QUIZ 3

CS 198-087: INTRODUCTION TO MATHEMATICAL THINKING
UC BERKELEY EECS
SPRING 2019

This quiz is open-book and open-note, but no collaboration is allowed.

Note: There are 24 possible points on the quiz, but the quiz will be scored out of 20.

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1. *Existence of Inverses (Points: 2 + 3 = 5)*
   a. Does 5 have an inverse in mod 10? Why or why not?
   b. Determine the number of solutions to $5x \equiv 5 \pmod{10}$. *(Hint: Since we're working in mod* 10*, the maximum number of solutions is 10.)*
2. *Modular Arithmetic Mechanics (Points: 5 + 5 = 10)*

   In both parts, you will need to show all of your work in order to receive credit. Solutions that just state the answer will not receive any credit.
   a. Determine $14^{93} \pmod{73}$.
   b. Determine $14^{-1} \pmod{73}$.
3. *Functions in Modular Arithmetic (Points: 3 + 3 + 3 = 9)*

   Recall, Z_n refers to the set of integers modulo n. In each each of the following, assume that we take mod n after the operation, if Z_n is the codomain of the function.
   a. Is $f(x) = 7x$ a bijection from Z_{12} to Z_{12}? Justify your answer.
   b. Is $f(x) = 6x$ a bijection from Z_{12} to Z_{24}? Justify your answer.
   c. Does there exist an surjection from Z_{12} to Z_{24}? If so, identify one. If not, explain why.