Problem 3

a) COIN-CHANGING-ALGORITHM (x, c1, c2, ..., cn)

SORT coin denominations so that c1 > c2 > .... > Cn

change = []

WHILE (x > 0)

i = 0

FOR j = 1 to n

      IF Cj ≤ x

          i = Cj

 IF (i = 0)

      RETURN "no solution."

 ELSE

      x = x – Ci

      append i to change

RETURN change

b) No, it is not optimal for any set of denominations. Let's look at a counter example.

Suppose the given denominations = { 1, 10, 21, 34, 70, 100, 350, 1225, 1500 }

While x = 140

Then, according to our greedy algorithm approach,

140 – 100 – 34 – 1 – 1 – 1 – 1 – 1 – 1 = 0

So, change = 100, 34, 1, 1, 1, 1, 1, 1

However, optimal approach = 140 – 70 – 70 = 0

So optimal change = 70, 70

Hence, it is possible for greedy algorithm to fail on certain denominations.