Problem A is for those who have not done it last week.

If you did it already, go on to problem B.

PROBLEM A: EDIT DISTANCE

The edit distance between two words—sometimes also called the *Levenshtein* distance—is the *minimum* number of letter insertions, letter deletions, and letter substitutions required to transform one word into another.

For example, the edit distance between FOOD and MONEY is at most four:

FOOD → MOOD → MON_D → MONED → MONEY

Given two strings, find the edit distance between them.

INPUT:

Line 1: the first string, A
Line 2: the second string, B

OUTPUT:

Edit distance between the two strings

1) We are transforming string A to string B. Assume that string A[0] .. A[i-1] have been transformed to be identical to B[0] .. B[j-1], and the consideration now is on A[i] and B[j].

   The table below lists all possible scenarios at state (i, j) and edit operations that can be performed. What is the consequential state for each combination of condition and operation ?

condition	edit operation	next state to consider
A[i] == B[j]	None	(i+1, j+1)
A[i] != B[j]	Insert B[j] in front of A[i]	(i, j+1) assume that that character already in A
A[i] != B[j]	Delete A[i]	(i+1, j) assume that we replace delete A[i] with B[j]
A[i] != B[j]	Change A[i] to B[j]	(i+1, j+1) but add 1 more

2) What is the beginning state? (0,0)

3) If A runs out, but B has not yet, in other words, i == len(A), but j < len(B), what is the additional edit distance required to complete the transformation? len(b) - j

4) If B runs out, but A has not yet, what is the additional edit distance required to complete the transformation? len(a) - i

5) Use the concepts obtained from step 1 to 4 above in write a recursive brute-force solution for this problem. The zipped test case file is downloadable from Class Materials.

6) Given that a string can be up to 1000 letters long, improve the brute-force solution so that the program will finish in no more than 2.5 seconds (CPU processing time).

PROBLEM B: Dynamic Programming for Minimum Coin Change

INPUT:

Line 1 : the list of coin denominator

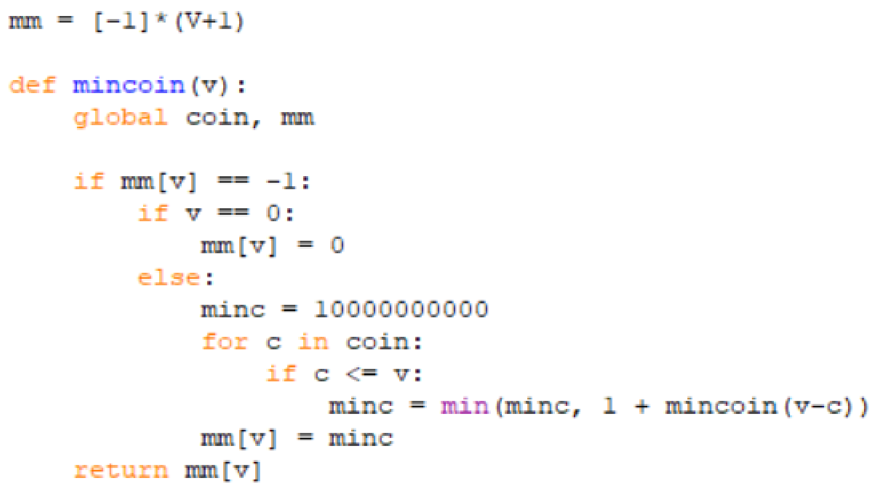
Line 2 : the amount of change

OUTPUT: The minimum number of coins required for the change

EXAMPLE

INPUT	OUTPUT
1 3 4 5 7	2
1 2 5 10 13 3377	260

The following code is a memoized minimum coin change function.



```
mm = [-1]*(V+1)

def mincoin(v):
    global coin, mm

    if mm[v] == -1:
        if v == 0:
            mm[v] = 0
        else:
            minc = 10000000000
            for c in coin:
                if c <= v:
                    minc = min(minc, 1 + mincoin(v-c))
            mm[v] = minc
    return mm[v]
```

1. Given that v1 ≥ v2,

   1.1 which recursive call, to mincoin(v1) or to mincoin(v2), is made first?

   v1 will made first because v1 > v2

   1.2 which recursive function, mincoin(v1) or mincoin(v2), returns first?

   v2 will be returned first due to it's recursion so it will find the base case first then return from the base case

   1.3 which mm's entry, mm[v1] or mm[v2], obtains its final value first?

   mm[v2] same reason as 1.2

   According, if items of mm are computed in a certain order, the function call "mincoin(v-c)" can always retrieve value from the pre-computed mm entry. Thus virtually eliminate chains of recursive calls.

2. Develop a *non-recursive* minimum coin change solution i.e. does not utilize recursive function, by iterating through mm's indices with an appropriate sequence, computing value of corresponding mm's entry along the way.