Name (PRINTED): ____________________

Student ID #: ____________________

Section # (or TA's: name and time) ____________________

CMSC 250 Quiz #13 ANSWERS Wed., April 28, 2004

Write all answers legibly in the space provided. The number of points possible for each question is indicated in square brackets – the total number of points on the quiz is 30, and you will have exactly 15 minutes to complete this quiz. You may not use calculators, textbooks or any other aids during this quiz.

1. [18 pnts.] Answer each of the following by writing either the word "Yes" or the word "NO" into the blank provided.

   Determine if the following functions are one-to-one.

   a. __________NO __________ $f : Z \to Z$ defined as $\forall n \in Z, f(n) = 3n^2 - 1$
   b. __________NO __________ $g : R \to Z$ defined as $\forall n \in R, g(n) = \lceil n + 5 \rceil$
   c. __________NO __________ $h : D \to C$ where D = $\{1, 3, 5, 7\}$ and C = $\{2, 4, 6, 8\}$ defined as $h = \{(1, 2), (3, 4), (5, 2), (7, 8)\}$

   Determine if the following functions are onto.

   a. __________NO __________ $f : Z \to Z$ defined as $\forall n \in Z, f(n) = 3n^3 + 2$
   b. __________YES __________ $g : R \to Z$ defined as $\forall n \in R, g(n) = \lceil n - 1 \rceil$
   c. __________YES __________ $h : D \to C$ where D = $\{1, 3, 5, 7\}$ and C = $\{2, 4, 8\}$ defined as $h = \{(1, 2), (3, 4), (5, 8), (7, 8)\}$

2. [12 pnts.] For each of the following prove that it has the property indicated or give a specific counter example to show that it doesn't have the property indicated.

   a. Is $f : R \to R$ where $f(x) = -3x^2 + 4$ onto?
   This funciton is not onto because there is no way to reach the elements in the co-domain that are greater than 4.
   The value of 0 for x gives the value 4, but if we go higher than 0 or lower than 0 as the value for x, the value for y goes down because the x is squared and so will be positive, but the positive value is multiplied by -3.

   b. Is $f : R^+ \to R^+$ where $f(x) = -3x^2 + 4$ one-to-one?
   This can't be one-to-one because this isn't even a total function.
   There are values for the domain whose image is outside of the codomain.
   For example if we use 2 (which is in the domain because it is in R^+), the image of 2 is $y = f(2) = -3(2)^2 + 4 = -3(4) + 4 = -12 * 4 = -8$.
   The problem is that -8 is not in the codomain.