ECE 2305
Introduction to C Programming

Programming Project 05
One-dimensional Arrays

Write a C++ program that will create an array of type **`double`** numbers with a given number of elements. Use the number of elements **`const int size = 10`** for demonstration purposes, but write the program where the size of the array can be changed by changing the value of one constant. Fill the array with random type **`double`** numbers between 0 and 100 using the expression **`rand()%100`** to generate the numbers. Write the program to present options to the user as a menu and perform the following operations:

1. Create a new array with random elements.
2. Display the elements of the array.
3. Find and display the largest value in the array.
4. Find and display the smallest value in the array.
5. Sort the array in descending order and display the array.
6. Find and display the mean value.
7. Find and display the median value.
8. Find and display the variance.
9. End

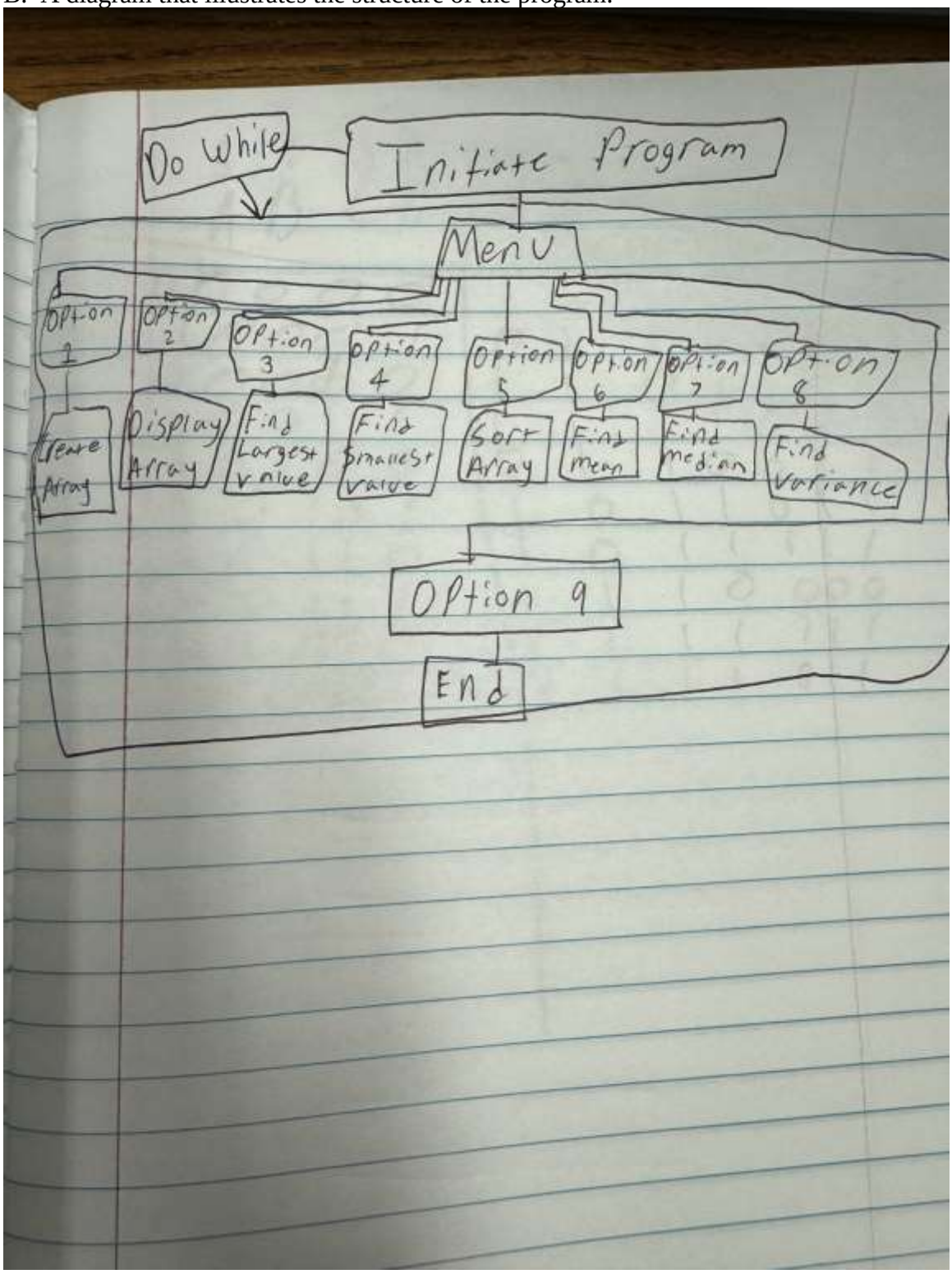
Each operation shall be written as an individual function. Pass the array address to the functions and the **`size`** of the array.

Document the program with a document with the following sections:

A. A written description of the purpose of the program and a description of the program structure.

   The purpose of this program is to create an array and complete different operations on it. It uses user defined functions for the menu options, a do while loop, and a switch structure to complete this objective.

B. A diagram that illustrates the structure of the program.



C. The code listing.

```
1  //ECE 2305-Programming Project 5-Kaleb Badgett
2  #include <iostream>
3  #include <cstdlib>
4  using namespace std;
5
6  void New_Array(double a[], int s)
7  {
8      for (int n = 0; n < s; n++)
9      {
10         a[n] = double(rand() % 100);
11     }
12 }
13
14 void Display_Array(double a[], int s)
15 {
16
17     for (int n = 0; n < s; n++)
18     {
19         cout << "a[" << n << "]\t" << a[n] << endl;
20     }
21 }
22
23 void Find_Largest(double a[], int s)
24 {
25     double max = a[0];
26     for (int n = 0; n < s; n++)
27     {
28         if (a[n] > max)
29             max = a[n];
30     }
31     cout << "Max value is " << max << endl;
32 }
```

```
34  void Find_Smallest(double a[], int s)
35  {
36      double min = a[0];
37      for (int n = 0; n < s; n++)
38      {
39          if (a[n] < min)
40              min = a[n];
41      }
42      cout << "Min value is " << min << endl;
43  }
44
45  void Sort(double a[], int s)
46  {
47      double t = 0;
48      for (int m = s - 1; m > 0; m--)
49      {
50          for (int n = 0; n < m; n++)
51          {
52              if (a[n] < a[n + 1])
53              {
54                  t = a[n + 1];
55                  a[n + 1] = a[n];
56                  a[n] = t;
57              }
58          }
59      }
60      cout << "Here is the sorted array" << endl;
61
62      Display_Array(a, s);
63  }
64
65  void Mean(double a[], int s)
66  {
67      double sum = 0.0;
68
69      for (int n = 0; n < s; n++)
70      {
71          sum = sum + a[n];
72      }
73      double mean = sum / s;
74      cout << "The mean is " << mean << endl;
75  }
76
77
78  void Median(double a[], int s)
79  {
80      Sort(a, s);
81      int n = 0;
82      double oddcase = 0.0;
83      double evencase = 0.0;
84      if (n % 2 != 0)
85      {
86          oddcase = a[s / 2];
87          cout << "The median is " << oddcase << endl;
88      }
89      else
90      {
91          evencase = (a[s / 2] + a[(s-1)/ 2] ) / 2;
92          cout << "The median is " << evencase << endl;
93      }
94
95  }
96
```

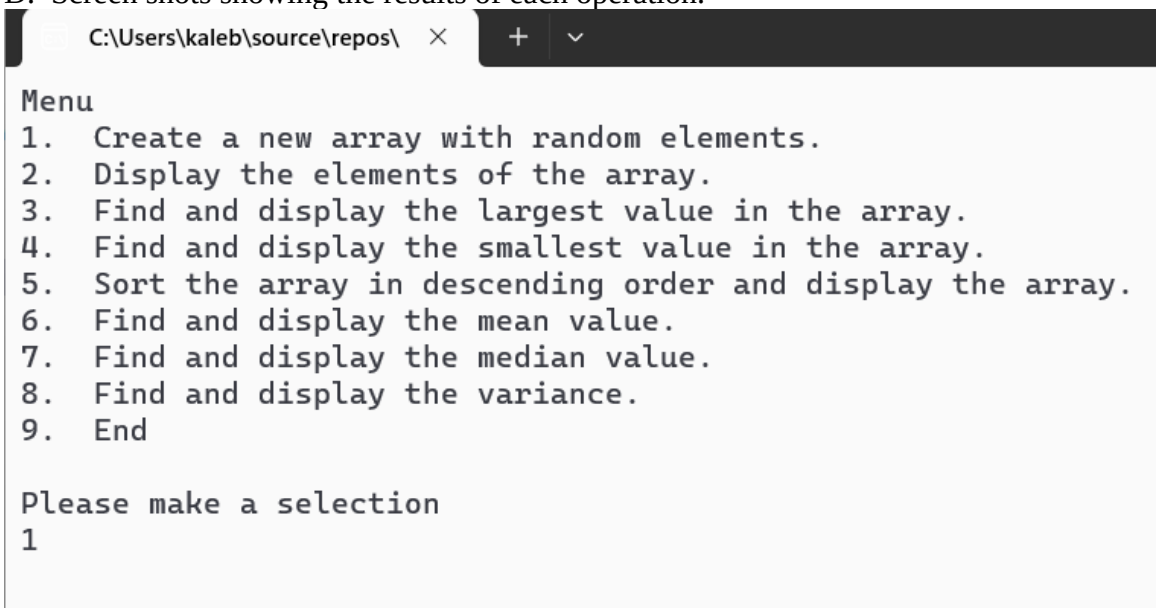
```
97  void Variance(double a[], int s)
98  {
99      double sum = 0.0;
100
101     for (int n = 0; n < s; n++)
102     {
103         sum = sum + a[n];
104     }
105     double mean = sum / s;
106
107     double variance = 0.0;
108     for (int n = 0; n < s; n++)
109     {
110         variance += (a[n] - mean) * (a[n] - mean);
111     }
112     cout << "The variance is " << variance/(s-1) << endl;
113 }
```

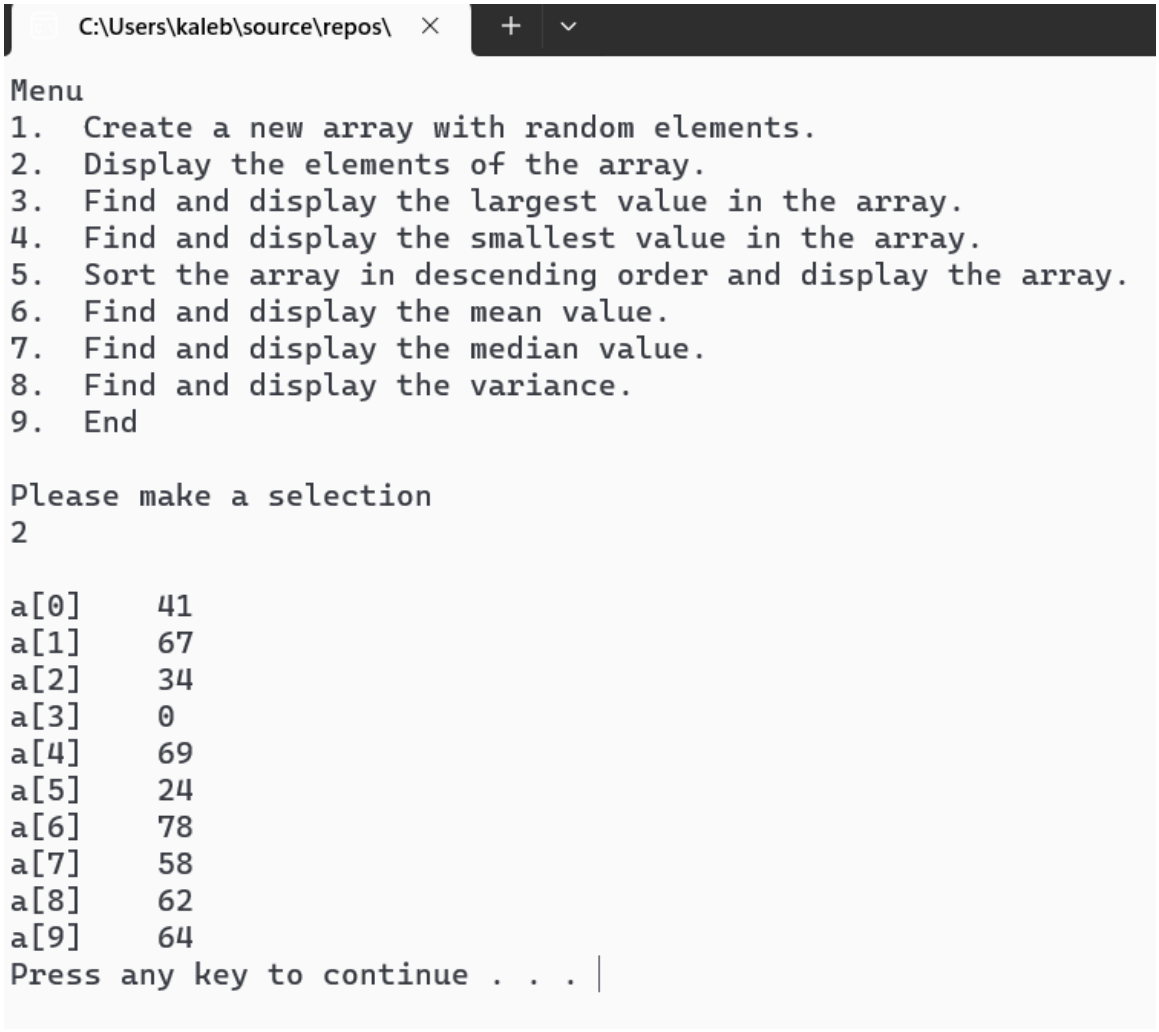
```
115 int main()
116 {
117     const int size = 10;
118
119     double array[size];
120
121     int choice = 0;
122
123     do
124     {
125         system("cls");
126         cout << "Menu" << endl;
127
128         cout << "1.  Create a new array with random elements." << endl;
129         cout << "2.  Display the elements of the array." << endl;
130         cout << "3.  Find and display the largest value in the array." << endl;
131         cout << "4.  Find and display the smallest value in the array." << endl;
132         cout << "5.  Sort the array in descending order and display the array." << endl;
133         cout << "6.  Find and display the mean value." << endl;
134         cout << "7.  Find and display the median value." << endl;
135         cout << "8.  Find and display the variance." << endl;
136         cout << "9.  End" << endl;
137         cout << endl;
138         cout << "Please make a selection" << endl;
139         cin >> choice;
140         cout << endl;
```

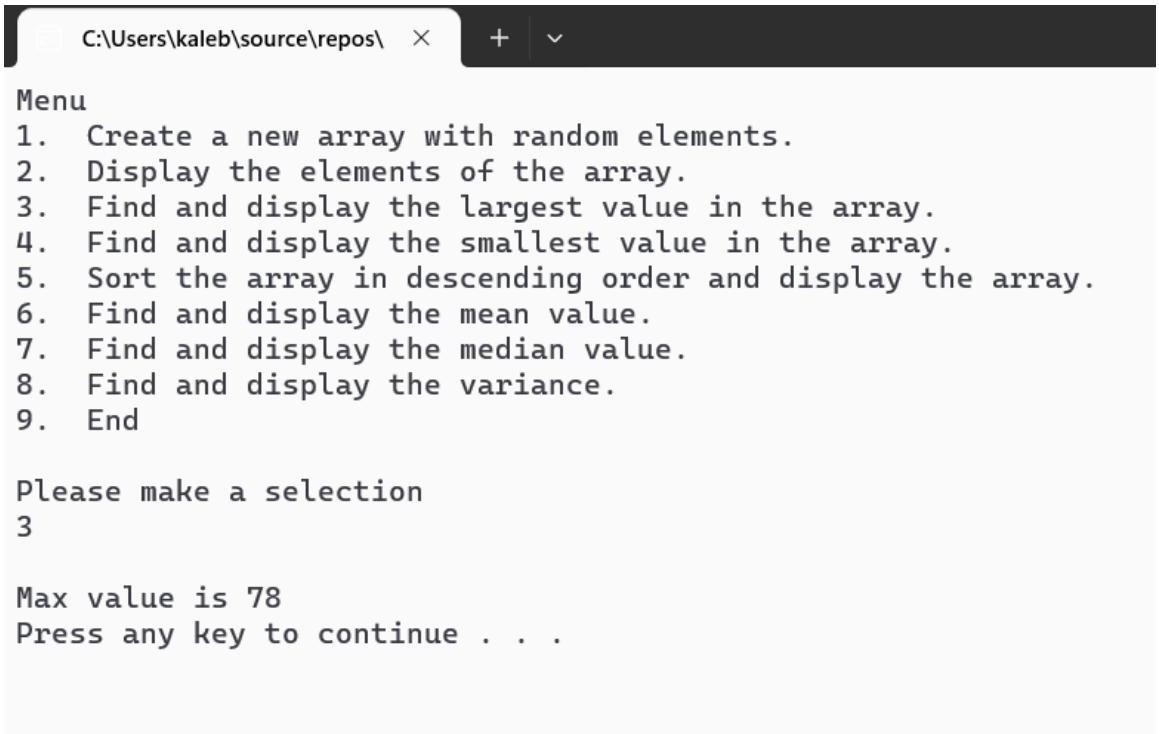
```
142         switch (choice)
143         {
144         case 1:
145         {
146             New_Array(array, size);
147             system("pause");
148             break;
149         }
150         case 2:
151         {
152             Display_Array(array, size);
153             system("pause");
154             break;
155         }
156         case 3:
157         {
158             Find_Largest(array, size);
159             system("pause");
160             break;
161         }
162         case 4:
163         {
164             Find_Smallest(array, size);
165             system("pause");
166             break;
167         }
168         case 5:
169         {
170             Sort(array, size);
171             system("pause");
172             break;
173         }
174         case 6:
175         {
176             Mean(array, size);
177             system("pause");
178             break;
179         }
```

```
180             case 7:
181             {
182                 Median(array, size);
183                 system("pause");
184                 break;
185             }
186             case 8:
187             {
188                 Variance(array, size);
189                 system("pause");
190                 break;
191             }
192             case 9:
193             {
194                 cout << "Goodbye" << endl;
195                 system("pause");
196                 break;
197             }
198             default:
199             {
200                 cout << "Choose a valid option." << endl;
201                 system("pause");
202                 break;
203             }
204             }
205         } while (choice != 9);
206 }
```

D. Screen shots showing the results of each operation.




C:\Users\kaleb\source\repos\
Menu
1. Create a new array with random elements.
2. Display the elements of the array.
3. Find and display the largest value in the array.
4. Find and display the smallest value in the array.
5. Sort the array in descending order and display the array.
6. Find and display the mean value.
7. Find and display the median value.
8. Find and display the variance.
9. End
Please make a selection
2
a[0] 41
a[1] 67
a[2] 34
a[3] 0
a[4] 69
a[5] 24
a[6] 78
a[7] 58
a[8] 62
a[9] 64
Press any key to continue . . .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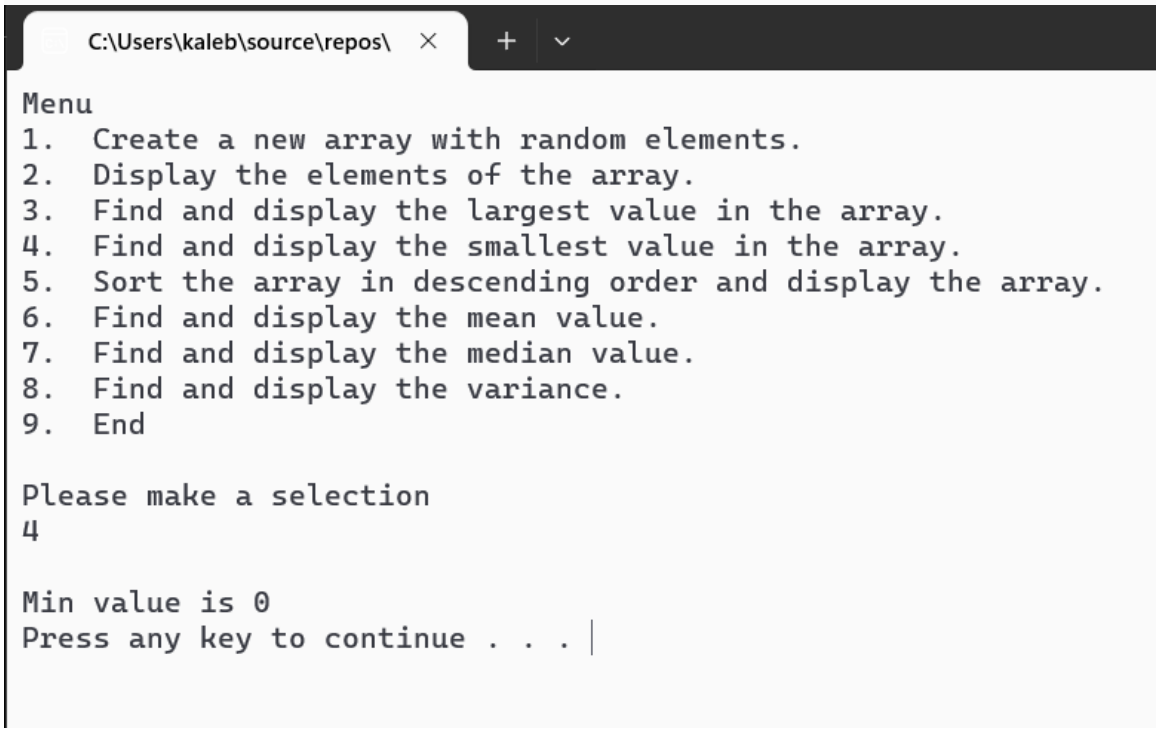
7. Find and display the median value.
8. Find and display the variance.
9. End
Please make a selection
3
Max value is 78
Press any key to continue . . .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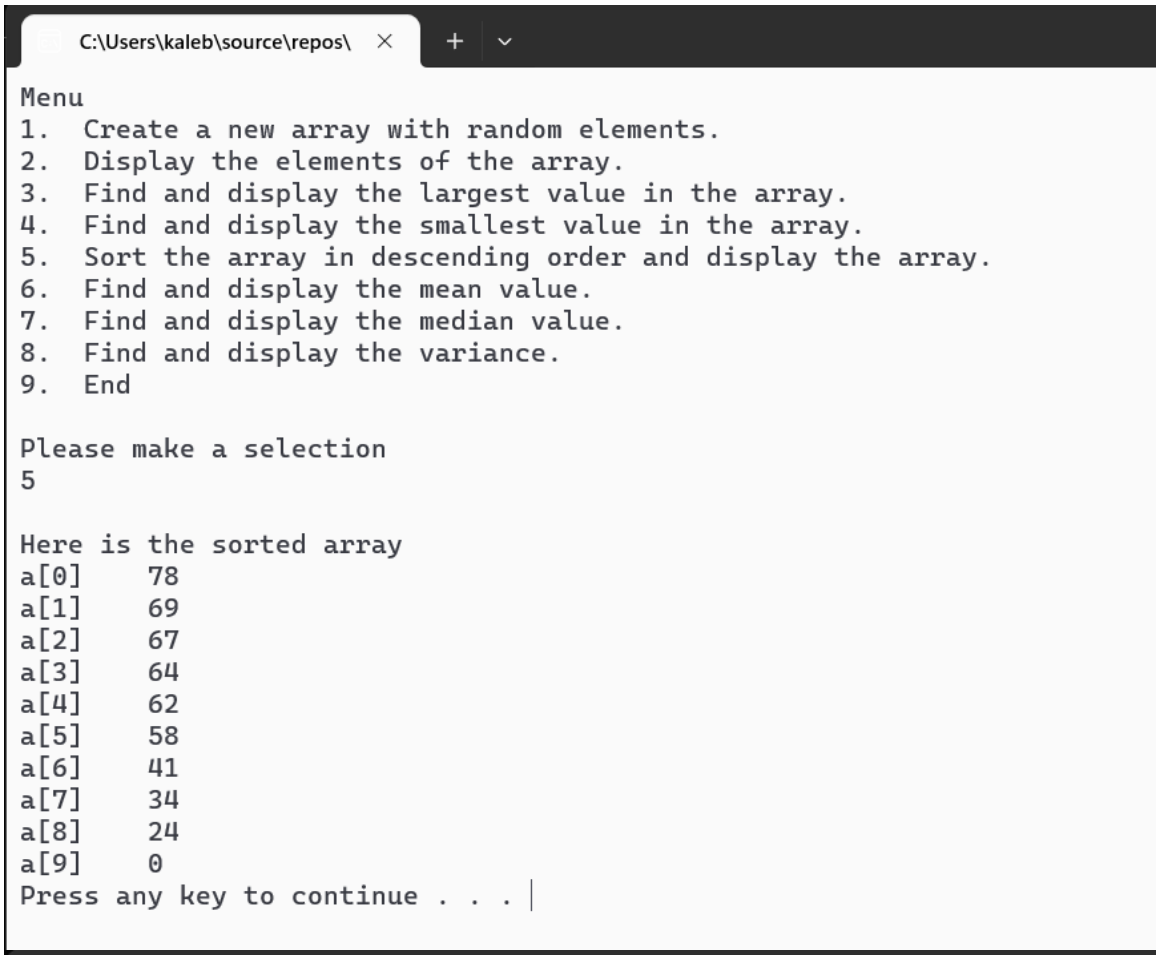
8. Find and display the variance.
9. End
Please make a selection
4
Min value is 0
Press any key to continue . . .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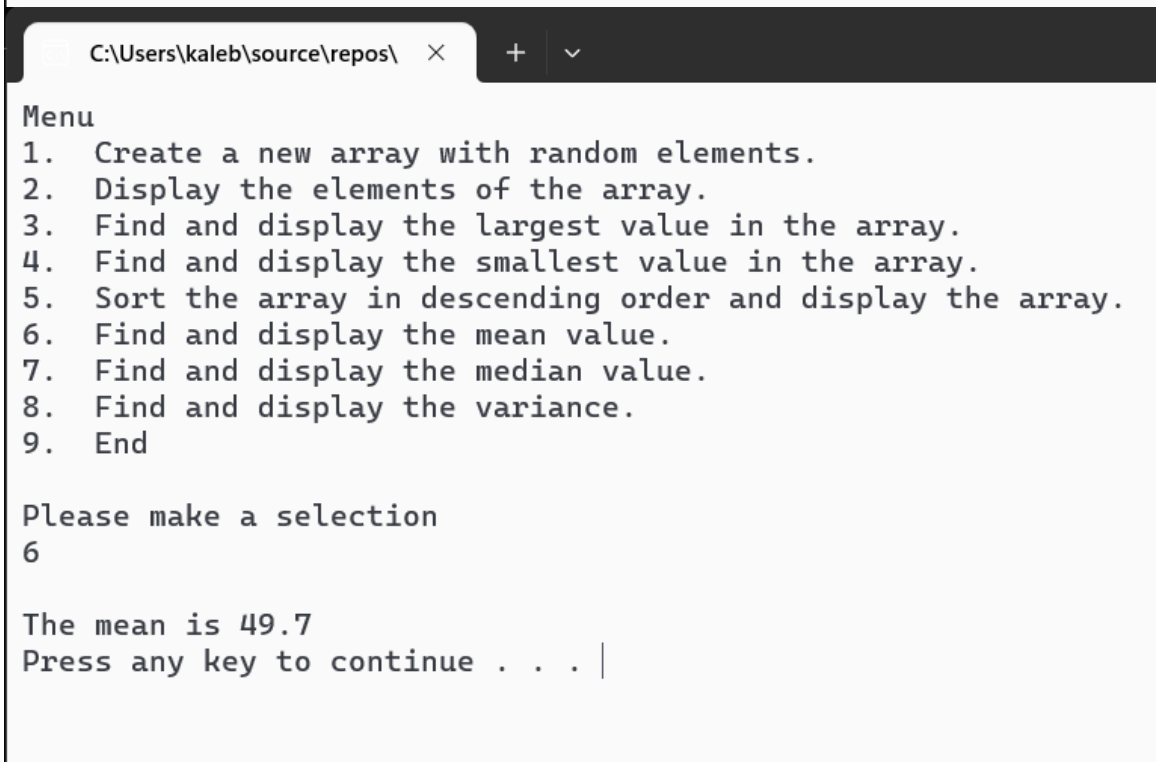
6. Find and display the mean value.
7. Find and display the median value.
8. Find and display the variance.
9. End
Please make a selection
5
Here is the sorted array
a[0] 78
a[1] 69
a[2] 67
a[3] 64
a[4] 62
a[5] 58
a[6] 41
a[7] 34
a[8] 24
a[9] 0
Press any key to continue . . .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6. Find and display the mean value.
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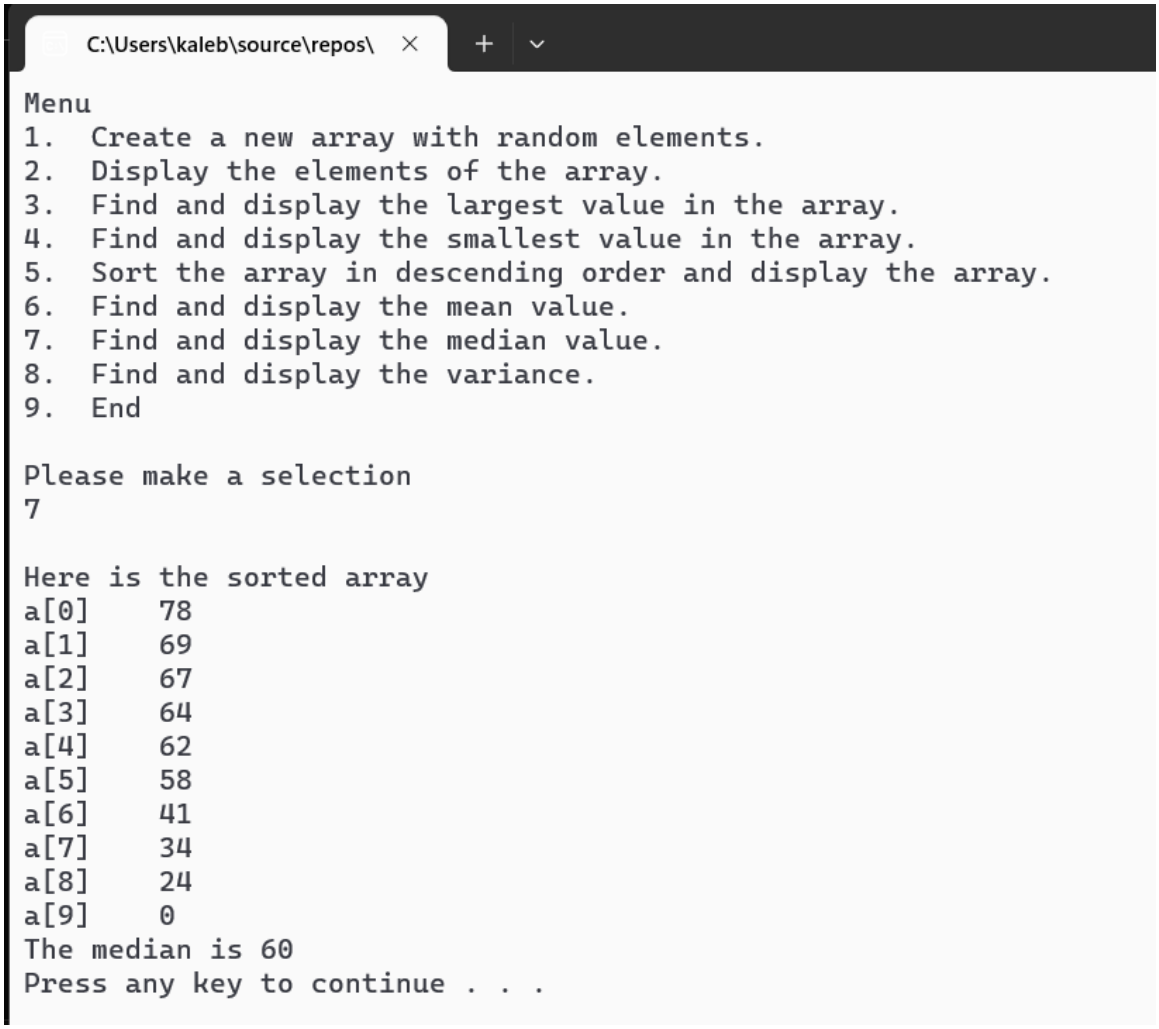
8. Find and display the variance.
9. End
Please make a selection
6
The mean is 49.7
Press any key to continue . . .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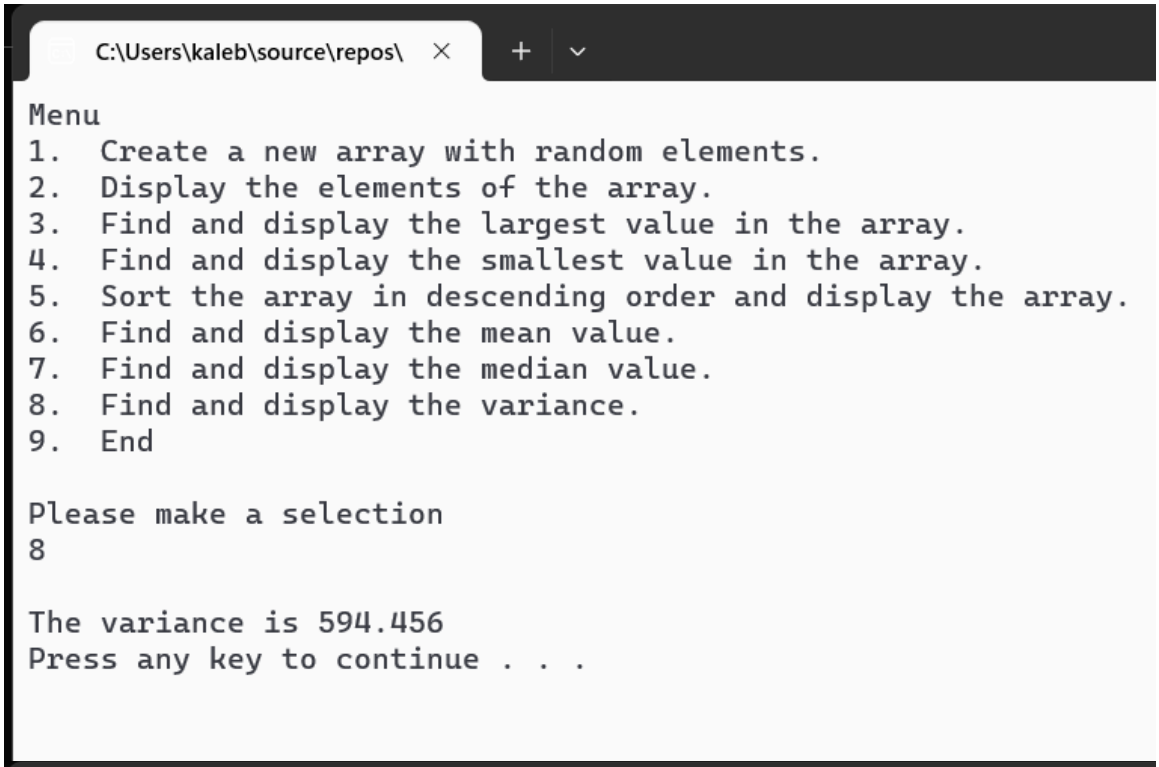
6. Find and display the mean value.
7. Find and display the median value.
8. Find and display the variance.
9. End
Please make a selection
7
Here is the sorted array
a[0] 78
a[1] 69
a[2] 67
a[3] 64
a[4] 62
a[5] 58
a[6] 41
a[7] 34
a[8] 24
a[9] 0
The median is 60
Press any key to continue . . .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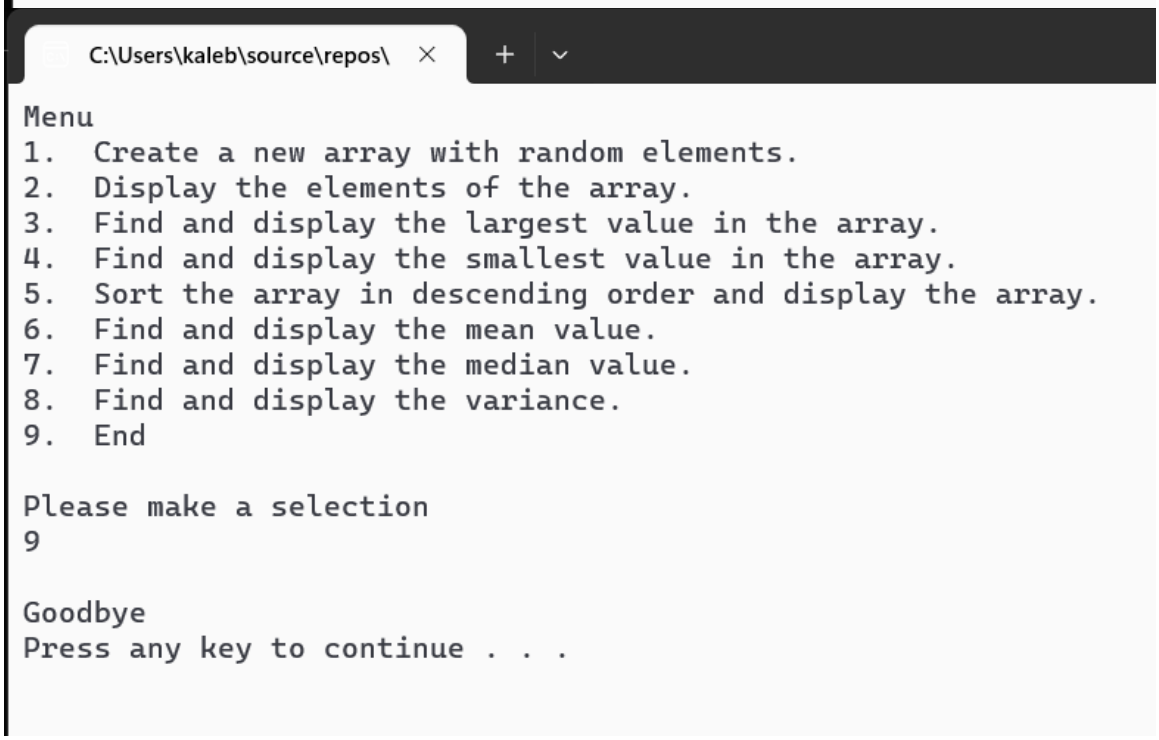
7. Find and display the median value.
8. Find and display the variance.
9. End
Please make a selection
8
The variance is 594.456
Press any key to continue . . .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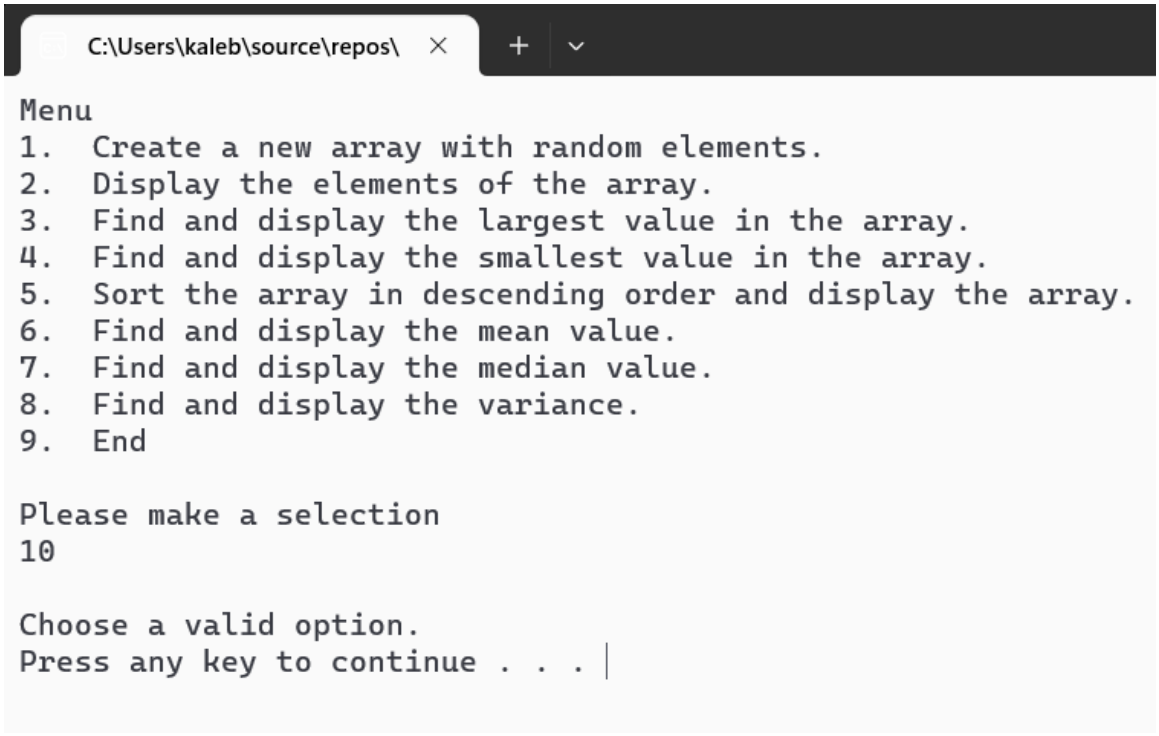
6. Find and display the mean value.
7. Find and display the median value.
8. Find and display the variance.
9. End
Please make a selection
9
Goodbye
Press any key to continue . . .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7. Find and display the median value.
8. Find and display the variance.
9. End
Please make a selection
10
Choose a valid option.
Press any key to continue . . .