Design and Analysis of Algorithms Assignment - 8

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Batch : B-3

Huffman Encoding

CODE :

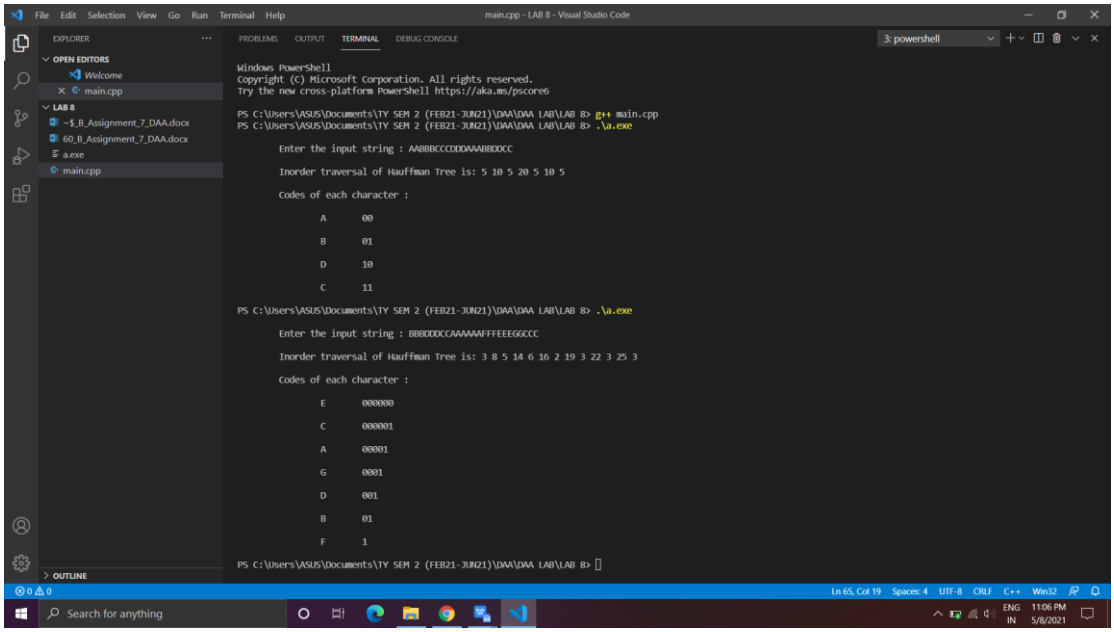
```
#include<bits/stdc++.h>
using namespace std;
struct Node
{
    char data;
    int freq;
    Node* left;
    Node* right;
};

Node* createNode(char d,int f)
{
    Node* temp = new Node;
    temp->data = d;
    temp->freq = f;
    temp->left = NULL;
    temp->right = NULL;
    return temp;
}
void show(Node* root)
{
    if(root)
```

```
    {
        show(root->left);
        cout<<root->freq<<" ";
        show(root->right);
    }
}
void generateCodes(Node* root,string s)
{
    if(!root)
        return;
    if(root->data!='$')
        cout<<"\n\t\t"<<root->data<<" "<<s<<endl;
    generateCodes(root->left,s+'0');
    generateCodes(root->right,s+'1');
}
void hauffmanTree(vector<pair<char,int>> &v)
{
    priority_queue<Node*,vector<Node*>,greater<Node*>> p;
    for(int i=0;i<v.size();i++)
    {
        Node* temp = new Node;
        temp = createNode(v[i].first,v[i].second);
        p.push(temp);
    }
    Node *left,*right,*top;
    while(p.size()!=1)
    {
        left = p.top();
        p.pop();
        right = p.top();
        p.pop();
        top = new Node;
        top = createNode('$',left->freq+right->freq);
        top->left = left;
        top->right = right;
        p.push(top);
```

```
    }
    cout<<"\n\tInorder traversal of Hauffman Tree is: ";
    show(p.top());
    cout<<endl<<"\n\tCodes of each character : "<<endl;
    generateCodes(p.top(),"\t");
    cout<<endl;
}
bool helper(pair<char,int> &p1,pair<char,int> &p2)
{
    return p1.second<p2.second;
}
int main()
{
    string s;
    cout<<"\n\tEnter the input string : ";
    cin>>s;
    unordered_map<char,int> m;
    for(int i=0;i<s.size();i++)
        m[s[i]]++;
    vector<pair<char,int>> v;
    for(auto i:m)
        v.push_back(i);
    sort(v.begin(),v.end(),helper);
    hauffmanTree(v);
}
```

O/P:



Time Complexity: O(nlogn)

Space Complexity: O(n)