Shri Vile Parle Kelavani Mandal's

INSTITUTE OF TECHNOLOGY

DHULE (M.S.)

DEPARMENT OF COMPUTER ENGINEERING

Subject : Competitive Programming Lab

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Class : TY. Comp. Engg. **Batch : T2** **Division: T**

Expt. No. :13 **Date : 24/03/2025**

Title : Priest Mathematician Problem

Remark

Signature

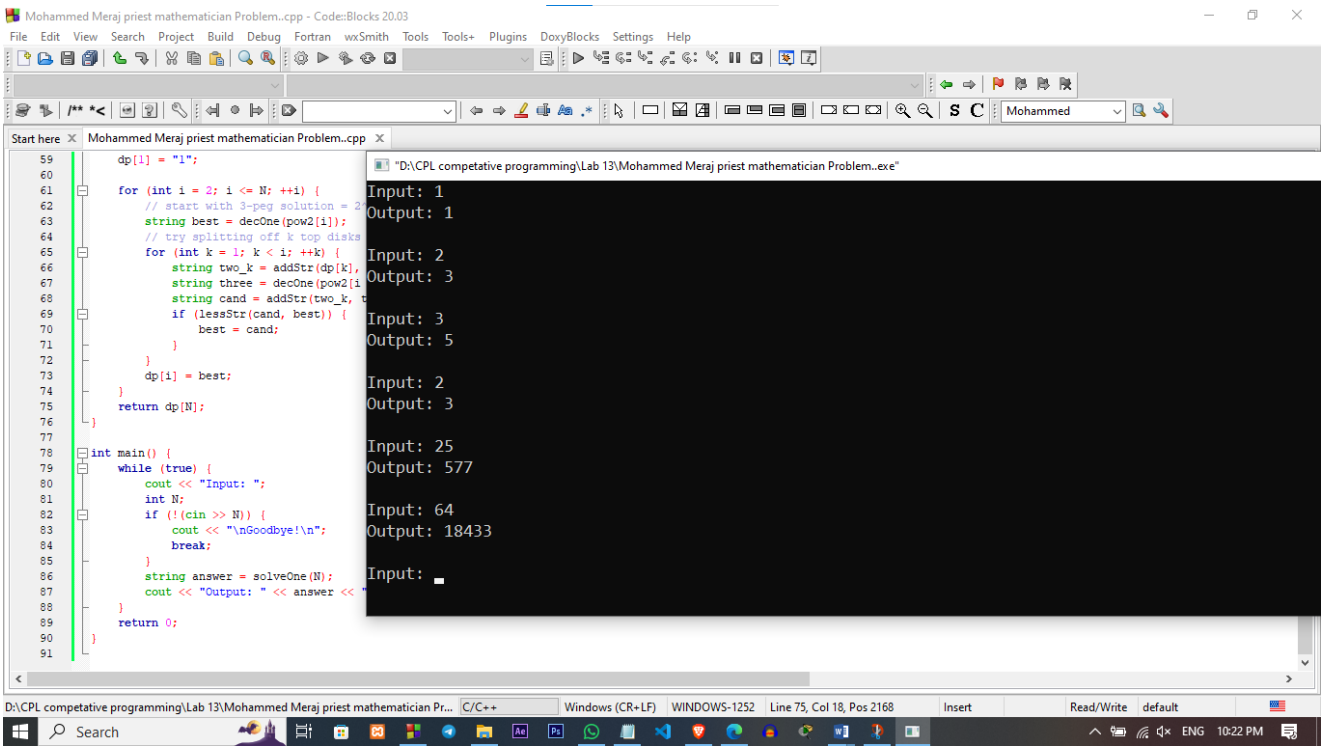
Language: C++

```
//  Priest Mathematician Problem by Meraj 32 T2
#include <iostream>
#include <vector>
#include <string>
#include <algorithm>
using namespace std;

// Add two non-negative decimal integers (as strings), both passed by value
string addStr(string a, string b) {
    int i = a.size() - 1, j = b.size() - 1, carry = 0;
    string res;
    while (i >= 0 || j >= 0 || carry) {
        int sum = carry;
        if (i >= 0) { sum += (a[i] - '0'); --i; }
        if (j >= 0) { sum += (b[j] - '0'); --j; }
        carry = sum / 10;
        res.push_back(char('0' + (sum % 10)));
    }
    reverse(res.begin(), res.end());
    // strip leading zeros
    size_t p = res.find_first_not_of('0');
    return (p == string::npos ? "0" : res.substr(p));
}
```

```
// Subtract exactly 1 from a positive decimal string
string decOne(string s) {
    int i = s.size() - 1;
    while (i >= 0) {
        if (s[i] > '0') {
            s[i] = char(s[i] - 1);
            break;
        }
        s[i] = '9';
        --i;
    }
    size_t p = s.find_first_not_of('0');
    return (p == string::npos ? "0" : s.substr(p));
}

// Return true if a < b, both non-negative decimal strings
bool lessStr(string a, string b) {
    if (a.size() != b.size())
        return a.size() < b.size();
    return a < b;
}

// Solve for one N using DP + Frame–Stewart
string solveOne(int N) {
    if (N <= 1) return (N == 0 ? "0" : "1");

    // build powers of two up to N
    vector<string> pow2(N+1);
    pow2[0] = "1";
    for (int i = 1; i <= N; ++i) {
        pow2[i] = addStr(pow2[i-1], pow2[i-1]);
    }

    // dp[i] = best moves for i disks on 4 pegs
    vector<string> dp(N+1, "0");
    dp[1] = "1";

    for (int i = 2; i <= N; ++i) {
        // start with 3-peg solution = 2^i - 1
        string best = decOne(pow2[i]);
        // try splitting off k top disks
        for (int k = 1; k < i; ++k) {
```

```
            string two_k = addStr(dp[k], dp[k]);
            string three = decOne(pow2[i - k]);
            string cand = addStr(two_k, three);
            if (lessStr(cand, best)) {
               best = cand;
            }
         }
         dp[i] = best;
      }
      return dp[N];
   }

   int main() {
      while (true) {
         cout << "Input: ";
         int N;
         if (!(cin >> N)) {
            cout << "\nGoodbye!\n";
            break;
         }
         string answer = solveOne(N);
         cout << "Output: " << answer << "\n\n";
      }
      return 0;
   }
```

Output :


Mohammed Meraj priest mathematician Problem..cpp - Code::Blocks 20.03
File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help
Start here
Mohammed Meraj priest mathematician Problem..cpp
"D:\CPL competative programming\Lab 13\Mohammed Meraj priest mathematician Problem..exe"
Input: 1
Output: 1
Input: 2
Output: 3
Input: 3
Output: 5
Input: 2
Output: 3
Input: 25
Output: 577
Input: 64
Output: 18433
Input:
D:\CPL competative programming\Lab 13\Mohammed Meraj priest mathematician Pr...
C/C++
Windows (CR+LF)
WINDOWS-1252
Line 75, Col 18, Pos 2168
Insert
Read/Write
default
Search
ENG
10:22 PM