                         cout << "Thank you." << endl;
217.                         break;
218.                 }
219.
220.         }
221.         return 0;
222. }
```

Solution explanation

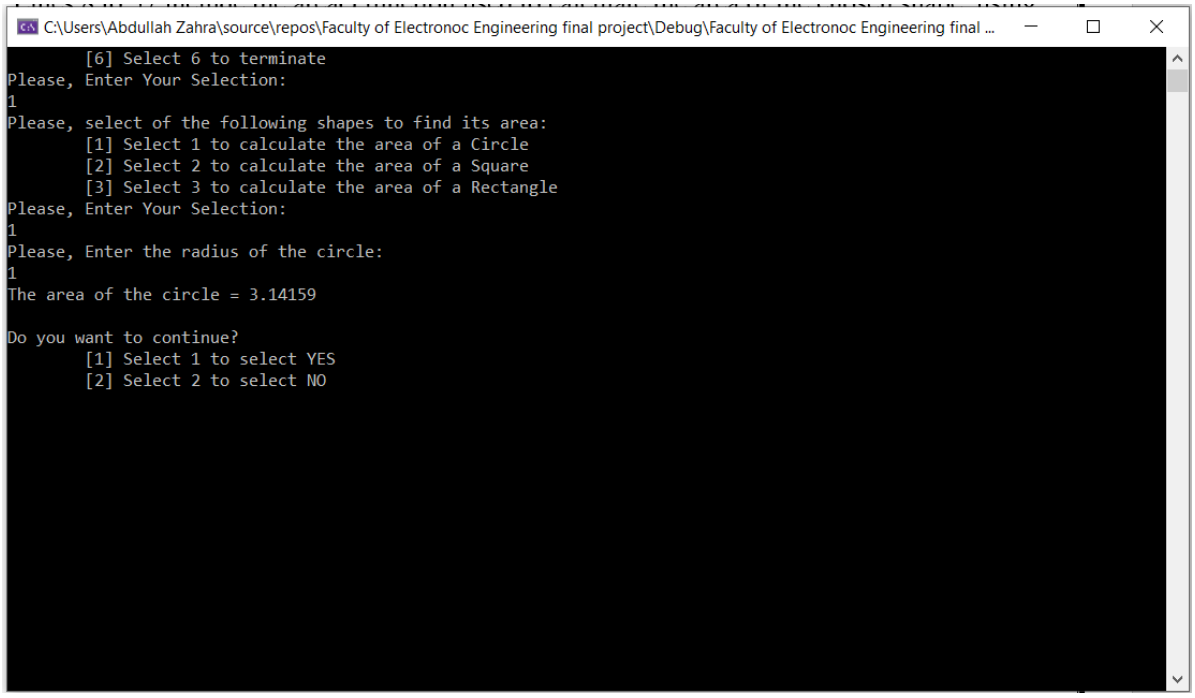
On lines, 1 to 3 #include handles the preprocessing operations which manipulate the non-standard C++ code. Three libraries included, iostream library to handle the input/output operations and includes cin and cout objects used to handle input and output streams in the program, cmath library to handle the mathematic operations in the program like the pow() function, algorithm library to declare min() and max() functions which are used to compare values in the program[6]. Lines, 127 to 222 include the main() function which the program starts with. A function is a set of statements used to do a certain task. Functions are used to solve major problems by dividing them into smaller problems. There are prewritten functions saved in certain libraries like pow() and sqrt(), which are included in cmath library[6]. The main() function in this program is the first to be executed and will begin by showing the user the instructions to use the program.



A while loop was used to enter an infinite loop only terminated by the user, the termination process is done using an if statement, which compares values the user enters with a certain value only to terminate the program as illustrated in the instructions.
The user enters a certain value enters a specific program using a switch statement, every switch case manipulates a specific set of instructions or a certain function illustrated below.
After the switch statement an if statement was used to confirm from the user whether to continue or to terminate.

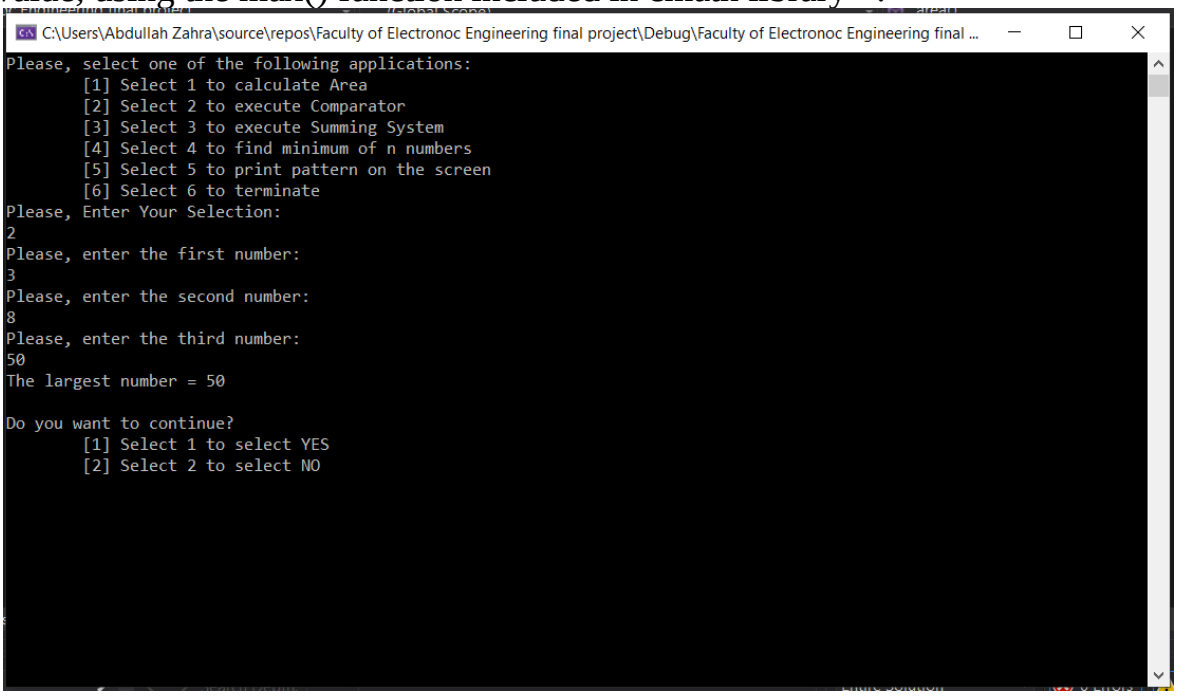
[1] Area calculator

Lines 8 to 57 include the area() function used to calculate the area of the chosen shape, using a switch statement to choose a specific shape. area() is a void function that does not return a value, instead, it shows the output directly.
In each case, the long double data type was used because pow() function was used and it does use floating values[6].
The calculation process was not outputted in a variable to save memory for the input stream and to allow the user to do calculations using large numbers.



[2] A simple comparator

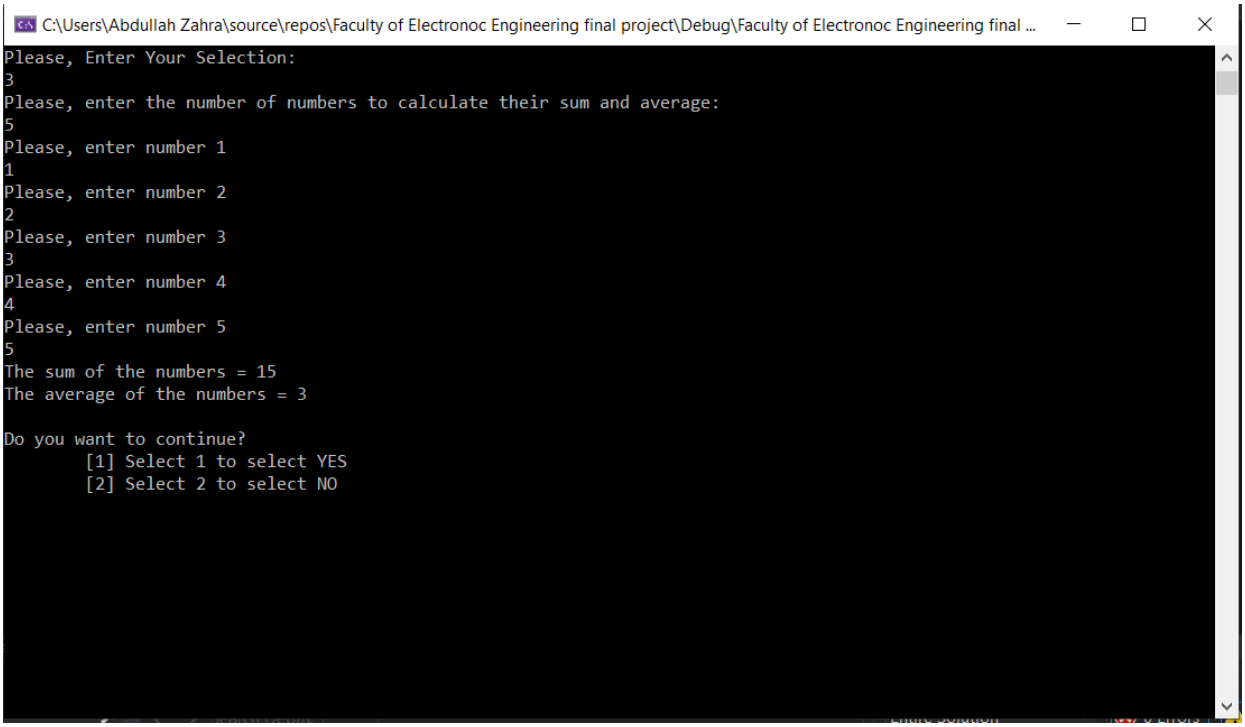
Lines 176 to 190 include a set of instructions to compare three integer values and print the largest value, using the max() function included in cmath library[6].



[3] Summing system

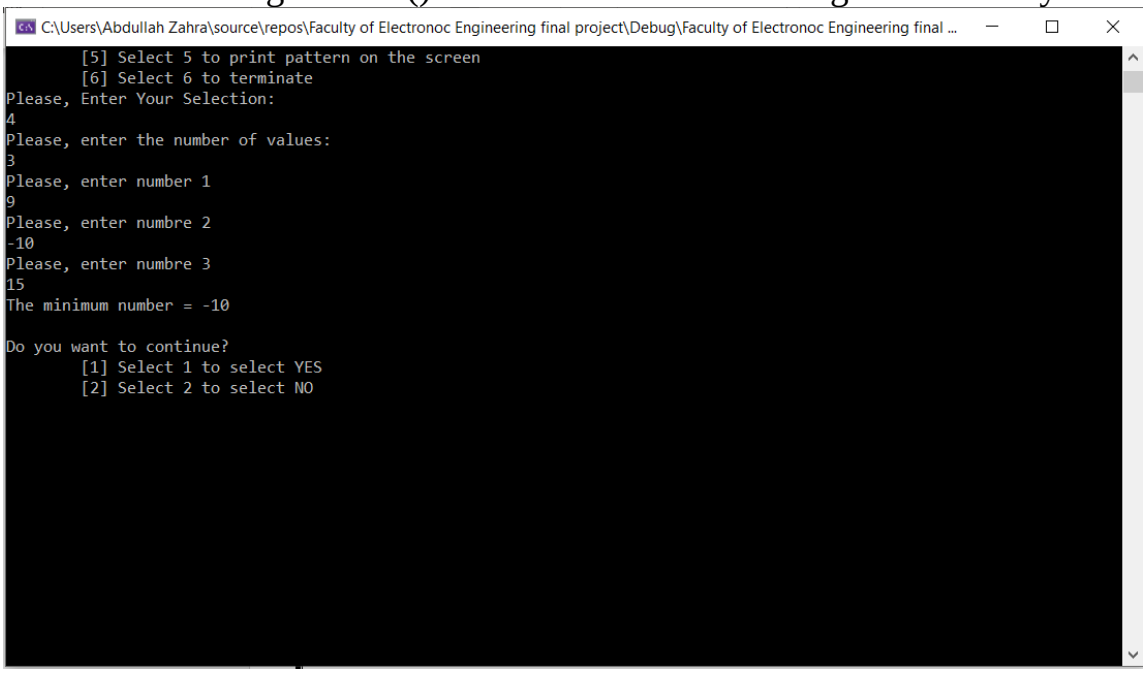
Lines 60 to 78 include the summing() function used to calculate the sum and average of a number of values. Long double was used because data types were not mentioned in this problem and to give the user a larger scale of calculations.

For loop statement was used to get the sum and then it is divided by the number of values to get the average.



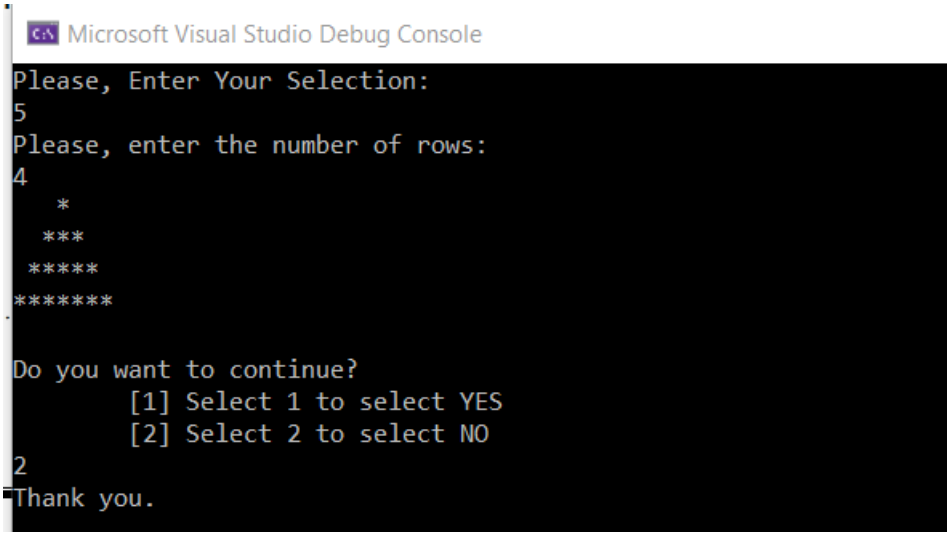
[4] Minimum function

Lines 82 to 99 include the minimum function. It calculates the minimum integer value from n integer values. An array was used to store the values and a for loop statement was used to get the minimum number using the min() function declared in the algorithm library[7].



[5] Patten

Lines 106 to 123 include the pattern function which draws a certain pattern on the screen depending on the number of lines (rows) the user wants.
This operation is done using a for loop statement.



Note:

The solution for the project was tested in several test cases and every test case was satisfied.

Any errors appears in this document is due to the word processing and it was not intended.

I uploaded the program online to handle such case.

To download the file please, click here or

http://www.mediafire.com/file/263uf6ysfn2d3lk/Abdullah_Mustafa_Zahra.rar/file

References

1. The Editors of Encyclopaedia Britannica. “Software.” Encyclopædia Britannica. Encyclopædia Britannica, inc., February 11, 2020. https://www.britannica.com/technology/software.
2. J. Fuegi and J. Francis, "Lovelace & Babbage and the creation of the 1843 'notes'," in IEEE Annals of the History of Computing, vol. 25, no. 4, pp. 16-26, Oct.-Dec. 2003, doi: 10.1109/MAHC.2003.1253887.
3. Savitch, Walter J., and Kenrick Mock. Problem Solving with C++. Boston: Pearson, 2015.
4. Aho, Alfred V., Monica S. Lam, and Ravi Sethi. Compilers: Principles, Techniques, & Tools. Boston, MA: Pearson/Addison Wesley, 2007.
5. Department of Computer Science and Engineering, Faculty of Electronic Engineering, Menoufia University, "Computer Languages", 2020.
6. Gaddis, Tony, Judy Walters, and Godfrey Muganda. Starting out with C : Early Objects. Pearson, 2017.