

# Search Algorithms Experiment

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## 1(a) Linear Search in C

### Pseudocode

```
procedure linear_search(A, n, key):  
    for i ← 0 to n-1 do  
        if A[i] = key then  
            return i  
    return -1
```

### C Code

```
#include <stdio.h>  
#include <stdlib.h>  
#include <time.h>  
  
// Linear Search function  
int linear_search(int arr[], int n, int key) {  
    for (int i = 0; i < n; i++) {  
        if (arr[i] == key)  
            return i;  
    }  
    return -1;  
}  
  
int main() {  
    int n, key, pos;  
    clock_t start, end;  
    double cpu_time_used;  
  
    for (n = 1000; n <= 50000; n += 5000) {  
        int *arr = (int*)malloc(n * sizeof(int));  
        for (int i = 0; i < n; i++) arr[i] = i;  
  
        key = n - 1; // worst case  
  
        start = clock();  
        pos = linear_search(arr, n, key);  
        end = clock();  
  
        cpu_time_used = ((double)(end - start)) / CLOCKS_PER_SEC;  
        printf("%d %f\n", n, cpu_time_used);  
  
        free(arr);  
    }  
    return 0;  
}
```

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## 1(b) Binary Search in C

### Pseudocode

```
procedure binary_search(A, n, key):
    low ← 0
    high ← n - 1
    while low ≤ high do
        mid ← (low + high) / 2
        if A[mid] = key then
            return mid
        else if A[mid] < key then
            low ← mid + 1
        else
            high ← mid - 1
    return -1
```

### C Code

```
#include <stdio.h>
#include <stdlib.h>
#include <time.h>

// Binary Search function
int binary_search(int arr[], int n, int key) {
    int low = 0, high = n - 1, mid;
    while (low <= high) {
        mid = (low + high) / 2;
        if (arr[mid] == key)
            return mid;
        else if (arr[mid] < key)
            low = mid + 1;
        else
            high = mid - 1;
    }
    return -1;
}

int main() {
    int n, key, pos;
    clock_t start, end;
    double cpu_time_used;

    for (n = 1000; n <= 50000; n += 5000) {
        int *arr = (int*)malloc(n * sizeof(int));
        for (int i = 0; i < n; i++) arr[i] = i;

        key = n - 1; // worst case

        start = clock();
```

```
    pos = binary_search(arr, n, key);
    end = clock();

    cpu_time_used = ((double)(end - start)) / CLOCKS_PER_SEC;
    printf("%d %f\n", n, cpu_time_used);

    free(arr);
}
return 0;
}
```

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## Python Code for Plotting

```
import matplotlib.pyplot as plt

linear_n, linear_t = [], []
with open("linear.txt") as f:
    for line in f:
        n, t = line.split()
        linear_n.append(int(n))
        linear_t.append(float(t))

binary_n, binary_t = [], []
with open("binary.txt") as f:
    for line in f:
        n, t = line.split()
        binary_n.append(int(n))
        binary_t.append(float(t))

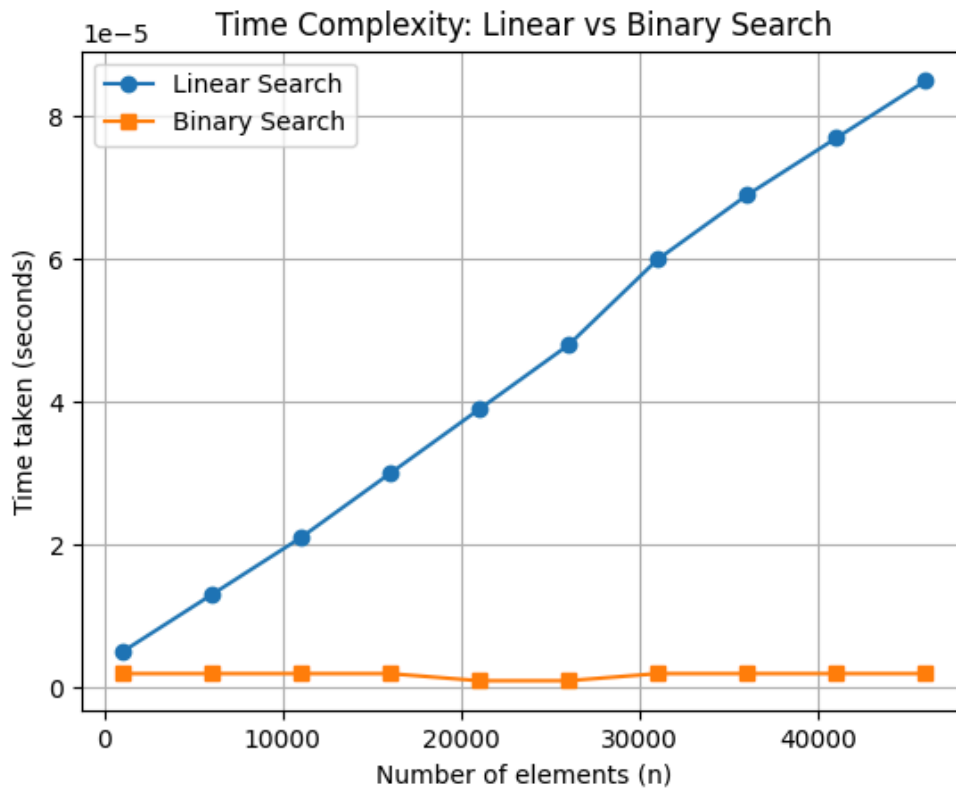
plt.plot(linear_n, linear_t, marker='o', label="Linear Search")
plt.plot(binary_n, binary_t, marker='s', label="Binary Search")

plt.xlabel("Number of elements (n)")
plt.ylabel("Time taken (seconds)")
plt.title("Time Complexity: Linear vs Binary Search")
plt.legend()
plt.grid(True)

plt.savefig("search_plot.png") # save instead of show
print("Plot saved as search_plot.png")
```

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## Output Plot



```
[2] 1:nvim-2:~$ bash*
(venv) praveen@archlinux:~/coding/DSD_practical/practical_1 $ gcc linear_search.c -o linear_search
(venv) praveen@archlinux:~/coding/DSD_practical/practical_1 $ ./linear_search
1000 0.000005
6000 0.000013
11000 0.000021
16000 0.000030
21000 0.000039
26000 0.000048
31000 0.000060
36000 0.000069
41000 0.000077
46000 0.000085
(venv) praveen@archlinux:~/coding/DSD_practical/practical_1 $ gcc bi
..._search.c ---.txt
(venv) praveen@archlinux:~/coding/DSD_practical/practical_1 $ gcc binary_search.c -o bina
..._search.c ---.txt
(venv) praveen@archlinux:~/coding/DSD_practical/practical_1 $ gcc binary_search.c -o binary
(venv) praveen@archlinux:~/coding/DSD_practical/practical_1 $ ./binary
1000 0.000002
6000 0.000002
11000 0.000002
16000 0.000002
21000 0.000001
26000 0.000001
31000 0.000002
36000 0.000002
41000 0.000002
46000 0.000002
(venv) praveen@archlinux:~/coding/DSD_practical/practical_1 $ python
python@ ...3@ ...3.13@ ...3.13-config@ ...-config@
(venv) praveen@archlinux:~/coding/DSD_practical/practical_1 $ python main.py
(venv) praveen@archlinux:~/coding/DSD_practical/practical_1 $ python main.py
(venv) praveen@archlinux:~/coding/DSD_practical/practical_1 $ git push
Enter passphrase for key '/home/praveen/.ssh/id_ed25519':
Everything up-to-date
(venv) praveen@archlinux:~/coding/DSD_practical/practical_1 $
```