
Insertion in Quad Merkle Tree

```
void insertQuad(string &t, vector<string> &trans, unordered_map<int, vector<string>> &mp, string &root){
    trans.push_back(t);
    int size = trans.size();
    string hash = sha256(t);
    int levels = ((ceil(log2(size) / 2)) + 1);
    mp[1].push_back(hash);
    int i = 2;
    while (i <= levels){
        int prevSz = mp[i - 1].size();
        int currSz = mp[i].size();
        int neededSz = (prevSz / 4) + (prevSz % 4 == 0 ? 0 : 1);
        string newVal = "";
        vector<string> v = mp[i - 1];
        int k = v.size() / 4 + (v.size() % 4 == 0 ? -1 : 0);
        int idx = k * 4;
        int cnt = 0;
        for (int i = v.size() - 1; i >= idx; i--){
            string s = v[i];
            reverse(s.begin(), s.end());
            newVal += s;
            cnt++;
        }
        string newHash;
        if (cnt == 1)
            newHash = hash;
        else
            newHash = sha256(newVal);
        if (currSz == neededSz)
            mp[i][mp[i].size() - 1] = newHash;
        else
            mp[i].push_back(newHash);
        i++;
    }
    if (mp[levels].size() == 1)
        root = mp[levels][0];
    else{
        string h1 = mp[levels][0];
        string h2 = mp[levels][1];
        reverse(h1.begin(), h1.end());
        reverse(h2.begin(), h2.end());
        string newHash = sha256(h2 + h1);
        root = newHash;
        mp[levels + 1].push_back(root);
    }
    return;
}
```
