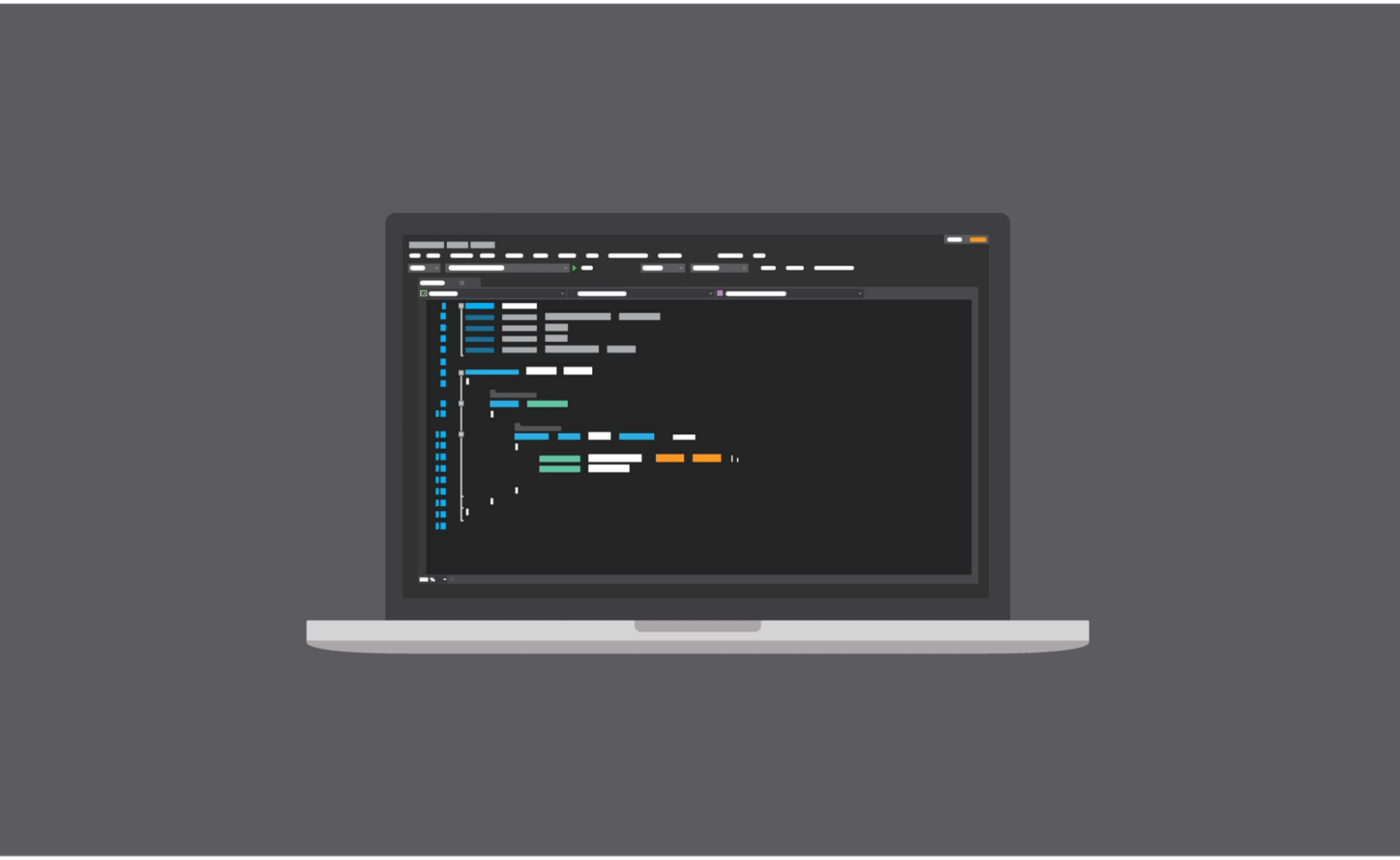


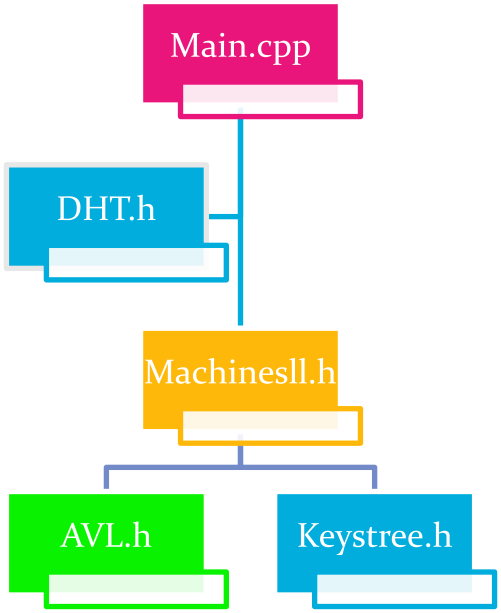
Final Project

DATA STRUCTURE

18I-0791 | Muneeb Bhalli | CS-E

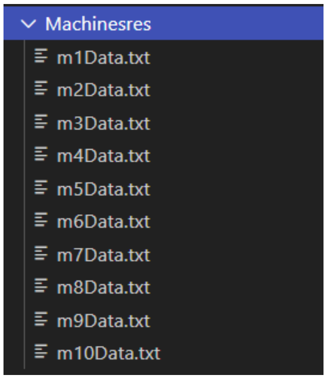
18I-0791 | Shoaib shahid ul Haq | CS-E

Files



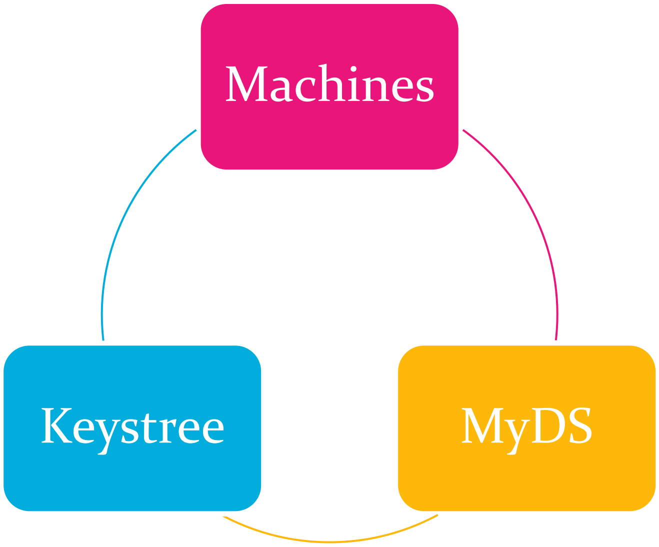
- **Main.cpp**: Menu and Initialization process.
- **DHT.h**: Functions used by the DHT.
- **Machinesll.h**: Consist of Msachines Class, Machine_node.
- **AVL.h**: MyDS class (AVL tree) and treeNode.
- **Keystree.h**: Keys_tree class and Keys_Node.

Folder **: MachineRes:** This Folder will consist of the files on which each machines data is written on with names representing machine id etc:



Machinesres
m1Data.txt
m2Data.txt
m3Data.txt
m4Data.txt
m5Data.txt
m6Data.txt
m7Data.txt
m8Data.txt
m9Data.txt
m10Data.txt

Classes



Keystree:

This Class is used for storing the Data that involves: key, hash key, value, status of the ports inside a Tree. It is used to initialize the ports in a machine where data is stored, it has the features to extend the ports, display the active ones, display all ports, insert data inside the ports and also the ability to extend the ports and retrieve their status. This class is responsible for all the hashing done to the data being stored inside the tree, also for the process when the data on a key is retrieved/deleted and the writing process inside files.

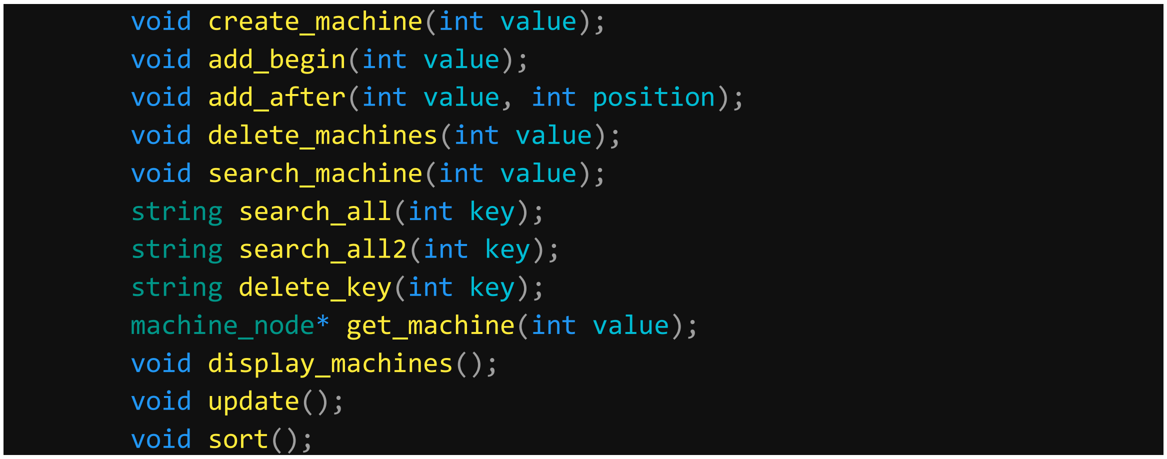
It has the following functions:

```
string hashfunc(int i)
bool get_Port_status(short int key_argument)
string get(int key)
bool deletekey(int key)
bool insertin(short int key_argument,string data)
void Extend_the_Ports_keys_array()
void Displayall()
void Displayactive()
void writetofile(string filepath,int key , string data_in)
```

Machines:

This Class is used to design a Circular LinkedList used for machines being used in the program. It also involves using the Keystree and MyDS classes. This class is responsible for creating new machines used in the hub , adding new machines , deleting existing machines , searching/deleting inside all machines and for getting the machine status which is then stored inside a machine node.

It has the following functions:

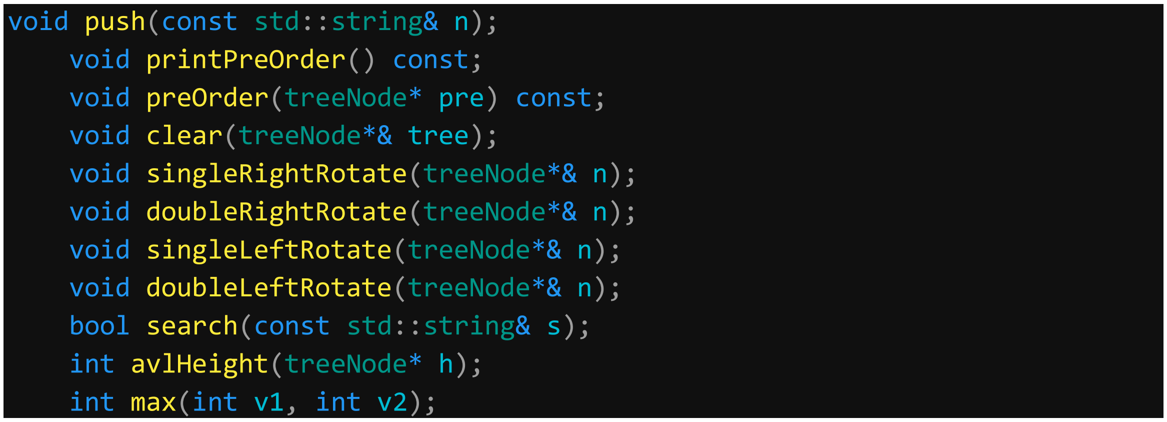


```
        void create_machine(int value);
        void add_begin(int value);
        void add_after(int value, int position);
        void delete_machines(int value);
        void search_machine(int value);
        string search_all(int key);
        string search_all2(int key);
        string delete_key(int key);
        machine_node* get_machine(int value);
        void display_machines();
        void update();
        void sort();
```

MyDS:

This class is used to design a AVL tree, that stores the data specific to each machine inside an AVL Tree. It is responsible for pushing something inside the Tree, also removing something out of the tree as well, it can search the AVL tree for a specific data that is to be deleted on a specific key and it can also display the AVL tree.

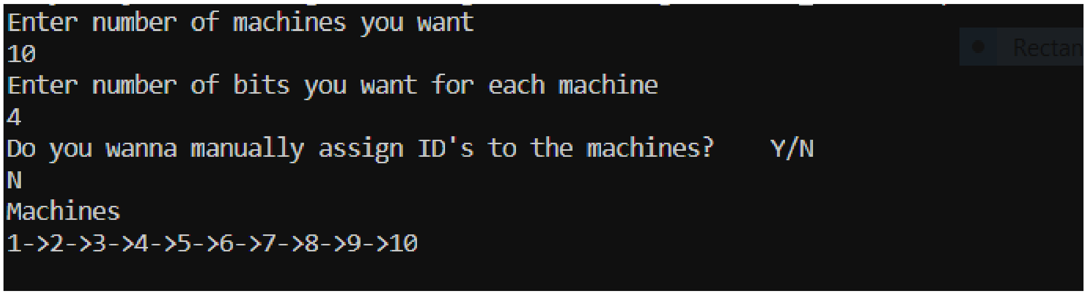
It has the following functions:



```
void push(const std::string& n);
    void printPreOrder() const;
    void preOrder(treeNode* pre) const;
    void clear(treeNode*& tree);
    void singleRightRotate(treeNode*& n);
    void doubleRightRotate(treeNode*& n);
    void singleLeftRotate(treeNode*& n);
    void doubleLeftRotate(treeNode*& n);
    bool search(const std::string& s);
    int avlHeight(treeNode* h);
    int max(int v1, int v2);
```

Starting out with the program

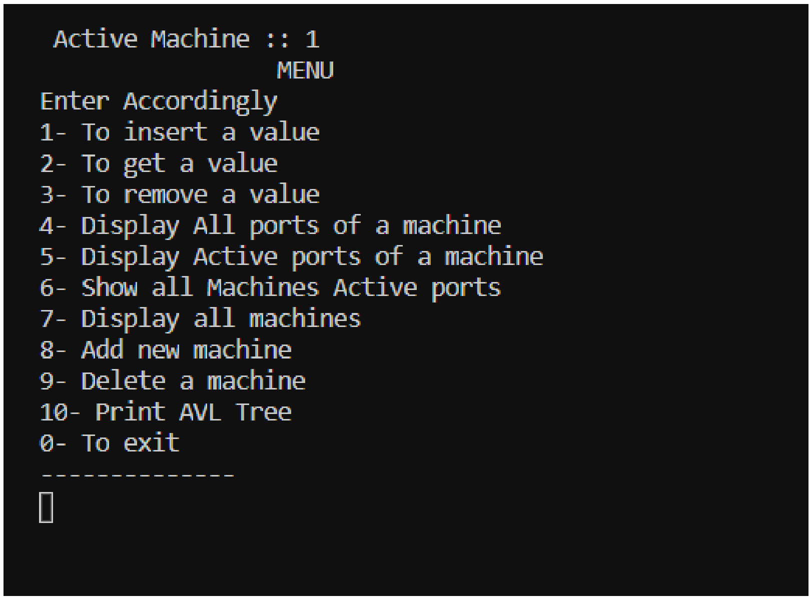
Initializing:



```
Enter number of machines you want
10
Enter number of bits you want for each machine
4
Do you wanna manually assign ID's to the machines?    Y/N
N
Machines
1->2->3->4->5->6->7->8->9->10
```

- First, we will specify the numbers of the machine we want.
- Then we will tell what bits we want for each machine.
- Afterwards we will be asked if we want to manually assign ID's to the machines we created in this case (10).
- After initializing the program will show as with the machines with their ID's. (in this case they were automatically assigned since I choose the option N)

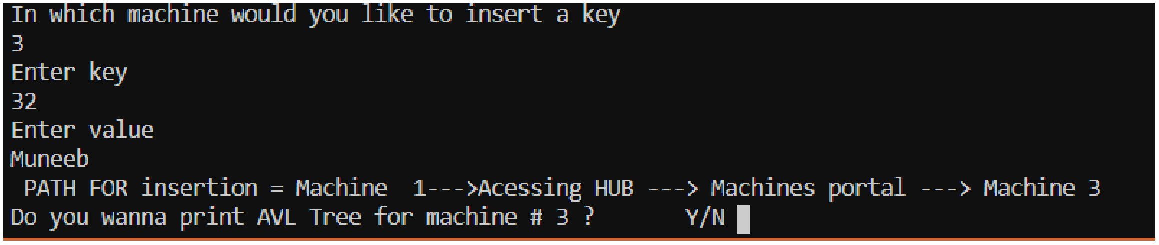
Menu:



```
 Active Machine :: 1
                MENU
Enter Accordingly
1- To insert a value
2- To get a value
3- To remove a value
4- Display All ports of a machine
5- Display Active ports of a machine
6- Show all Machines Active ports
7- Display all machines
8- Add new machine
9- Delete a machine
10- Print AVL Tree
0- To exit
--------------
```

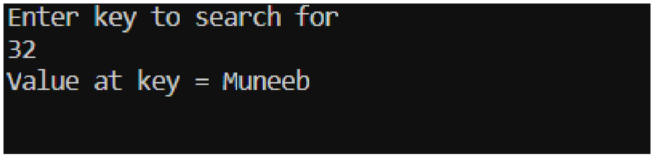
The Menu shows the active machine at the top and inside the menu we are presented with 11 options:

1. This option allows us to insert a value inside a machine we want. It will ask us for a key and the data. After which it will show us the Path for insertion and the option if we want to print a AVL tree for the machine.



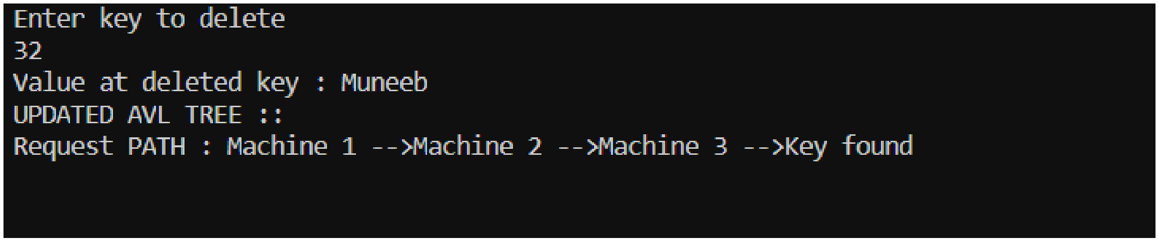
```
In which machine would you like to insert a key
3
Enter key
32
Enter value
Muneeb
 PATH FOR insertion = Machine  1--->Acessing HUB ---> Machines portal ---> Machine 3
Do you wanna print AVL Tree for machine # 3 ?       Y/N
```

2. This option allows us to retrieve data from a key , previously as I inserted “Muneeb” on key 32 , we can retrieve the data present on the key.



```
Enter key to search for
32
Value at key = Muneeb
```

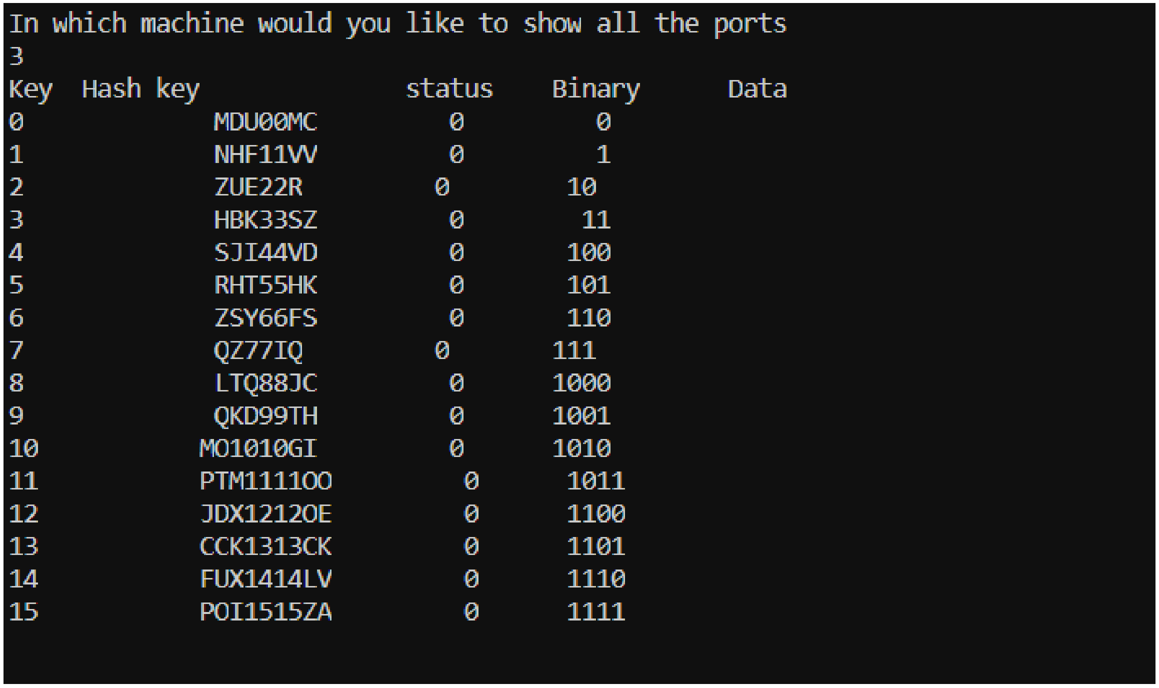
3. This option allows us to remove the data by providing a key. This also shows us the value that was present at the key and also shows us the updated AVL tree after deletion (In this case no other values existed other than the one deleted) and it also shows us the path of how the request reached the machine where it found the key.



```
Enter key to delete
32
Value at deleted key : Muneeb
UPDATED AVL TREE ::
Request PATH : Machine 1 -->Machine 2 -->Machine 3 -->Key found
```

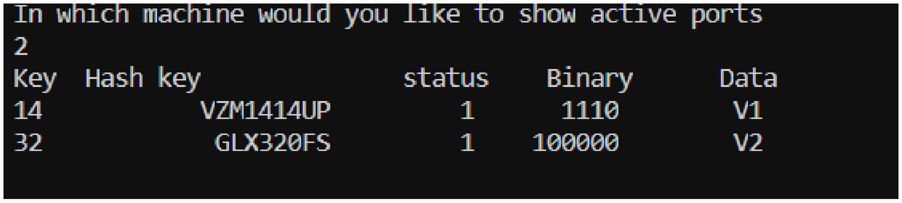
4. This option allows us to show all ports present inside a machine. It will ask us for a machine id and show its all ports that exist depending on the bits we decided (in

our case I used 4 bits which means 4*4 = 16 ports and also the key we inserted).



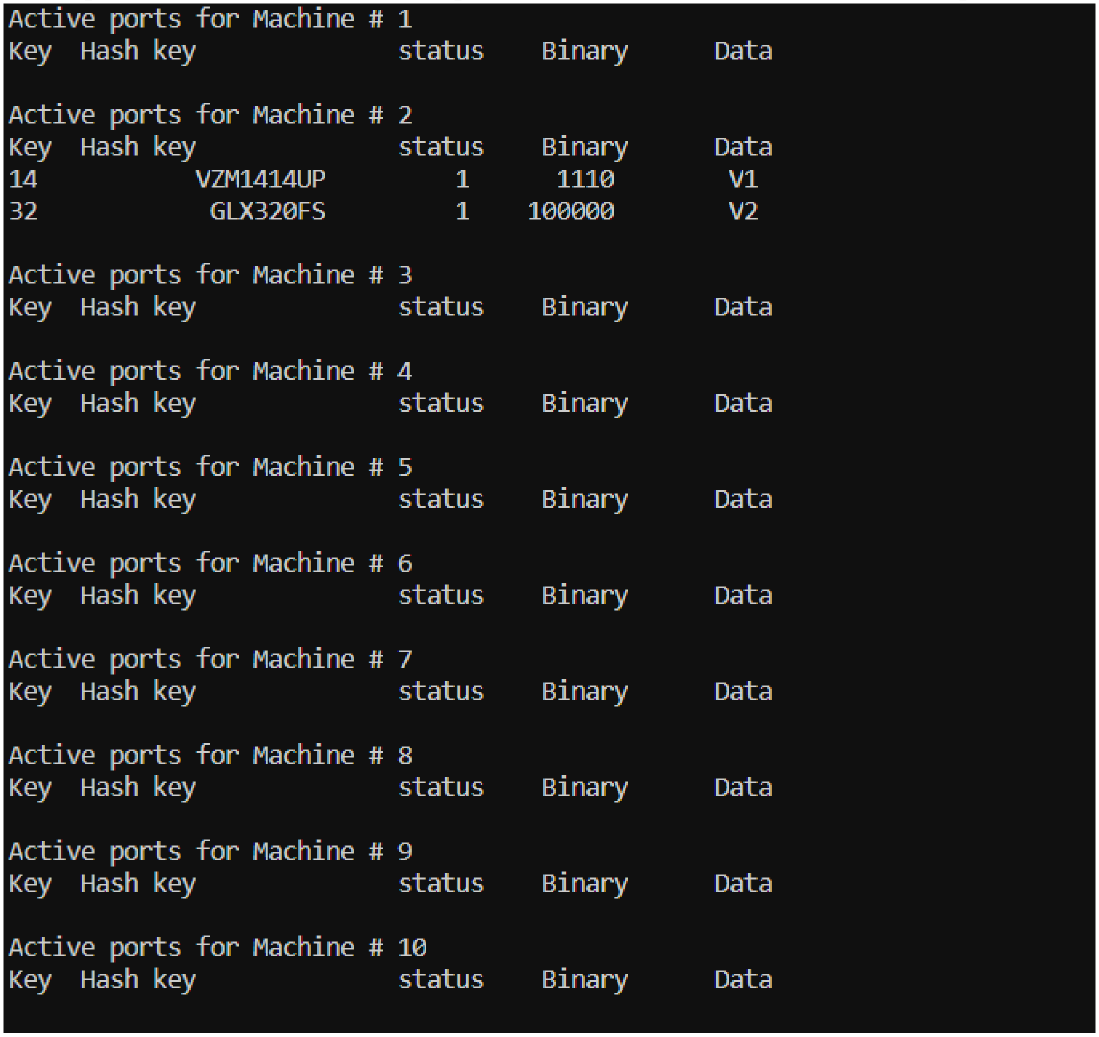
```
In which machine would you like to show all the ports
3
Key  Hash key             status    Binary      Data
0            MDU00MC        0         0
1            NHF11VV        0         1
2            ZUE22R        0        10
3            HBK33SZ        0        11
4            SJI44VD        0       100
5            RHT55HK        0       101
6            ZSY66FS        0       110
7            QZ77IQ        0       111
8            LTQ88JC        0      1000
9            QKD99TH        0      1001
10          MO1010GI        0      1010
11          PTM1111OO        0      1011
12          JDX1212OE        0      1100
13          CCK1313CK        0      1101
14          FUX1414LV        0      1110
15          POI1515ZA        0      1111
```

5. This option shows us all the active ports inside a machine, in which a value exists. In our case we don’t have any values existing as we deleted the one, I added so I will add 2 values inside machine 5 on keys 14 and 32 and show the active ports.



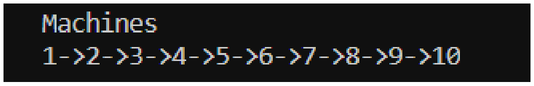
```
In which machine would you like to show active ports
2
Key  Hash key             status    Binary      Data
14          VZM1414UP         1      1110        V1
32            GLX320FS        1    100000        V2
```

6. This option shows us all the active ports on all the machines where data is present.



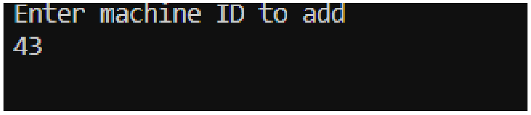
```
Active ports for Machine # 1
Key  Hash key              status    Binary      Data

Active ports for Machine # 2
Key  Hash key              status    Binary      Data
14          VZM1414UP         1       1110        V1
32           GLX320FS         1     100000        V2

Active ports for Machine # 3
Key  Hash key              status    Binary      Data

Active ports for Machine # 4
Key  Hash key              status    Binary      Data

Active ports for Machine # 5
Key  Hash key              status    Binary      Data

Active ports for Machine # 6
Key  Hash key              status    Binary      Data

Active ports for Machine # 7
Key  Hash key              status    Binary      Data

Active ports for Machine # 8
Key  Hash key              status    Binary      Data

Active ports for Machine # 9
Key  Hash key              status    Binary      Data

Active ports for Machine # 10
Key  Hash key              status    Binary      Data
```

7. This option is used to Display all current machines.



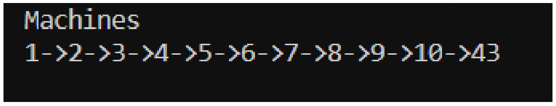
```
Machines
1->2->3->4->5->6->7->8->9->10
```

8. This option is used to add a new machine to the RING DHT. It will ask us for a machine ID and add it to the ring.



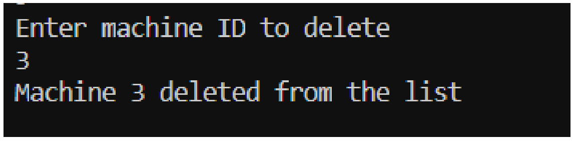
```
Enter machine ID to add
43
```

Then we can use option 7 to display machines to verify.



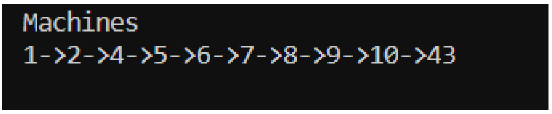
```
Machines
1->2->3->4->5->6->7->8->9->10->43
```

9. This option allows us to delete a machine by asking us for a machine ID to delete.



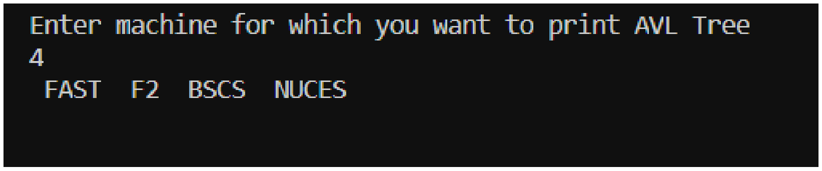
```
Enter machine ID to delete
3
Machine 3 deleted from the list
```

We can again display the machines to verify.



```
Machines
1->2->4->5->6->7->8->9->10->43
```

10. This option is used to print AVL tree present on a specific machine, where we input the machine's id. I will add 4 values on machine 4 and print its AVL tree. In this sequence : FAST , F2 , NUCES , BSCS



```
Enter machine for which you want to print AVL Tree
4
 FAST  F2  BSCS  NUCES
```

TO exit we will use the option 0.