22C:44 Homework 6

Due by 5pm on Tuesday, 4/17

Each problem is worth 10 points.

1. Problems 12.3-4 (page 232) and 12.4-1 (page 240).

2. Consider the hash function
$$h(k, i) = (k \bmod m + c \cdot i) \bmod m$$
where c is some positive integer. Suppose that we want to use this hash function for open addressing. Characterize values of c that will make the probe sequence
$$h(k, 0), h(k, 1), \ldots, h(k, m-1)$$
a permutation? Your friend claims that for an appropriately chosen c this hash function is better than linear probing. What do you think?

3. Problem 12-4 on Page 242.

4. Problem 17-1 (b) on Page 353 with $c = 2$.
Hint: Mimic the proof of correctness you saw in class when the denominations were quarters, dimes, nickels, and pennies. In particular, let $\{c_1, c_2, \ldots, c_N\}$ be greedy change and let $\{f_1, f_2, \ldots, f_M\}$ be optimal change, with $M < N$. Here $c_1 \geq c_2 \geq \cdots \geq c_N$ and $d_1 \geq d_2 \geq \cdots \geq d_N$. Consider i such that $c_j = f_j$ for all $j < i$, and $c_i > f_i$. It is possible to obtain a contradiction by showing that $(f_i + f_{i+1} + \cdots + f_M) < c_i$.

5. Determine if the following "greedy" algorithm is correct for the activity selection problem. Prove your claim. Here `A` is the given set of activities (intervals).

```
GreedyActivitySelection(A){
        S ← ∅;
        while (A ≠ ∅) do {
                a ← interval that is compatible with most intervals in A;
                S ← S ∪ {a};
                Remove from A all intervals incompatible with a;
        }
        return S;
}
```
