CS 280 FALL 2001
Homework 5 Grading Guide

Section 3.1

8) a) 1 point. Almost everybody got this one correct.

8) c and e) 2 points each. Errors:
Letting your Boolean variables take on non-boolean meanings. For example, p = is insect, q = is spider. Those are not Boolean values.
Insects, spiders, food, tofu, and cheeseburgers should be sets.

16) a) 1 point – almost everyone had this correct.
16) b) 2 points – almost nobody got this correct.
First off, many people did not see that you needed to prove n^2 is odd $\rightarrow$ n is odd.
For those that saw this: you cannot let $n^2 = (2k+1)^2$. Neither can you let $n^2 = 2k+1$ and then let $k = 2m+1$. This is the same error as letting $n^2 = (2k+1)^2$. Nor can you use any other such trickery to get n^2 in the form of an odd number squared (except for a proof of course).
16) c) 2 points – almost everybody had this correct. Some people used their incorrect answer to part b as reasoning, but we didn't take off points for that. Just be careful next time!

30) 5 points. 1 point if you had all the cases, and 1 point for each case (if you had different cases, then the points were distributed accordingly). Most people had this question correct. There were a few proofs by example. If you had this, see the professor or go to office hours.

32) 5 points. 2 for the even case, 3 for the odd case. Strangely enough, the most common error was that people thought the floor and ceiling were brackets. That cost 3 points total.
Also, you cannot assume the conclusion and derive something true. It is not a valid method of proof. For example, in the n is even case, you cannot assume that
$\lfloor n/2 \rfloor \lceil n/2 \rceil = \lfloor n/4 \rfloor$ and using that derive that $k^2 = k^2$, where $n = 2k$.

Section 3.2

Problem 3.2.4 (5 points) 1 point for showing the base case, 1 point for stating the induction hypothesis, 3 points for the induction step.

Problem 3.2.28 (5 points) 2 points for showing the base case (this includes mentioning that n=2,3 do not work), 1 point for stating the induction hypothesis, 2 points for the induction step. 1 point deducted if you assume $2n+1<n*n!$ or for other assumptions besides the IH in the IS.

Problem 3.2.32 (5 points) 1 point for showing the base case (this includes mentioning that 5 and 15 cents cannot be formed), 1 point for stating the induction hypothesis, 3 points for the induction step. 1

point deducted if you mention removing a quarter and adding three dimes and not the other case (removing two dimes and adding a quarter) and vice-versa.

Problem 3.2.40 (5 points) 1 point for showing the base case, 1 point for stating the induction hypothesis, 3 points for the induction step.

Sections 3.3,3.4

Sec 3.3 (20 marks)

4) Each part is worth 1 mark, if fully correct.
You get 1/2 if at least 2 out of 4 correct.

18) 5 marks for the 2 algorithms, 2.5 each.
Base case is worth 1 mark, recursive formula is worth 1.5 marks.

Common mistake:
Wrong base case.
Max(a) should return a. A lot of people did not handle the case where we only need to find the max and min of one element.

22) 2 marks for each part, 6 marks in total.
Comments:
We accepted alternative answers such as $p(n+1) = a_n x^{n+1} + p(n)$, p(n) denotes polynomial of degree n.

40) 5 marks. Credit was given to all steps of working shown even if the final answer was incorrect.

Sec 3.4 (10 marks)

6 & 22) 5 marks each
2 marks for base case
3 marks for recursive definition

Comments:
Although strictly speaking, the algorithm should compute remainder of x^n mod m where the remainder is less than m, we accepted answers such as (x mod m) * (powermod(x,n-1,m)) which will not always give us an answer < m.
Some people did it by reducing x^n mod m by m each time. The problem with this is that the algorithm will take an extremely long time to run. Imagine reducing 2^{1000} by 5 each time! Furthermore, there are also problems such as overflow, for example, the program cannot handle powers of x if n is too large.