**CSE 330 Lab 2 Report**

Daniel Meyer

Data Structures

Fall 2017

**Status:** 100%

**Time Complexity:** O(n^2)

**Storage Complexity:** O(1)

**Source Code:**

Selection Sort – Pages 3-4

Insertion Sort – Pages 5-6

Bubble Sort – Pages 7-8

**Sample Run:**

Selection Sort – Pages 9-12

Bubble Sort – Pages 12-15

Insertion Sort – Pages 15-18

**Timings**

**Selection Sort (sec)**

2.938

4.921

2.201

2.178

2.207

2.341

2.584

2.928

2.728

4.180

**Bubble Sort (sec)**

2.937

2.614

1.956

2.291

2.482

2.366

2.628

2.570

2.530

3.884

**Insertion Sort (sec)**

3.540

1.901

1.572

1.854

2.030

2.203

2.901

2.146

2.213

2.477

**Source Code**

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\*Daniel Meyer

\*selection\_sort.cpp

\*10/2/17

\*Lab 2: Time Complexity

\*Implement a selection sort to test that the execution time is O(n^2)

\*CSE 330

\*Fall 2017

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#include <vector>

#include <iostream>

using namespace std;

void print(vector<int> v);

void selection\_sort(vector <int> &v);

//Main Function to implement selection sort algorithm

int main()

{

int n;

cin >> n;

vector<int> v(n);

srand(time(0));

for(int i = 0; i < n; i++) {

v[i] = rand() % 1000000;

}

cout << "---------- Pre- Selection Sort ----------" << endl;

print(v);

selection\_sort(v);

cout << endl;

cout << "---------- Post- Selection Sort ----------" << endl;

print(v);

return 0;

}

//Function to print content of vector to compare vector before and after sort

void print(vector<int> v)

{

for(int i = 0; i < v.size(); i++) {

cout << v[i] << endl;

}

}

//Sorting algorithm based on selection sort method

void selection\_sort(vector<int> &v)

{

for(int i = 0; i < v.size()-1; i++) {

for(int j = i+1; j < n; j++) {

if(v[i] > v[j]) {

swap(v[i], v[j]);

}

}

}

}

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\*Daniel Meyer

\*insertion\_sort.cpp

\*10/2/17

\*Lab 2: Time Complexity

\*Implement a insertion sort to test that the execution time is O(n^2)

\*CSE 330

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#include <vector>

#include <iostream>

using namespace std;

void print(vector<int> v);

void insertion\_sort(vector <int> &v);

//Main Function to implement insertion sort algorithm

int main()

{

int n;

cin >> n;

vector<int> v(n);

srand(time(0));

for(int i = 0; i < n; i++) {

v[i] = rand() % 1000000;

}

cout << "---------- Pre- Insertion Sort ----------" << endl;

print(v);

insertion\_sort(v);

cout << endl;

cout << "---------- Post- Insertion Sort ----------" << endl;

print(v);

return 0;

}

//Function to print content of vector to compare vector before and after sort

void print(vector<int> v)

{

for(int i = 0; i < v.size(); i++) {

cout << v[i] << endl;

}

}

//Sorting algorithm based on insertion sort method

void insertion\_sort(vector<int> &v)

{

int i, j, elem;

for(i = 1; i < v.size(); i++) {

for(elem = v[i], j = i-1; j >= 0 && elem < v[j]; j--) {

v[j+1] = v[j];

}

v[j+1] = elem;

}

}

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\*Daniel Meyer

\*bubble\_sort.cpp

\*10/2/17

\*Lab 2: Time Complexity

\*Implement a bubble sort to test that the execution time is O(n^2)

\*CSE 330

\*Fall 2017

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#include <vector>

#include <iostream>

using namespace std;

void print(vector<int> v);

void bubble\_sort(vector <int> &v);

//Main Function to implement bubble sort algorithm

int main()

{

int n;

cin >> n;

vector<int> v(n);

srand(time(0));

for(int i = 0; i < n; i++) {

v[i] = rand() % 1000000;

}

cout << "---------- Pre- Bubble Sort ----------" << endl;

print(v);

bubble\_sort(v);

cout << endl;

cout << "---------- Post- Bubble Sort ----------" << endl;

print(v);

return 0;

}

//Function to print content of vector to compare vector before and after sort

void print(vector<int> v)

{

for(int i = 0; i < v.size(); i++) {

cout << v[i] << endl;

}

}

//Sorting algorithm based on bubble sort method

void bubble\_sort(vector<int> &v)

{

for(int i = v.size()-1; i > 0; i--) {

for(int j = 0; j < i; j++) {

if(v[j] > v[j+1]) {

swap(v[j], v[j+1]);

}

}

}

}

**Sample Runs**

**Selection Sort Run**

Script started on 2017-10-02 14:36:49-0700

]777;notify;Command completed;exit]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > selection.txt

1000

real 0m2.938s

user 0m0.014s

sys 0m0.005s

]777;notify;Command completed;time ./a.out > selection.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > selection.txt

29 000

real 0m4.921s

user 0m0.044s

sys 0m0.004s

]777;notify;Command completed;time ./a.out > selection.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > selection.txt

3000

real 0m2.201s

user 0m0.089s

sys 0m0.006s

]777;notify;Command completed;time ./a.out > selection.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > selection.txt

4000

real 0m2.178s

user 0m0.154s

sys 0m0.007s

]777;notify;Command completed;time ./a.out > selection.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > selection.txt

5000

real 0m2.207s

user 0m0.240s

sys 0m0.006s

]777;notify;Command completed;time ./a.out > selection.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > selection.txt

6000

real 0m2.341s

user 0m0.341s

sys 0m0.006s

]777;notify;Command completed;time ./a.out > selection.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > selection.txt

7000

real 0m2.584s

user 0m0.459s

sys 0m0.011s

]777;notify;Command completed;time ./a.out > selection.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > selection.txt

8000

real 0m2.928s

user 0m0.597s

sys 0m0.010s

]777;notify;Command completed;time ./a.out > selection.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > selection.txt

9000

real 0m2.728s

user 0m0.753s

sys 0m0.012s

]777;notify;Command completed;time ./a.out > selection.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > selection.txt

10000

real 0m4.180s

user 0m0.929s

sys 0m0.016s

]777;notify;Command completed;time ./a.out > selection.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ exit

Script done on 2017-10-02 14:38:01-0700

**Bubble Sort Run**

Script started on 2017-10-02 14:41:52-0700

]777;notify;Command completed;time ./a.out > selection.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > bu[K[KBubble.txt

1000

real 0m2.937s

user 0m0.013s

sys 0m0.004s

]777;notify;Command completed;time ./a.out > Bubble.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Bubble.txt

2000

real 0m2.614s

user 0m0.034s

sys 0m0.005s

]777;notify;Command completed;time ./a.out > Bubble.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Bubble.txt

3000

real 0m1.956s

user 0m0.079s

sys 0m0.005s

]777;notify;Command completed;time ./a.out > Bubble.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Bubble.txt

4000

real 0m2.291s

user 0m0.133s

sys 0m0.006s

]777;notify;Command completed;time ./a.out > Bubble.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Bubble.txt5[K

5000

real 0m2.482s

user 0m0.202s

sys 0m0.014s

]777;notify;Command completed;time ./a.out > Bubble.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Bubble.txt

6000

real 0m2.366s

user 0m0.296s

sys 0m0.013s

]777;notify;Command completed;time ./a.out > Bubble.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Bubble.txt

7000

real 0m2.628s

user 0m0.401s

sys 0m0.009s

]777;notify;Command completed;time ./a.out > Bubble.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Bubble.txt

8000

real 0m2.570s

user 0m0.521s

sys 0m0.014s

]777;notify;Command completed;time ./a.out > Bubble.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Bubble.txt

9000

real 0m2.530s

user 0m0.657s

sys 0m0.015s

]777;notify;Command completed;time ./a.out > Bubble.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Bubble.txt

10000

real 0m3.884s

user 0m0.812s

sys 0m0.020s

]777;notify;Command completed;time ./a.out > Bubble.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ exit

Script done on 2017-10-02 14:42:53-0700

**Insertion Sort Run**

Script started on 2017-10-02 14:45:17-0700

]777;notify;Command completed;time ./a.out > ]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time a.[K[K./a.out > Insertion.txt

1000

real 0m3.540s

user 0m0.007s

sys 0m0.005s

]777;notify;Command completed;time ./a.out > Insertion.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Insertion.txt

2000

real 0m1.901s

user 0m0.018s

sys 0m0.003s

]777;notify;Command completed;time ./a.out > Insertion.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Insertion.txt

3000

real 0m1.572s

user 0m0.027s

sys 0m0.007s

]777;notify;Command completed;time ./a.out > Insertion.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Insertion.txt

4000

real 0m1.854s

user 0m0.044s

sys 0m0.009s

]777;notify;Command completed;time ./a.out > Insertion.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Insertion.txt

5000

real 0m2.030s

user 0m0.065s

sys 0m0.011s

]777;notify;Command completed;time ./a.out > Insertion.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Insertion.txt

6000

real 0m2.203s

user 0m0.089s

sys 0m0.017s

]777;notify;Command completed;time ./a.out > Insertion.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Insertion.txt

7000

real 0m2.901s

user 0m0.124s

sys 0m0.015s

]777;notify;Command completed;time ./a.out > Insertion.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Insertion.txt

8000

real 0m2.146s

user 0m0.155s

sys 0m0.021s

]777;notify;Command completed;time ./a.out > Insertion.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Insertion.txt

9000

real 0m2.213s

user 0m0.196s

sys 0m0.023s

]777;notify;Command completed;time ./a.out > Insertion.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ time ./a.out > Insertion.txt

10000

real 0m2.477s

user 0m0.245s

sys 0m0.014s

]777;notify;Command completed;time ./a.out > Insertion.txt]0;005051094@jb358-9:/students/csci/005051094/cse330/lab2]7;file://jb358-9.cse.csusb.edu/students/csci/005051094/cse330/lab2[005051094@jb358-9 lab2]$ exit

Script done on 2017-10-02 14:46:09-0700