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	
A[i] != B[j]	Insert B[j] in front of A[i]	
A[i] != B[j]	Delete A[i]	
A[i] != B[j]	Change A[i] to B[j]	

2) What is the beginning state?

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?

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

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

(Targeted time to finish : not longer than 1 hour)

INPUT:

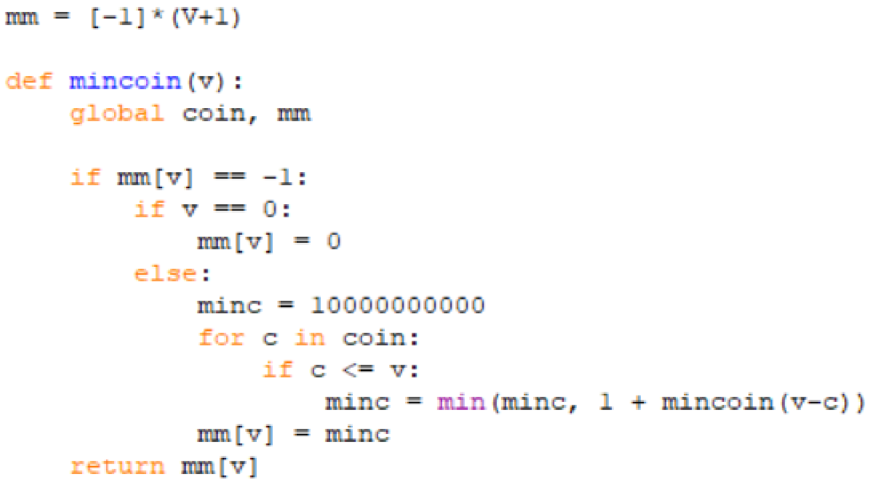
Line 1 : the list of coin denominator
Line 2 : the amount of change

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?

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

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

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.