CS302 - Assignment 11

Due: Thursday, April 5 at the beginning of class
Hand-in method: paper

http://www.smbc-comics.com/index.php?db=comics&id=2217

1. **[3 points]** Show the result of inserting 5, 28, 19, 15, 20, 33, 12, 17, 10 into a hashtable with collision resolution by chaining. The table should have 9 slots and use $h(k) = kmod9$ for the hash function.

2. **[3 points]** Now, show the result of inserting the first 6 of these into another hashtable using open addressing and linear probing. For these inserted entries, what was the largest number of entries you had to search before finding an open slot?

3. **[3 points]** In class we mentioned a greedy approach for solving the fractional knapsack problem:

   - sort the items by v_i/w_i (that is the value per weight)
   - pick as much of highest item as possible until either weight limit is reached or you take the whole item
   - continue taking the as much of the next highest item, etc. until the weight limit is reached

   Prove that this algorithm is correct, that is it gives us the optimal answer. You can either to a "stays ahead" proof or a proof by contradiction.

4. **[2 points]** For the 0-1 knapsack problem one attempt at a greedy solution is to try the same approach above, sorting the items based on v_i/w_i, then adding the items to the bag in order until the weight limit is reached. Give a counterexample where this greedy approach fails to obtain the optimal solution.

5. **[7 points]** Given a set of points $x_1, x_2, ..., x_n$ on the real line, describe a greedy algorithm that determines the smallest set of unit-length closed intervals that contains all of the given points. State the worst case running time and prove that your algorithm is correct. You do not need write pseudo-code, but make you description