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#include <bits/stdc++.h>

using namespace std;

int i,j,sz,nr,p,produs,mat_formare[5][5], cincii = 5;
bool mat[5][5];
string s;

void lin(int a, int b)
{
    for(int i = 1; i <= 4; ++ i)
        ++ mat_formare[a][i], ++ mat_formare[b][i];
}

void col(int a,int b)
{
    for(int i = 1; i <= 4; ++ i)
        ++ mat_formare[i][a], ++ mat_formare[i][b];
}

void formare()
{
    if(s[i] == '~')
    {
        ++ i;
        if(s[i] == 'A')
            col(3, 4);
        else if(s[i] == 'B')
            lin(3, 4);
        else if(s[i] == 'C')
            col(1, 4);
        else
            lin(1, 4);
    }
    else
    {

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    if(s[i] == 'A')
        col(1, 2);
    else if(s[i] == 'B')
        lin(1, 2);
    else if(s[i] == 'C')
        col(2, 3);
    else
        lin(2, 3);
}
++ i;
}
void construire()
{
    for(int i = 1; i <= 4; ++ i)
        for(int j = 1; j <= 4; ++ j)
            mat_formare[i][j] = (mat_formare[i][j] == produs ? mat_formare[i][j] : 0);
}
void adaugare_mat()
{
    for(int i = 1; i <= 4; ++ i)
        for(int j = 1; j <= 4; ++ j)
            mat[i][j] = (mat_formare[i][j] ? 1 : mat[i][j]);
}
int main()
{
    ios_base::sync_with_stdio(false);
    cin.tie(nullptr);
    while(cinci --)
    {
        memset(mat, 0, sizeof(mat));
        getline(cin, s);
        sz = s.length();
        for(i = 0; i < sz; ++ i)
            if(s[i] == ' ')
            {

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    s.erase(i, 1);
    -- i;
    -- sz;
}
else if((s[i] == 'A' && s[i + 1] == '~' && s[i + 2] == 'A')
    || (s[i] == 'B' && s[i + 1] == '~' && s[i + 2] == 'B')
    || (s[i] == 'C' && s[i + 1] == '~' && s[i + 2] == 'C')
    || (s[i] == 'D' && s[i + 1] == '~' && s[i + 2] == 'D'))
{
    s.erase(i, 3);
    sz -= 3;
    -- i;
}
i = 0;
while(i < sz)
{
    formare();
    produs = 1;
    while(i < sz && s[i] != '+')
    {
        ++ produs;
        formare();
        construire();
    }
    adaugare_mat();
    memset(mat_formare, 0, sizeof(mat_formare));
    ++ i;
    while(i < sz && s[i] == '+')
        ++ i;
}
for(i = 1; i <= 4; ++ i)
{
    nr = 0;
    p = 1;
    for(j = 4; j >= 1; -- j)

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{
    nr += p * mat[i][j];
    p *= 2;
}
if(nr < 10)
    cout << nr;
if(nr == 10)
    cout << 'A';
if(nr == 11)
    cout << 'B';
if(nr == 12)
    cout << 'C';
if(nr == 13)
    cout << 'D';
if(nr == 14)
    cout << 'E';
if(nr == 15)
    cout << 'F';
}
cout << '\n';
}
}
```