CS4104 Fall 2010 Homework Assignment 4
Due at 11:00pm on Wednesday, September 22
50 Points
Corrected 9/20/2010

Pledge: I (we) have not received unauthorized aid on this assignment. I (we) understand the answers that I (we) have submitted. The answers submitted have not been directly copied from another source, but instead are written in my (our) own words.

1. [25 points]

(a) Use induction to show that $n^2 - n$ is always even.

(b) Find a one-line proof of the same result.

(c) Show that $n^3 - n$ is always divisible by three.

(d) Is $n^5 - n$ aways divisible by 5? Prove your answer.

2. [25 points] Consider a variation on linear search in an unordered array that first checks the middle position of the array. If the element in this position is not equal to the search key, then linear search is called recursively on the lower half (not including the middle position) and the upper half (not including the middle position).

(a) Write a recursive algorithm to implement this version of linear search. Be careful get the computation for the middle element correct, and to pass the bounds correctly on the recursive calls!

(b) Show the recurrence relation for the number of comparisons performed by the algorithm in the worst case. Be sure to show the EXACT values for the size of the subproblems in the recurrence (they are NOT quite $\frac{n}{2}$). You may *not* assume that n is a power of two, nor make any other such convenient restriction on n for analysis purposes.

(c) Using your choice of either **substitute and guess** or **guess and test**, find a candidate closed form solution for the recurrence you gave in part (b).

(d) Use induction to prove that your candidate from part (c) is correct.