MAT 2440 - Prof. Ghezzi
Review Problems for Exam 2

NAME: _____

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1. For Algorithms (Section 3.1) see problems 1-4 in Assignment 2 (maximum, linear search, binary search, bubble sort, insertion sort).

2. Let $f : \{a, b, c, d\} \to \{a, b, c, d\}$, $f(a) = b$, $f(b) = a$, $f(c) = d$, $f(d) = b$.

   a) Is f one to one? Justify your answer.

   b) Is f onto? Justify your answer.

3. Let $f : \mathbf{Z} \to \mathbf{Z}$, $f(n) = 4n$. (Recall that $\mathbf{Z}$ denotes the integers).

   a) Is f one to one? Justify your answer.

   b) Is f onto? Justify your answer.

4. Let $f : \mathbf{R} \to \mathbf{R}$, $f(x) = 4x$. (Recall that $\mathbf{R}$ denotes the real numbers).

   a) Is f one to one? Justify your answer.

   b) Is f onto? Justify your answer.

5. Let $f : \mathbf{Z} \times \mathbf{Z} \to \mathbf{Z}$, $f(m, n) = m^2 + n^2$.

   a) Is f one to one? Justify your answer.

   b) Is f onto? Justify your answer.

6. Compute the terms a_1, a_2, a_3, a_4, where $a_n = 2^n + (-2)^n$.

7. Compute each of the following.

   a) $\lceil -\frac{1}{3} \rceil$;

   b) $\lfloor -\frac{1}{3} \rfloor$;

   c) $\sum_{n=2}^{4} (-3)^n$;

   d) $\sum_{i=0}^{2} \sum_{j=0}^{3} (2i + 3j)$.

8. Determine whether each of these integers is congruent to 4 modulo 11. Justify your answer.

   a) 59; b) 51; c) -59, d) -51; e) 4.

9. a) Evaluate 144 **mod** 7.

   b) Evaluate (-94 **mod** 5) **mod** 3.

10. Let n be an integer. Show that if n is a multiple of 3, then $n^3 + 45$ is a multiple of 9.