ASSIGNMENT 1
02/02/23

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GROUP : CS4D
TOPIC : ANALYSIS OF ALGORITHM LAB
CODE : CS-14202

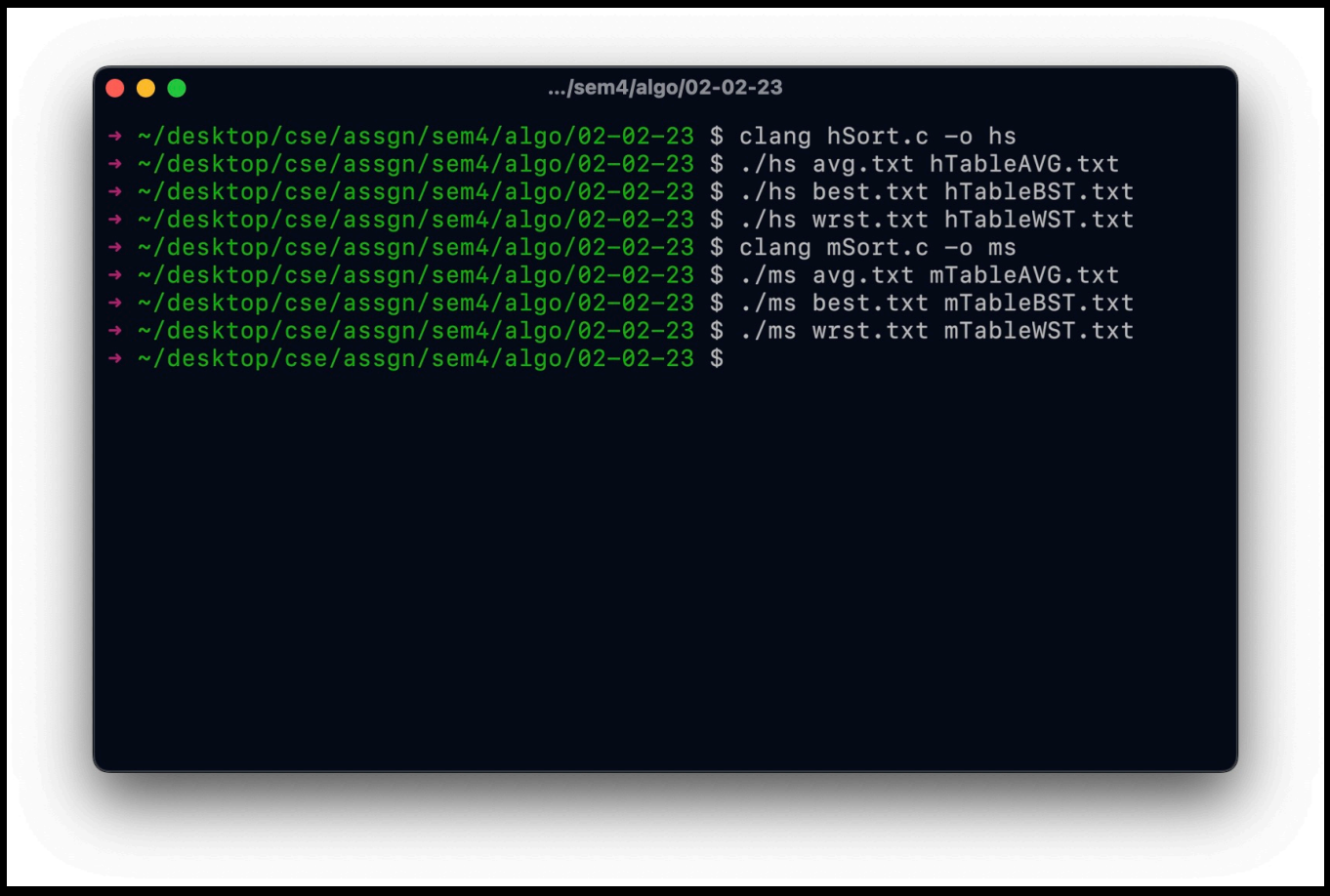
```c
// Analysis of Merge Sort over 100K entries

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

clock_t begin;
clock_t end;

void swap(int *x, int *y) {
    int temp = *x;
    *x = *y;
    *y = temp;
}

void merge(int A[],int l,int mid,int r)
{
    int i=l,j=mid+1,k=l;
    int B[1000000];
    while(i<=mid && j<=r)
    {
        if(A[i]<A[j])
            B[k++]=A[i++];
        else
            B[k++]=A[j++];
    }
    for(;i<=mid;i++)
        B[k++]=A[i];
    for(;j<=r;j++)
        B[k++]=A[j];
    for(i=l;i<=r;i++)
        A[i]=B[i];
}

void mSort(int A[],int l,int r)
{
    int mid;
    if(l<r)
    {
        mid=(l+r)/2;
        mSort(A,l,mid);
        mSort(A,mid+1,r);
        merge(A,l,mid,r);
    }
}
```

```c
void writeTable(int size, double time, char *filename)
{
    int i;
    FILE *fp = fopen(filename, "a+");

    if (fp == NULL) printf("FILE CANNOT BE OPENED\n");
    else {
        fprintf(fp, "%d %lf", size, time);
        fprintf(fp, "\n");
    }
    fclose(fp);
}

void readData(int arr[], char *filename) {
    FILE *fp = fopen(filename, "r+");
    char x[16];
    int i, k = 0;

    if (fp == NULL) printf("FILE CANNOT BE OPENED\n");
    else {
        while (fgets(x, 16, fp) != NULL) {
            int num = 0;
            fscanf(fp, "%d", &num);
            if (num == 0) break;
            arr[k++] = num;
        }
    }
    fclose(fp);
}

int main(int argc, char **argv) {
    int arr[100000];
    int size[] = {1000, 5000, 8000, 10000, 20000,
30000, 40000, 50000, 65000, 80000, 90000, 100000};
    int i = 0;
    for (i = 0; i <= 11; i++) {
        readData(arr, argv[1]);
        begin = clock();
        mSort(arr, 0, size[i]);
        end = clock();
        writeTable(size[i], (end - begin) / 100,
argv[2]);
    }
    return 0;
}
```

```c
// Analysis of Heap Sort over 100K entries

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

clock_t begin;
clock_t end;

void insertMaxHeap(int arr[], int n) {
    int t, i = n;
    t = arr[n];

    while (i > 1 && t > arr[i / 2]) {
        arr[i] = arr[i / 2];
        i /= 2;
    }
    arr[i] = t;
}

int removeMaxHeap(int arr[], int n) {
    int i, j, x, t, val;
    val = arr[1];
    x = arr[n];
    arr[1] = arr[n];
    arr[n] = val;
    i = 1;
    j = i * 2;

    while (j <= n - 1) {
        if (j < n - 1 && arr[j + 1] > arr[j])
            j++;
        if (arr[i] < arr[j]) {
            t = arr[i];
            arr[i] = arr[j];
            arr[j] = t;
            i = j;
            j *= 2;
        } else break;
    }
    return val;
}

void createMaxHeap(int arr[], int n) {
    int i;
    for (i = 2; i < n; i++)
```

```
        insertMaxHeap(arr, i);
}

void hSort(int arr[], int n) {
    int i;
    for (i = 2; i < n; i++)
        insertMaxHeap(arr, i);
    for (i = n - 1; i > 1; i--)
        removeMaxHeap(arr, i);
}

void writeTable(int size, double time, char *filename)
{
    int i;
    FILE *fp = fopen(filename, "a+");

    if (fp == NULL) printf("FILE CANNOT BE OPENED\n");
    else {
        fprintf(fp, "%d %lf", size, time);
        fprintf(fp, "\n");
    }
    fclose(fp);
}

void readData(int arr[], char *filename) {
    FILE *fp = fopen(filename, "r+");
    char x[16];
    int i, k = 0;

    if (fp == NULL) printf("FILE CANNOT BE OPENED\n");
    else {
        while (fgets(x, 16, fp) != NULL) {
            int num = 0;
            fscanf(fp, "%d", &num);
            if (num == 0) break;
            arr[k++] = num;
        }
    }
    fclose(fp);
}

int main(int argc, char **argv) {
    int arr[100000];
    int size[] = {1000, 5000, 8000, 10000, 20000,
30000, 40000, 50000, 65000, 80000, 90000, 100000};
```

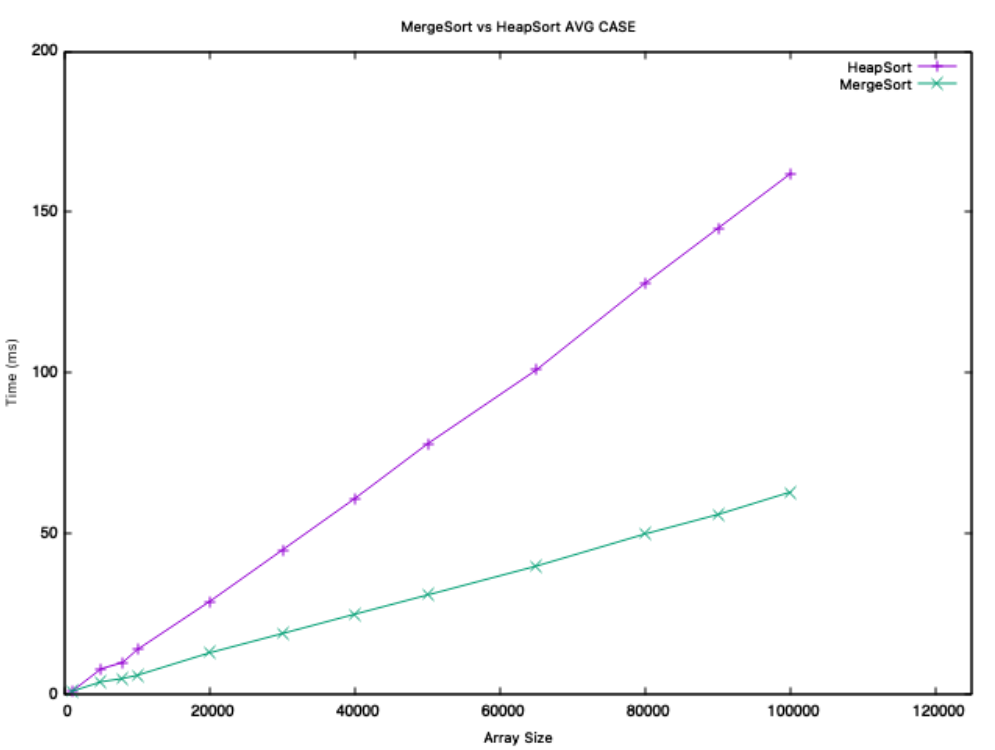
```c
    int i;
    for (i = 0; i <= 11; i++) {
        readData(arr, argv[1]);
        begin = clock();
        hSort(arr, size[i] - 1);
        end = clock();
        writeTable(size[i], (end - begin) / 100,
argv[2]);
    }
    return 0;
}
```

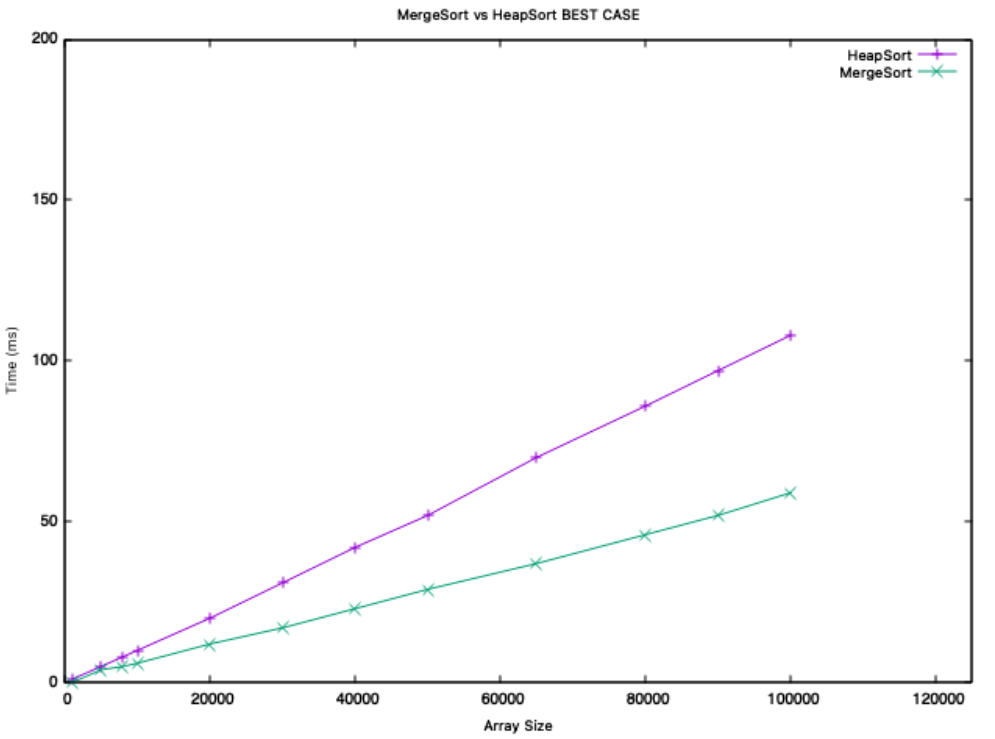


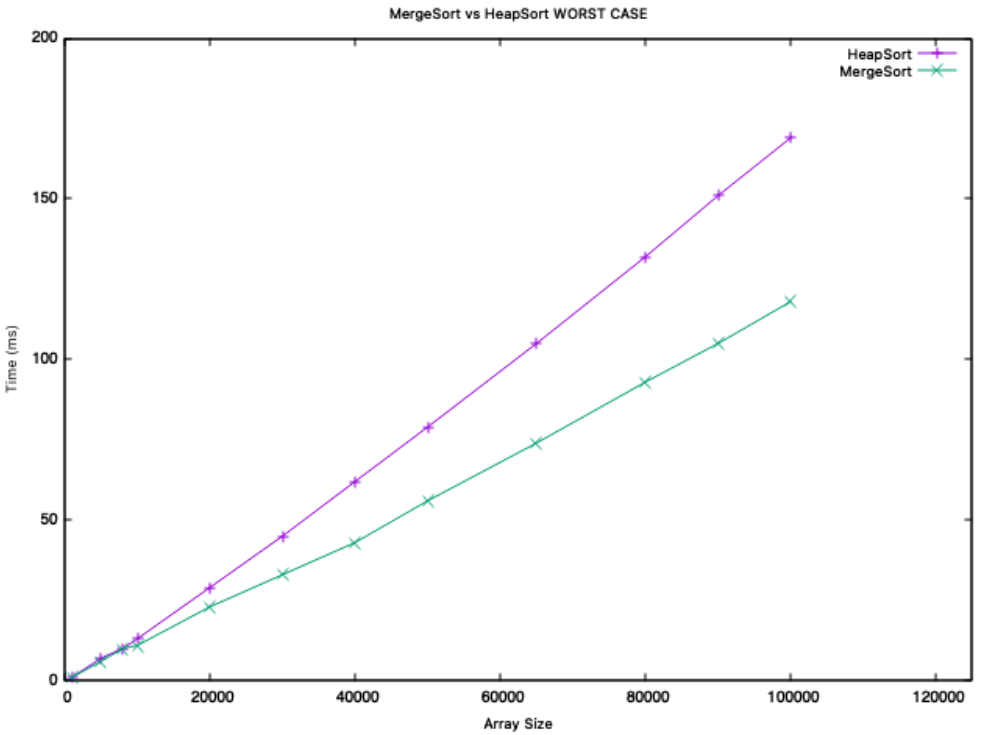
```
#pltAVG.p

set autoscale                          # scale axes automatically
unset log                                # remove any log-scaling
unset label                              # remove any previous labels

set xtic auto                            # set xtics automatically
set ytic auto                            # set ytics automatically
set tics font "Helvetica,10"

set title "MergeSort vs HeapSort AVG CASE"
set xlabel "Array Size"
set ylabel "Time (ms)"
#set key 0.01,100
#set label "Yield Point" at 0.003,260
#set arrow from 0.0028,250 to 0.003,280
set xr [0:125000]
set yr [0:200]
plot  "hTableAVG.txt" using 1:2 title 'HeapSort' with linespoints, \
      "mTableAVG.txt" using 1:2 title 'MergeSort'  with linespoints
```

```
#pltBST.p

set autoscale                          # scale axes automatically
unset log                                # remove any log-scaling
unset label                              # remove any previous labels

set xtic auto                            # set xtics automatically
set ytic auto                            # set ytics automatically
set tics font "Helvetica,10"

set title "MergeSort vs HeapSort BEST CASE"
set xlabel "Array Size"
set ylabel "Time (ms)"
#set key 0.01,100
#set label "Yield Point" at 0.003,260
#set arrow from 0.0028,250 to 0.003,280
set xr [0:125000]
set yr [0:200]
plot  "hTableBST.txt" using 1:2 title 'HeapSort' with linespoints, \
      "mTableBST.txt" using 1:2 title 'MergeSort'  with linespoints
```

```
#pltWST.p

set autoscale                          # scale axes automatically
unset log                                # remove any log-scaling
unset label                              # remove any previous labels

set xtic auto                            # set xtics automatically
set ytic auto                            # set ytics automatically
set tics font "Helvetica,10"

set title "MergeSort vs HeapSort BEST CASE"
set xlabel "Array Size"
set ylabel "Time (ms)"
#set key 0.01,100
#set label "Yield Point" at 0.003,260
#set arrow from 0.0028,250 to 0.003,280
set xr [0:125000]
set yr [0:200]
plot  "hTableBST.txt" using 1:2 title 'HeapSort' with linespoints, \
      "mTableBST.txt" using 1:2 title 'MergeSort'  with linespoints
```


MergeSort vs HeapSort AVG CASE
HeapSort
MergeSort
Time (ms)
Array Size
0
50
100
150
200
0
20000
40000
60000
80000
100000
120000


MergeSort vs HeapSort BEST CASE
HeapSort
MergeSort
Time (ms)
Array Size
0
50
100
150
200
0
20000
40000
60000
80000
100000
120000


MergeSort vs HeapSort WORST CASE
HeapSort
MergeSort
Time (ms)
Array Size
0
50
100
150
200
0
20000
40000
60000
80000
100000
120000