CSCI 3333 Practice Quiz DP2

- The actual quiz consists of one question and a 10-minute duration.
- The actual quiz question may or may not be one of the questions here.

**Problem 1.** Complete the following implementation of a function `make_change` that decides whether change can be made for \( w \) using coins from a set of denominations \( C \) using dynamic programming.

```cpp
bool make_change(set<int> &C, int w) {
    bool* T = new bool[w+1];
    for (int i = 0; i < w+1; ++i)
        T[i] = false;

    for (int c : C)
        T[c] = _____;

    for (int sub_w = 1; sub_w <= w; ++sub_w)
        for (int c : C)
            { if (sub_w-c _____ 0)
                ______;
                if (T[______])
                    T[sub_w] = true;
            }

    bool soln = T[w];
    delete[] T;
    return soln;
}

int main()
{
    set<int> C{1, 4, 5, 9};
    cout << "Change for 30 can be made using coin values 1, 4, 5, 9: ";
    cout << make_change(C, 30) << endl;
}
```

**Problem 2.** Complete the following implementation of a function `catalan` that computes the number of binary trees containing \( n \) nodes using memoization.
int catalan(int n, map<int, int> &C)
{
    if (C.find(n) != C.end())
        return _____;
    if (n == 0)
        return 1;
    if (n == 1)
        return _____;
    int cn = 0;
    for (int l = 0; l <= n-1; ++l)
    {
        int r = n-1-l;
        cn _____ catalan(l, C) * catalan(r, C);
    }
    _____ = cn;
    return cn;
}

int main()
{
    cout << "The number of binary trees containing 10 nodes is ";
    map<int, int> C;
    cout << catalan(10, C) << endl;
}

Problem 3. Complete the following implementation of a function tribonacci that computes elements of the Tribonacci sequence using memoization.

int tribonacci(int n, map<int> &T)
{
    if (T.find(_____) != T.end())
        return _____;
    if (n == 0)
        return 0;
    if (n == 1)
        return 2;
return 1;
if (n == 2)
    return 1;

int tn = tribonacci(_____, T)
    + tribonacci(_____, T)
    + tribonacci(_____, T);

_____ = tn;
return _____;
}

int main()
{
    cout << "The 10th Tribonacci number is ";
    map<int> T;
    cout << tribonacci(10, T) << endl;
}