Exercise for algorithm

It is my solution for exercise in problem in ppt for algorithm.

[CH1]

int fake\_coins(A,left,right)

{

int mid=(left+right)/2;

if(right<=left+1) // there are one or two coins or something wrong!

{

if(right<left-1){Throw error;}

if(right==left)// there is one coin.{return 0;}

if(A[left]==A[right]){return 0;}

else if(A[left]<A[right]){return 1;}

else{return 2;}

}

if(sum(A,left,mid)==sum(A,mid+1,right))

{

int lp=fake\_coin(A,left,mid);

int rp=fake\_coin(A,mid+1,right);

if(lp!=0 and rp!=0){Throw error;} // at least two fake coins.

if(lp==0 and rp==0){return 0;}//NO fake coins.

if(lp!=0){return lp;}

if(rp!=0){return rp;}

}

}

int sum(A,left,right)

{

int total=0;

for(int i=left;i<=right;i++){total+=A[i];}

return total;

}

void main()

{

int res=fake\_coin(A,1,A.length);

if(res==0){printf(“NO fake coins.”);}

else if(res==1){printf(“there is a lighter coin.”);}

else {printf(“there is a heavier coin.”);}

}

[CH2]

for i=1 to n do   
 for j=1 to n do  
 { c[i][j]=0;  
 for k=1 to n do   
 c[i][j]=c[i][j]+a[i][k]\*b[k][j];  
 }

[CH3]

* 小明有資金20萬元，想做一年理財規劃。理財專員提供下列6個投資標的資訊給小明選擇，個別投資標的可部分出售但不可多選，報酬依比例計算，請問小明要如何選擇才會獲得最大報酬？
* M=22 and 4 kinds of food with (3,4), (8,5),(6,9),(8,13). //Ans. Foods 4,3,1 100%, food 2: 62.5%, total values: 29.125

[CH4]

* *利用遞迴呼叫轉換成陣列查表處理組合數  
  C(m,n)=C(m-1,n-1)+C(m-1,n),   
  初始值 若m=n 或n=0 則C(m,n)=1*

*有一個程式如下：  
  
  
  
  
(a) F(10)的回傳值是多少?*

*(b) 執行F(10)的過程中，F函式共被呼叫多少次? (含F(10)本身)*

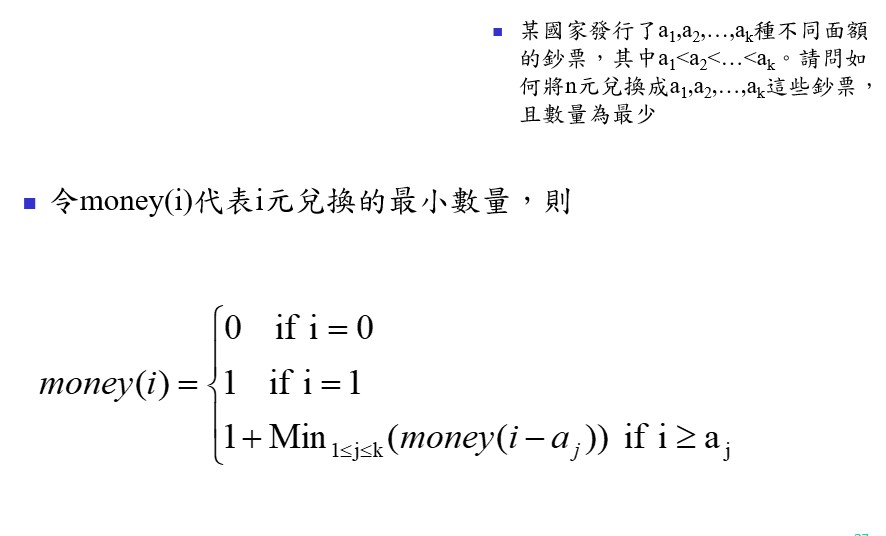
*(c) 請將此程式改為dynamic programming版本*

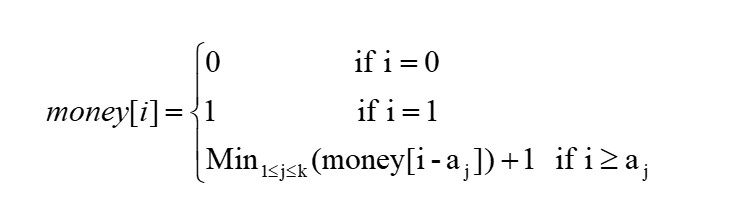
[Online Judge](https://onlinejudge.org/index.php?option=onlinejudge&Itemid=8&page=show_problem&problem=1275)

[Online Judge](https://onlinejudge.org/index.php?option=onlinejudge&Itemid=8&page=show_problem&problem=1346)

*將編號從1至n的n張卡片由小而大排序。你可以選出一張卡片，然後將它移到任意位置(只可插入任意位置，不能交換)。請實作一函式，依據所輸入的卡片順序數列，傳回將這組卡片由小而大排序所需的最少移動次數。例如，若輸入數列為 {1,2,5,3,4,7,6}，那麼可將5插入到4和7之間，使排列變成 {1,2,3,4,5,7,6}，這樣算移動1次。接著再將7移到6之後，就排序完成。因此將原順序為{1,2,5,3,4,7,6}的卡片由小而大排序，至少要移動2次。*

* *前面所定義的LCS並不要求所得出的LCS是由連續的字元所組成，若現在要求LCS是由連續的字元所組成，則你如何修改你的dynamic programming方法? 你的演算法時間複雜度還是O(mn)嗎?*
* *某國家發行了a1,a2,…,ak種不同面額的鈔票，其中a1<a2<…<ak。請問如何將n元兌換成a1,a2,…,ak這些鈔票，且數量為最少*

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[Change-making problem - Wikipedia](https://en.wikipedia.org/wiki/Change-making_problem)

* *There are 3 coins worth 1,2 and 3 dollars. How can we change 6 dollars in these 3 kinds of bills with minimum number.*
* *Find an optimal parenthesization of a matrix-chain product A1\*A2\*A3 by the dynamic programming approach, where the dimensions of the matrices A1,A2, A3 are 20\*2, 2\*30, 30\*12 respectively.*
* *Suppose we wish to multiply four matrices of real numbers A1\*A2\*A3\*A4 where A1 is 20 by 10, A2 is 10 by 40, A3 is 40 by 100, and A4 is 100 by 10. Assume that the multiplication of a p\*q matrix by a q\*r matrix requires pqr operations. Find the optimal order in which to multiply the matrices so as to minimize the total number of operations.*

[Find Minimum Edit Distance in Python - CodeSpeedy](https://www.codespeedy.com/minimum-edit-distance-in-python/)

* *Use dynamic programming approach to find the minimal number of edit steps (insertion, deletion, or replacement) used to change the string A=acbabca to the string B=babcbac  
  (1) How many edit steps are used  
  (2) Describe how those edit steps are applied in changing A to B*

*A=acbabca*

*B=babcbac*

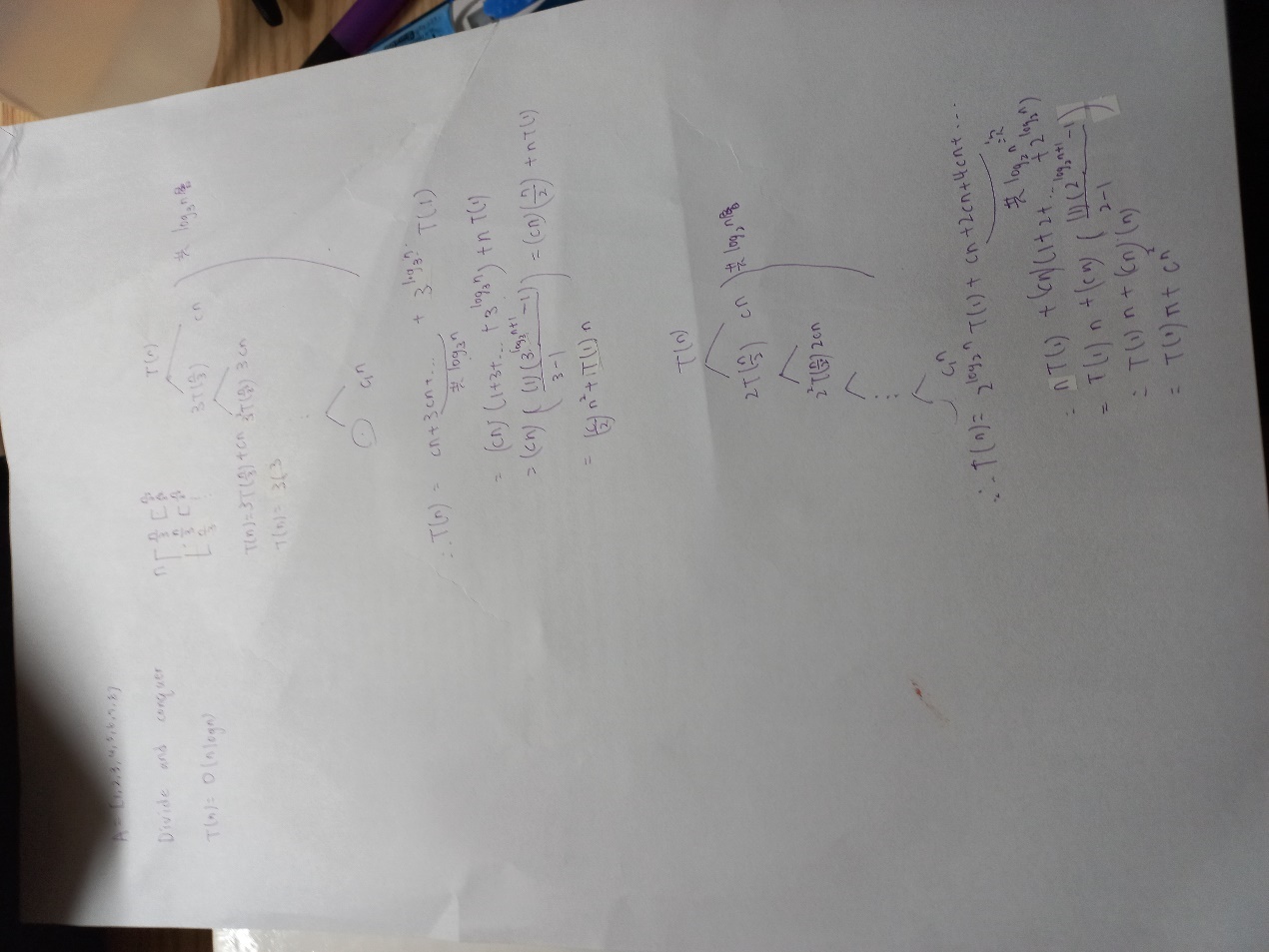
* *使用dynamic programming 方法求出 X=algorithms 與 Y=glorious 的 minimum edit distance*
* *若上例各項operations (insert, delete, update) 之edit distance 成本不同? 則  
  C[i,j]的 recurrence relation有何差異?*
* *將下列的資源分配問題所對應的多階圖畫出來，並且利用dynamic programming求出它的最佳解*

|  |  |  |  |
| --- | --- | --- | --- |
| ***資源***  ***研究計畫*** | ***1*** | ***2*** | ***3*** |
| *1* | *1* | *2* | *7* |
| *2* | *3* | *4* | *6* |
| *3* | *1* | *5* | *7* |

* *若輸入一包含正數與負數的陣列，你如何求出其子陣列的最大和? 而該子陣列必須由陣列中的連續數字構成。*
* *若0/1背包問題有n=5個物件，背包限重 W=18，物件的重量及利益如下表，請以dynamic programming策略求0/1背包問題的答案。*

|  |  |  |
| --- | --- | --- |
| **i** | **bi** | **wi** |
| 1 | 40 | 10 |
| 2 | 20 | 7 |
| 3 | 30 | 5 |
| 4 | 33 | 4 |
| 5 | 32 | 6 |

* *若每次將array等分成三部分，每部分 [n/3]資料量個別sorting 後再做merge工作，則時間複雜度可否改進?*

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* *請分別寫出Quicksort時間複雜度T(n)在best case, worst case 及average case之遞迴關係式*
* *Consider a set of N distinct real numbers. Can it be done in O(n) time to determine two numbers x and y from these N numbers such that |x-y| is maximum? If yes, state the algorithm briefly. If no, state your reason and the best possible algorithm.*
* *在平面上有(5,12),(12,10),(2,9),(5,7),(10,6),(9,4),(6,3),(11,4), (1,3),(6,1) 共10個點，遵循演算法一步一步求出最接近兩點間的距離*
  + *如果已知輸入點都共線，那麼你有更快的方法求出最接近兩點的距離嗎?*
* *考慮下面找出最小展開樹的方法：step1. 將圖形切割成兩部份，對每部份各自遞迴地建出最小展開樹。 step 2. 以最短的邊連接這兩部份。則(a)上述方法屬於演算法的何種策略? (b) Prove or disprove上述方法能正確的找出最小展開樹?*
* *將n個盤子從木樁1搬移到木樁3，盤子最少需搬動幾次?*
* *假設好晶片的數量與壞晶片的數量都一樣是兩顆，則此演算法能找出一顆好晶片嗎?*
* *若晶片數量不是2的整數次冪，或者甚至是奇數時，如何修改此演算法使其同樣可以work?*
* *上述演算法的Step1: Divide S into n/5 subsets，若改成n/ 4 或 n/7 subsets，可行嗎?*
* *Binary search每一次都找中間元素比對，即 middle=(left+right)/2。若我們事先已知要搜尋的資料是偏大的，例如越大的值被搜尋的機率越高，那麼選擇 middle=2\*(left+right)/3 是否會更好?*
* *請找出n個數字中最小的k個數字。例如，輸入包含8個數字的陣列{4,5,1,6,2,7,3,8}時，傳回最小的4個數字1、2、3和4。*
* *假設S與T是兩個含有n個數值，並且已由小到大排序好了的陣列。請設計一個能夠找出所有2n個數值之中位數的演算法，你的演算法的時間複雜度必須是 O(log n)*
* *所謂名人就是大家都認識他，但是他不認識任何人。我們想要在n個人中找出其中的名人，如果没有，则告知其中没有名人。設此n個人彼此認不認識的情況記錄於相鄰矩陣Matrix中(如 i 認識j 則Matrix[i][j]=1；若j不認識i，則Matrix[j][i]=0)，請提出一個演算法找出其中的名人*