Lab 7

Data Structure

Lab 7 (due on Lab Session)

1. Do p7_1.c

HW 7 (due on the day before the next Lab Session)

1. Do p7_2.c

Evaluation criteria

Category	Evaluation	
p7_1	50	
p7_2	50	
Total	100	

- *Use GCC 4.8 version or GCC 5.4 version.*
- *No score will be given if the gcc version is different.*

Lab 7 Binary max heap

- You should finish p7_1 (CreateHeap, Insert, Find) during the lab session and submit it to git before you leave.
- For p7_2 (DeleteMax, PrintHeap) you can submit it to the git later
- Folder name : Lab7
- code name: p7_1, p7_2
- -15 score , if the folder, code names are wrong.
- -5 per code, if it does not use FILE I/O
- Each code will be tested by 5 different input files.
- 10 score for each input, if you don't get the answer you get 0 score.

Lab 7 Binary max heap

Heap* CreateHeap(int heapSize) Create a heap with the size of ‘heapSize’

void Insert(Heap *heap, int value) Insert a new key to the max heap. You should find the right position for the new key to maintain the max heap. If heap is full, print an error message. If the key already exists in the heap, print an error message. Print what key you insert.

int Find (Heap *heap, int value) Find the key in the heap. Return 1 if the value exists. Otherwise, return 0.

int DeleteMax(Heap* heap) Delete the max in root node and reconstruct the heap to maintain max heap. If your list does not have any element, just print an error message.

void PrintHeap(Heap* heap) Print the entire heap. If your queue is empty, just print an error message.

Lab 7 – Binary max heap

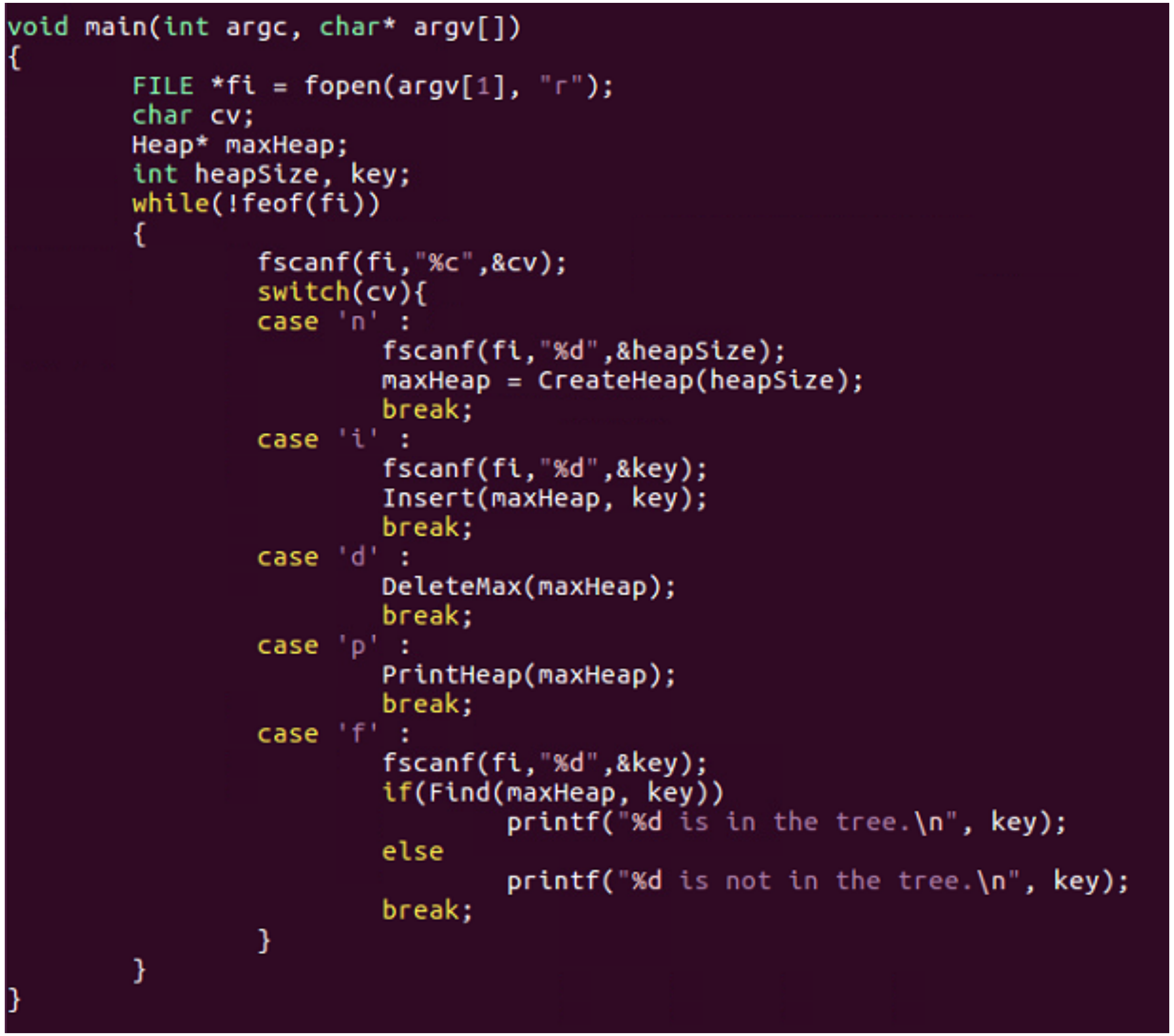
- **n x** create a new heap with the size of x. The number x is the maximum size of the MaxHeap. This operation will always be given in the first line of the operations in your input file
- **i x** insert a new key “x” into the max heap. If the key already exists in the heap, print an error message. Print what key you insert.
- **f x** find the given key to check whether the key exists in the heap .
- **d** delete the max key in the root node
- **p** print the entire max heap.

Lab 7 – MaxHeap

- Structure

```
struct HeapStruct {
                        int Capacity;
                        int Size;
                        ElementType *Elements;
            };
```

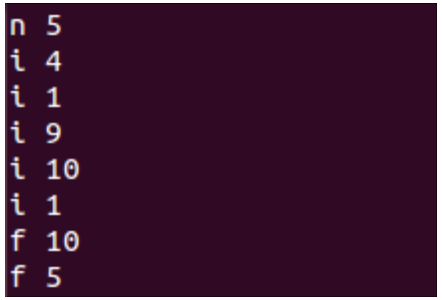
Lab 7. MaxHeap



```c
void main(int argc, char* argv[])
{
        FILE *fi = fopen(argv[1], "r");
        char cv;
        Heap* maxHeap;
        int heapSize, key;
        while(!feof(fi))
        {
                fscanf(fi,"%c",&cv);
                switch(cv){
                case 'n' :
                        fscanf(fi,"%d",&heapSize);
                        maxHeap = CreateHeap(heapSize);
                        break;
                case 'i' :
                        fscanf(fi,"%d",&key);
                        Insert(maxHeap, key);
                        break;
                case 'd' :
                        DeleteMax(maxHeap);
                        break;
                case 'p' :
                        PrintHeap(maxHeap);
                        break;
                case 'f' :
                        fscanf(fi,"%d",&key);
                        if(Find(maxHeap, key))
                                printf("%d is in the tree.\n", key);
                        else
                                printf("%d is not in the tree.\n", key);
                        break;
                }
        }
}
```

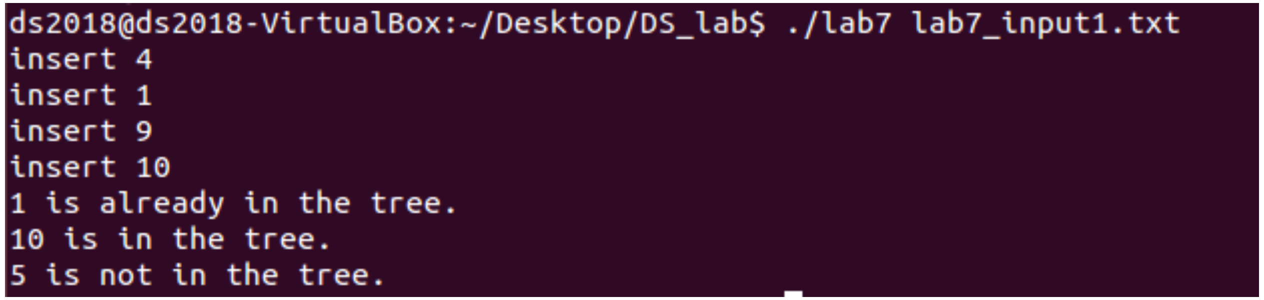
Lab 7. MaxHeap ADT – Example1

- input file : Lab7_input1.txt



```
n 5
i 4
i 1
i 9
i 10
i 1
f 10
f 5
```

- Result



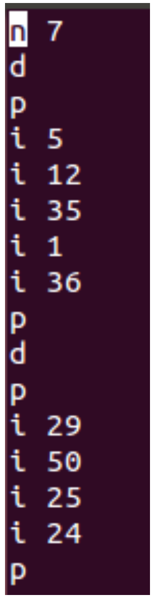
```
ds2018@ds2018-VirtualBox:~/Desktop/DS_lab$ ./lab7 lab7_input1.txt
insert 4
insert 1
insert 9
insert 10
1 is already in the tree.
10 is in the tree.
5 is not in the tree.
```

Lab 7. MaxHeap ADT – CreateHeap, Insert, Find

- program name : p7_1.c
- input : a list of commands in a file.
- output : the corresponding result in the standard output.

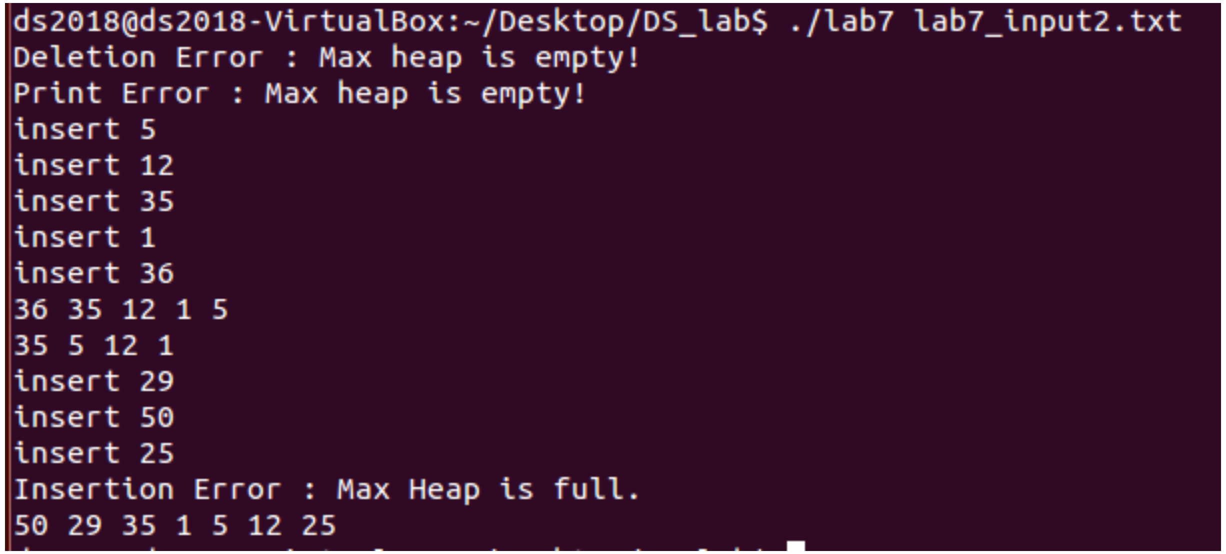
Lab 7. MaxHeap ADT – Example2

- input file : Lab7_input.txt



```
n 7
d
p
i 5
i 12
i 35
i 1
i 36
p
d
p
i 29
i 50
i 25
i 24
p
```

- Result



```
ds2018@ds2018-VirtualBox:~/Desktop/DS_lab$ ./lab7 lab7_input2.txt
Deletion Error : Max heap is empty!
Print Error : Max heap is empty!
insert 5
insert 12
insert 35
insert 1
insert 36
36 35 12 1 5
35 5 12 1
insert 29
insert 50
insert 25
Insertion Error : Max Heap is full.
50 29 35 1 5 12 25
```

Lab 7. MaxHeap ADT – DeleteMax, PrintHeap

- program name : p7_2.c
- input : a list of commands in a file.
- output : the corresponding result in the standard output.