CSCI 3104 Fall 2022
Instructor: Prof. Grochow and Chandra Kanth Nagesh

Quiz 2 - Standard 4

Due Date ..... Thursday Sep 22, 8pm MT
Name ..... **Tyler Huynh**
Student ID **109603994**
Quiz Code (enter in Canvas to get access to the LaTeX template) ..... **QWERT**

Contents

Instructions

- You may either type your work using this template, or you may handwrite your work and embed it as an image in this template. **If you choose to handwrite your work, the image must be legible, and oriented so that we do not have to rotate our screens to grade your work.** We have included some helpful LaTeX commands for including and rotating images commented out near the end of the LaTeX template.
- You should submit your work through the **class Gradescope page** only. Please submit one PDF file, compiled using this LaTeX template.
- You may not need a full page for your solutions; pagebreaks are there to help Gradescope automatically find where each problem is. Even if you do not attempt every problem, please submit this document with no fewer pages than the blank template (or Gradescope has issues with it).
- You **may not collaborate with other students**. **Copying from any source is an Honor Code violation. Furthermore, all submissions must be in your own words and reflect your understanding of the material.** If there is any confusion about this policy, it is your responsibility to clarify before the due date.
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Problem HC.

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- Any collaborations and external sources have been clearly cited in this document.
- I have not posted to external services including, but not limited to Chegg, Reddit, StackExchange, etc.
- I have neither copied nor provided others solutions they can copy.

I agree to the above, Tyler Huynh. □

4 Standard 4 - Greedy Counterexamples

Problem 4. Consider the Making Change problem where we have three coins: 2 cent pieces, 5 cent pieces, and 10 cent pieces. We take as input an integer $n \geq 0$. The goal is to make change for n using only these coin denominations, using the fewest total number of coins. Consider a greedy algorithm which selects as many 10 cent pieces as possible, followed by as many 5 cent pieces, then lastly 2 cent pieces.

Give an integer $n \geq 0$ such that (i) the greedy algorithm will not make change for n (even using more coins than necessary), yet (ii) it is possible to make change for n using **at least one of each coin**. For (i), show what choices the greedy algorithm makes before failing. For (ii), list the number of 2-cent, 5-cent, and 10-cent pieces that add up to n.

Tyler Huynh

Quiz 2 S4

Where the greedy algorithm will fail:

i.)

let $n = 31$, such $31 \geq 0$

- Our greedy algorithm will choose the largest coin first that being 10 cents, such that if $n=31$ it would be:

It will fail here after choosing the third 10 cent coin.

$n=31$

$10+10+10+2=32$ } where it fails because we were unable to make exact change, since our greedy algorithm will choose the largest value first

$32 \neq 31$

ii.)

- We can make exact change for $n=31$, such that:

$n=31$

$10+10+5+2+2+2=31$

- This will make exact change because we are able to choose the coins in a way that we can make exact change.

2 - 10 cent coins
1 - 5 cent coin
3 - 2 cent coins

Thus, our greedy algorithm will not make change for n, using the fewest number of coins because in some cases it will not make exact change even though we can use our set of coins to make exact change.

Answer. □