

## 1) Binary Search

**Code :**

```
#include <stdio.h>
#include <stdlib.h>
#include <sys/time.h>
#include <math.h>

void fnGenRandInput(int X[], int n)
{
    int i;
    srand(time(NULL));
    for (i = 0; i < n; i++)
        X[i] = rand() % 10000;
}

int binarySearch(int A[], int n, int k)
{
    int l = 0;
    int r = n - 1;
    int m;
    while (l <= r)
    {
        m = (l + r) / 2;
        if (A[m] == k)
        {
            return m;
        }
        else if (A[m] < k)
        {
            l = m + 1;
        }
        else
        {
            r = m - 1;
        }
    }

    return -1;
}

int main(int argc, char **argv)
{
    FILE *fp;
    struct timeval tv;
    double dStart, dEnd;
    int Arr[100000], i;
    fp = fopen("binarytimeC.txt", "w");
    for (i = 100; i < 15000; i += 500)
    {
        fnGenRandInput(Arr, i);
        gettimeofday(&tv, NULL);
        dStart = tv.tv_sec + (tv.tv_usec / 1000000.0);
```

```

        // Perform binary search on Arr here if needed
        dEnd = tv.tv_sec + (tv.tv_usec / 1000000.0);
        fprintf(fp, "%d\t%lf\t%d\n", i, dEnd - dStart, (int)((log(i) / log(2)) / 1000000.0));
    }
    fclose(fp);

    FILE *gnuplotPipe = popen("gnuplot -persistent", "w");
    if (gnuplotPipe != NULL)
    {
        fprintf(gnuplotPipe, "set xlabel 'Input Size'\n");
        fprintf(gnuplotPipe, "set ylabel 'Time Taken (seconds)'\n");
        fprintf(gnuplotPipe, "set title 'Time Efficiency of Binary Search'\n");
        fprintf(gnuplotPipe, "set style line 1 lc rgb '#0060ad' lt 1 lw 2 pt 7 ps 0.5\n");
        fprintf(gnuplotPipe, "set style line 2 lc rgb '#006ae90' lt 2 lw 2 pt 8 ps 0.5\n");
        fprintf(gnuplotPipe, "plot 'binarytimeC.txt' using 1:2 with linespoints ls 1 title 'Actual
Time', %f*x**2 with lines ls 2 title 'Estimated Time'\n", ((log(i) / log(2)) / 1000000.0));
        fprintf(gnuplotPipe, "set term png\n");
        fprintf(gnuplotPipe, "set output 'binarysearch_efficiencyC.png'\n");
        fprintf(gnuplotPipe, "replot\n");
        fflush(gnuplotPipe);
        fprintf(gnuplotPipe, "exit\n");
        pclose(gnuplotPipe);
    }
    return 0;
}

```

#### Time Content:

100	0.000000	0
600	0.000000	0
1100	0.000000	0
1600	0.000000	0
2100	0.000000	0
2600	0.000000	0
3100	0.000000	0
3600	0.000000	0
4100	0.000000	0
4600	0.000000	0
5100	0.000000	0
5600	0.000000	0
6100	0.000000	0
6600	0.000000	0
7100	0.000000	0
7600	0.000000	0
8100	0.000000	0
8600	0.000000	0
9100	0.000000	0
9600	0.000000	0
10100	0.000000	0
10600	0.000000	0
11100	0.000000	0
11600	0.000000	0
12100	0.000000	0

12600	0.000000	0
13100	0.000000	0
13600	0.000000	0
14100	0.000000	0
14600	0.000000	0

**Graph:**

