Name (PRINTED): ______________________

Student ID #: ______________________

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

CMSC 250 Quiz #13 Wed., Nov. 24, 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 onto.

   a. __________NO __________ $f: Z \to Z$ defined as $\forall n \in Z, f(n) = 3n^2 - 1$

   b. __________YES __________ $g: R \to Z$ defined as $\forall n \in R, g(n) = \lfloor 2n + 5 \rfloor$

   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 one-to-one.

   a. __________YES __________ $f: Z \to Z$ defined as $\forall n \in Z, f(n) = 3n^3 + 2$

   b. __________NO __________ $g: R \to Z$ defined as $\forall n \in R, g(n) = \lceil 2n - 1 \rceil$

   c. __________NO __________ $h: D \to C$ 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 do one of the following:

- explain why it is not a total function at all (so we can't look at the property indicated)
- or give a complete proof that the function given has the property indicated
- or give a specific counter example to prove that the function given does not have the property indicated (along with enough algebra to justify it as a valid counter example)

a. Is $f : Z \to Z$ where $f(x) = x + 200$ onto?
ANSWER: This function does have the property indicated.
Proof:
Let y be arbitrary in Z.
Select x to be $y - 200$.
$x \in Z$ by closure of Z in subtraction.
$f(x) = f(y - 200)$ by substitution
$= (y - 200) + 200$ by substitution
$= y$ by algebra
$\exists x \in Z f(x) = y$ by existential generalization
$\forall y \in Z, \exists x \in Z, f(x) = y$ by generalizing from the Generic Particular.

b. Is $f : R^+ \to R^+$ where $f(x) = -3x + 5$ one-to-one?
ANSWER: This is not a "Total Function" because not all elements of the domain map to one and only one value in the co-domain. The value 2 can be used to show a counter example. 2 is both real and positive so it is a member of R^+. The problem is that $f(2) = -3(2)+5 = -6+5 = -1$, and $-1 \notin R^+$.