CS302 - Assignment 11

Due: Thursday, April 4 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 $h(k) = k \bmod 9$ 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. **[13 points]** A thief robbing a bulk food store finds n items worth $v_1, v_2, ..., v_n$ dollars and weigh $w_1, w_2, , w_n$ pounds, where v_i and w_i are integers. The thief can carry at most W pounds in the knapsack. Because it's a bulk food store, the thief may take all of an item *or* only some fraction of any item (e.g. half of item i, getting value $v_i/2$ with weight $w_i/2$). The goal of the thief is to select the items so as to maximize the profit while staying under the weight constraint.

   (a) **[5 points]** Describe an optimal greedy heuristic and a high-level algorithm for selecting which items (and how much) to select. You don't need to state the low-level details of the algorithm, just how you will construct your solution.

   (b) **[5 points]** Prove that your algorithm is correct. You may either use a "stays ahead" proof or a proof by contradiction.

   (c) **[3 points]** State your algorithm more precisely and, based on this, state what the running time of your algorithm will be in terms of n the number of items.