**Foundations of Discrete Mathematics**
**COT 2104**

**Practice 5**

1. Determine whether or not each of the following relations is a function with domain {a, b, c, d}. For any relation that is not a function, explain why it isn't.

   a) f = {(a, b), (a, c), (d, c)}
   b) f = {(b, a), (b, b), (b, c), (b, d)}
   c) f = {(d, a), (c, b), (a, d), (b, c)}

2. Determine whether each relation is a function. Identify the domain and the range.

   a) {(2,10), (3,15), (4,20)}
   b) {(-7,3),(-2,1),(-2,4),(0,7)}
   c) {(-2,1), (0,1), (2,1), (4,1),(-3,1)}

3. Find the inverse of the following relations

   a) {(1, 2), (2, 4), (3, 3), (4, 1)}
   b) {(7,8),(-2,8),(3,-4),(8,-8)}
   c) {(-1,3),(2,5),(-3,5),(2,0)}

4. Determine whether it is one-to-one, find a formula for the inverse

   a) $f(x) = x + 4$
   b) $f(x) = x^3 - 1$
   c) $f(x) = 4 / (x + 7)$

5. Give an example of a function $N \rightarrow N$ which is

   a) Onto but not one-to-one.
   b) Neither one-to-one nor onto.
   c) Both one-to-one and onto

6. Show that the following functions $f: A \rightarrow R$ is one-to-one. Find the range and the suitable inverse

   a) $A = \{x \in R \mid x \neq -1/2\}$, $f(x) = 3x / (2x + 1)$
   b) $A = \{x \in R \mid x \neq -3\}$, $f(x) = (x - 3) / (x + 3)$

7. Let f = {(1,3), (2, 2), (3, 4) , (4, 1) and g = {(1, 4), (2, 3), (3, 1), (4, 2)}.

   a) Find $g^{-1}$ and $f \circ g^{-1}$. Is g one-to-one? Explain.
   b) Find $g \circ f$. Is $g \circ f$ one-to-one? Explain