Computational Thinking and Problem Solving (COMP1002) and Problem Solving Methodology in Information Technology (COMP1001)

Assignment 3

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Q1.

Input: a currency with coins, and the number of dollars of change.

Set ***currency*** as a list, storing values of each coin in that currency in **descending** order.

Set ***num*** as a list with the same length of ***currency*** list, for storing the number of coins in ***currency*** list need to be used, correspondingly.

Set ***minNum*** to store the minimum number of coins to use, initialized to **infinity**.

Set ***minList*** as a list to store the ***num*** list with minimum sum value.

Set ***totalAmount*** as the amount of dollars of change.

Set ***i*** as 0

Repeat:

  Set ***amount*** as ***totalAmount***

  Reset all elements in ***num*** to 0

  Set ***j*** to ***i***

  Repeat:

    If ***amount*** >= ***currency***[j]:

      Set ***num***[j] to the floored quotient of ***amount*** and ***currency***[j], as the number of this coin needed,

      Set ***amount*** to the remainder of ***amount*** divided by ***currency***[j], get the remaining amount of change

    Add 1 to ***j***

  Until ***j*** > length of ***currency***

  If the sum of numbers in ***num*** list < ***minNum***, and ***amount*** = 0:

    Set ***minNum*** to the sum of elements in ***num*** list

    Set ***minList*** equal to ***num***

  Add 1 to ***i***

Until ***i*** > length of ***currency***

Output:

The minimum number of coins: ***minNum***

The number of each coin need to be used: each element in ***minList*** list, correspondingly.

*(Remark: a single loop of greedy algorithm may not be correct (e.g., $6 to change with currency of $4, $3, $1 coin, may find 1*$4+2*$1, but 2*$3 is the best), therefore use nested loop of greedy algorithm to solve the problem)*

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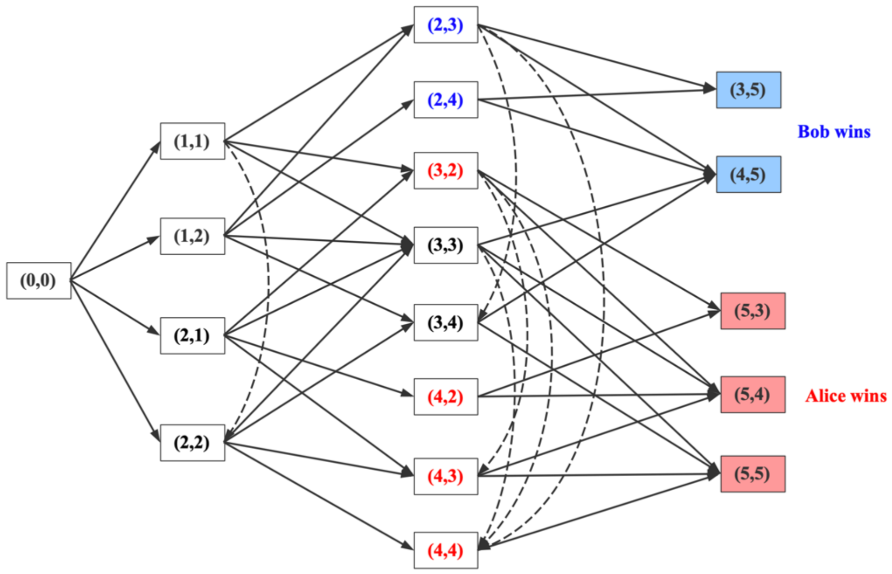
Q2.

a) The "state" of the game is a tuple with two integer ***a***, ***b*** represents the number called by **Alice** and **Bob** in each round (e.g., **(0,0)** for the beginning Alice and Bob holds 0 and 0. (2,1) for Alice and Bob holding 2 and 1 in a round).

$\{(a,b)|a,b \in [0,5], |a-b| \leq 2, a_{i+1} - a_i \in [1,2], b_{i+1} - b_i \in [1,2], a \in Z, b \in Z\}$



b) Yes, Bob can win the game, end at the state **(3,5) and (4,5)**, but with small chance.
Assumptions:
(0,0) →(1,1) →(2,2) →(3,3) →(4,5) Bob wins
(0,0) →(1,1) →(2,2) →(3,4) →(4,5) Bob wins
(0,0) →(1,1) →(2,3) →(3,5) Bob wins
(0,0) →(1,1) →(2,3) →(4,5) Bob wins
(0,0) →(1,1) →(2,3) →(3,4) →(4,5) Bob wins
(0,0) →(1,1) →(3,3) →(4,5) Bob wins
(0,0) →(1,2) →(2,3) →(3,5) Bob wins
(0,0) →(1,2) →(2,3) →(4,5) Bob wins
(0,0) →(1,2) →(2,3) →(3,4) →(4,5) Bob wins
(0,0) →(1,2) →(2,4) →(3,5) Bob wins
(0,0) →(1,2) →(2,4) →(4,5) Bob wins
(0,0) →(1,2) →(3,3) →(4,5) Bob wins
(0,0) →(1,2) →(3,4) →(4,5) Bob wins
(0,0) →(2,1) →(3,3) →(4,5) Bob wins
(0,0) →(2,2) →(3,3) →(4,5) Bob wins
(0,0) →(2,2) →(3,4) →(4,5) Bob wins

Because Alice will always take the first call, so it has more chances that the number called by Alice is greater than Bob's one in each round, which gives Alice more chance to win.