МІНІСТЕРСТВО ОСВІТИ ТА НАУКИ УКРАЇНИ
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Звіт з лабораторної роботи 2.1

Тема: «Сортування масивів. Лінійна вставка. Алгоритм простого вибору. Бульбашкове сортування. Шейкерне сортування»

Варіант 2

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1.Алгоритм лінійної вставки (linear insert)

Код программи:

```cpp
#include <iostream>
#include <cstdlib>

using namespace std;
void Print(int arr[], int size) {
    for(int i = 0; i < size; ++i) cout << arr[i] << '\t';
}
int main() {
    int size, key, check = 0, change = 0, mode;
    cout << "Enter array size: ";
    cin >> size;
    int *arr = new int[size];
    cout << "0. Random fill\n"
            "1. Manual fill\n"
            "Choose mode: ";
    cin >> mode;
    switch(mode) {
        case 0: for(int i = 0; i < size; ++i) arr[i] = rand()%100;
            cout << "Generated array: "; Print(arr, size);
            cout << endl;
            break;

        case 1: cout << "Enter array: "; for(int i = 0; i < size; ++i)
        cin >> arr[i]; break;

        default: break; }
    for(int i = 1; i < size; ++i) {
        cout << "Step " << i << ": "; int j;
        key = arr[i];
        j = i - 1;
        check++;
        while(j >= 0 && arr[j] > key) {
            check++;
            change++;
            arr[j + 1] = arr[j]; j -= 1;
        }
        change++;
        arr[j + 1] = key; Print(arr, size); cout << endl;
    }
    cout << "Result: ";
    Print(arr, size);
    cout << endl << "Number of checks: " <<
         check << endl;
    cout << "Number of replaces: " <<
         change << endl; return 0;
}
```

Заповнення масиву випадковими числами:

```
Enter array size: 10
0. Random fill
1. Manual fill
Choose mode: 0
Generated array: 7  49  73  58  30  72  44  78  23  9
Step 1: 7   49  73  58  30  72  44  78  23  9
Step 2: 7   49  73  58  30  72  44  78  23  9
Step 3: 7   49  58  73  30  72  44  78  23  9
Step 4: 7   30  49  58  73  72  44  78  23  9
Step 5: 7   30  49  58  72  73  44  78  23  9
Step 6: 7   30  44  49  58  72  73  78  23  9
Step 7: 7   30  44  49  58  72  73  78  23  9
Step 8: 7   23  30  44  49  58  72  73  78  9
Step 9: 7   9   23  30  44  49  58  72  73  78
Result: 7   9   23  30  44  49  58  72  73  78
Number of checks: 33
Number of replaces: 33

Process finished with exit code 0
```

Заповнення масиву «від руки»:

```
Enter array size: 10
0. Random fill
1. Manual fill
Choose mode: 1
Enter array: 89
87
54
32
14
17
21
46
68
89
Step 1: 87  89  54  32  14  17  21  46  68  89
Step 2: 54  87  89  32  14  17  21  46  68  89
Step 3: 32  54  87  89  14  17  21  46  68  89
Step 4: 14  32  54  87  89  17  21  46  68  89
Step 5: 14  17  32  54  87  89  21  46  68  89
Step 6: 14  17  21  32  54  87  89  46  68  89
Step 7: 14  17  21  32  46  54  87  89  68  89
Step 8: 14  17  21  32  46  54  68  87  89  89
Step 9: 14  17  21  32  46  54  68  87  89  89
Result: 14  17  21  32  46  54  68  87  89  89
Number of checks: 32
Number of replaces: 32

Process finished with exit code 0
```

2.Алгоритм простого вибору «Simple choice»

Код програми:

```cpp
#include <iostream>
using namespace std;

void Print(int arr[], int size) {
    for(int i = 0; i < size; ++i) cout << arr[i] << '\t';
}
int main() {
    int size, mini, mode, check = 0, change = 0;
    bool ch = false;
    cout << "Enter array size: ";
    cin >> size;
    int *arr = new int[size];
    cout << "0. Random fill\n"
            "1. Manual fill\n"
            "Choose mode: ";
    cin >> mode;
    switch (mode) {
        case 0:
            for (int i = 0; i < size; ++i)
                arr[i] = rand() % 100;
            cout << "Generated array: ";
            Print(arr, size);
            cout << endl;
            break;
        case 1:
            cout << "Enter array: ";
            for (int i = 0; i < size; ++i)
                cin >> arr[i];
            break;
        default:
            break;
    }
    for (int i = 0; i < size - 1; ++i) {
        cout << "Step " << i + 1 << ": ";
        mini = i;
        for (int j = i + 1; j < size; ++j) {
            check++;
            if (arr[j] < arr[mini]) {
                mini = j;
                ch = true;
            }
        }
        if (ch) {
            swap(arr[i], arr[mini]);
            change++;
        }
        Print(arr, size);
        cout << endl;
    }
    cout << "Result: ";
    Print(arr, size);
    cout << endl << "Number of iterations: " << check <<
endl;
    cout << endl << "Number of replaces: " << change <<
endl;
    return 0;
}
```

```
Enter array size: 10
0. Random fill
1. Manual fill
Choose mode: 0
Generated array: 7  49  73  58  30  72  44  78  23  9
Step 1: 7   49  73  58  30  72  44  78  23  9
Step 2: 7   49  73  58  30  72  44  78  23  9
Step 3: 7   49  58  73  30  72  44  78  23  9
Step 4: 7   30  49  58  73  72  44  78  23  9
Step 5: 7   30  49  58  72  73  44  78  23  9
Step 6: 7   30  44  49  58  72  73  78  23  9
Step 7: 7   30  44  49  58  72  73  78  23  9
Step 8: 7   23  30  44  49  58  72  73  78  9
Step 9: 7   9   23  30  44  49  58  72  73  78
Result: 7   9   23  30  44  49  58  72  73  78
Number of checks: 33
Number of replaces: 33

Process finished with exit code 0
```

```
Enter array size: 10
0. Random fill
1. Manual fill
Choose mode: 1
Enter array: 21
32
42
35
46
12
98
96
75
83
Step 1: 21  32  42  35  46  12  98  96  75  83
Step 2: 21  32  42  35  46  12  98  96  75  83
Step 3: 21  32  35  42  46  12  98  96  75  83
Step 4: 21  32  35  42  46  12  98  96  75  83
Step 5: 12  21  32  35  42  46  98  96  75  83
Step 6: 12  21  32  35  42  46  98  96  75  83
Step 7: 12  21  32  35  42  46  96  98  75  83
Step 8: 12  21  32  35  42  46  75  96  98  83
Step 9: 12  21  32  35  42  46  75  83  96  98
Result: 12  21  32  35  42  46  75  83  96  98
Number of checks: 20
Number of replaces: 20

Process finished with exit code 0
```

3.Алгоритм бульбашкового сортування

Код програми :

```
#include <iostream>
using namespace std;

void Print(int arr[], int size) {
   for(int i = 0; i < size; ++i) cout << arr[i] <<
'\t';
}

int main() {
   int size, mode, check = 0, change = 0;
   bool ch = false;
   cout << "Enter array size: ";
   cin >> size;
   int *arr = new int[size];
   cout << "0. Random fill\n"
         "1. Manual fill\n"
         "Choose mode: ";
   cin >> mode;
   switch(mode) {
      case 0:
         for (int i = 0; i < size; ++i)
            arr[i] = rand() % 100;
         cout << "Generated array: ";
         Print(arr, size);
         cout << endl;
         break;
      case 1:
         cout << "Enter array: ";
         for (int i = 0; i < size; ++i)
            cin >> arr[i];
         break;
      default: break;
   }
   for(int i = 1; i < size; ++i) {
      cout<<"Step "<< i <<": ";
      ch = false;
      for(int j = 0; j < size - 1; ++j) {
         check++;
         if (arr[j] > arr[j + 1]) {
            swap(arr[j + 1], arr[j]);
            change++;
            ch = true;
         } }
      Print(arr, size); cout << endl;
      if (!ch) break;
   }
   cout << "Result: ";
   Print(arr, size);
   cout << endl <<"Number of iterations: "<< check << endl;
   cout << "Number of replaces: " << change << endl;
   return 0; }
```

```
Enter array size: 12
0. Random fill
1. Manual fill
Choose mode: 0
Generated array: 7  49  73  58  30  72  44  78  23  9   40  65
Step 1: 7   49  58  30  72  44  73  23  9   40  65  78
Step 2: 7   49  30  58  44  72  23  9   40  65  73  78
Step 3: 7   30  49  44  58  23  9   40  65  72  73  78
Step 4: 7   30  44  49  23  9   40  58  65  72  73  78
Step 5: 7   30  44  23  9   40  49  58  65  72  73  78
Step 6: 7   30  23  9   40  44  49  58  65  72  73  78
Step 7: 7   23  9   30  40  44  49  58  65  72  73  78
Step 8: 7   9   23  30  40  44  49  58  65  72  73  78
Step 9: 7   9   23  30  40  44  49  58  65  72  73  78
Result: 7   9   23  30  40  44  49  58  65  72  73  78
Number of iterations: 99
Number of replaces: 33

Process finished with exit code 0
```

```
Enter array size: 10
0. Random fill
1. Manual fill
Choose mode: 1
Enter array: 91
32
51
14
68
54
19
29
59
81
Step 1: 32  51  14  68  54  19  29  59  81  91
Step 2: 32  14  51  54  19  29  59  68  81  91
Step 3: 14  32  51  19  29  54  59  68  81  91
Step 4: 14  32  19  29  51  54  59  68  81  91
Step 5: 14  19  29  32  51  54  59  68  81  91
Step 6: 14  19  29  32  51  54  59  68  81  91
Result: 14  19  29  32  51  54  59  68  81  91
Number of iterations: 54
Number of replaces: 21

Process finished with exit code 0
```

4.Алгоритм шейкерного сортування

Код програми:

```
#include <iostream>;
using namespace std;

void Print(int arr[], int size) {
   for(int i = 0; i < size; ++i)
      cout << arr[i] << '\t';
}
int main() {
   int size, end, begin = 0, mode, check = 0, change = 0;
   bool ch = true;
   cout << "Enter array size: ";
   cin >> size;
   end = size - 1;
   int *arr = new int[size];
   cout << "0. Random fill\n"
         "1. Manual fill\n"
         "Choose mode: ";
   cin >> mode;
   switch(mode)
   {
      case 0:
         for(int i = 0; i < size; ++i) arr[i] = rand()%100;
         cout<< "Generated array: ";
         Print(arr, size);
         cout << endl;
      break;

      case 1: cout << "Enter array: ";
      for(int i = 0; i < size; ++i)
      cin >> arr[i];
      break;

      default: break;
   }
   int s = 1;
   while(begin < size && ch) {
      cout << "Step " << s << ": "; s++;
      Print(arr, size);
      ch = false;
      for (int i = 0; i < end; ++i) {
         check++;
         if (arr[i] > arr[i + 1]) {
            swap(arr[i], arr[i + 1]);
            change++;
            ch = true;
         }
      }
            end--;
            for (int i = end;i>begin;i--){
               check++;
         if (arr[i] < arr[i - 1]) {
            swap(arr[i], arr[i - 1]);
            change++;
            ch = true;
         }
            }
      begin++;
      cout << endl;
   }
```

```
Enter array size: 10
0. Random fill
1. Manual fill
Choose mode: 0
Generated array: 7  49  73  58  30  72  44  78  23  9
Step 1: 7   49  73  58  30  72  44  78  23  9
Step 2: 7   9   49  58  30  72  44  73  23  78
Step 3: 7   9   23  49  30  58  44  72  73  78
Step 4: 7   9   23  30  44  49  58  72  73  78
Result: 7   9   23  30  44  49  58  72  73  78
Number of checks: 50
Number of replaces: 24

Process finished with exit code 0
```

```
Enter array size: 10
0. Random fill
1. Manual fill
Choose mode: 1
Enter array: 21
95
83
72
58
63
80
42
33
14
Step 1: 21  95  83  72  58  63  80  42  33  14
Step 2: 14  21  83  72  58  63  80  42  33  95
Step 3: 14  21  33  72  58  63  80  42  83  95
Step 4: 14  21  33  42  58  63  72  80  83  95
Result: 14  21  33  42  58  63  72  80  83  95
Number of checks: 50
Number of replaces: 33

Process finished with exit code 0
```

```
    cout << "Result: ";
    Print(arr, size);
    cout << endl << "Number of checks: " << check << endl;
    cout << "Number of replaces: " << change << endl;
    return 0;
}
```