

**COT 3100 Homework #3: Functions, Sequences, Sums, Matrices**  
**Due Date/Time: Friday, January 31<sup>st</sup>, 2014 in recitation**

1) An example of a function that maps UCF students to the set of positive integers is  $f(x) =$  the number of UCF courses student  $x$  has taken. Come up with a separate idea of a function from everyday life and list a table with five inputs to the function and their five corresponding outputs.

2) Prove that the function  $f(n) = 2n$  with the domain  $n \in \mathbb{Z}$  is a one-to-one (injective) function, but not an onto (surjective) function.

3) Let  $f(x) = x^2 - 6x + 4$  for all real  $x \geq 3$ . Determine  $f^{-1}(x)$ . What is the range of  $f(x)$  and the domain of  $f^{-1}(x)$ ? Also, show that if we allowed the domain to be all real values of  $x$ , the function  $f$  would not be invertible.

4) Let  $f(x) = (2x + 3)^2$  and let  $g(x) = e^x$ . Determine the functions  $f(g(x))$  and  $g(f(x))$ .

5) What is the sum of the arithmetic sequence with first term 7, common difference 4 and 40 terms?

6) What is the sum of the geometric sequence with the first term 3, common ratio of 2 with 20 terms?

7) What is the sum of the infinite geometric sequence with first term 6 and common ratio  $\frac{1}{3}$ ?

8) Determine the following sum in terms of  $n$ :  $\sum_{i=1}^{2n-1} (3i^2 + 2)$ .

9) Determine the following matrix product:  $\begin{bmatrix} 2 & 6 \\ -3 & 4 \\ 5 & -1 \end{bmatrix} \begin{bmatrix} -6 & 5 & -1 \\ -2 & 4 & 7 \end{bmatrix}$ .

10) Rewrite the following system of equations as a matrix equation:

$$\begin{aligned} 3x + 4y - z &= 15 \\ 2x - 5y + 4z &= 41 \\ x + 2y - 6z &= -24 \end{aligned}$$