10/6/2025 Fall 2025, Discrete Structures I Quiz 4 v2 Sitaraman

Howard University Math Department

Instructions:

PLEASE PROVIDE STEP BY STEP EXPLANATIONS

WRITING ONLY ANSWERS WILL NOT GET FULL CREDIT

Time Limit 30 minutes

Please read the questions carefully before answering

1. (15 points) Use strong induction to prove that postage of 2 cents or more can be obtained by using only 2 cent and 3 cent stamps. (This is easy to do without strong induction, but the idea is to learn how to use strong induction. No credit for doing it without strong induction)

2. (15 points) Show using strong induction that for any natural number $n \geq 4$, the Fibonacci numbers defined by $F_1 = 1, F_2 = 1, F_3 = 2, F_4 = 3, F_5 = 5, F_6 = 8, ..., F_n = F_{n-1} + F_{n-2}$ satisfy
$$F_n < \left(\frac{7}{4}\right)^{n-2}.$$
Note that it *doesn't* work for n up to 3. For example, $(7/4)^{3-2} = 1.75$ but $F_3 = 2$.

3. (Extra credit 15 points) Prove : For any natural number $n \geq 24$ you can find positive integers x, y such that $n = 5x + 7y$.