Marking Scheme CSC236, Summer 2005, Assignment 2

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All four questions have equal weight. Your mark, out of 100, can be expressed as:

$$Q1 \times 5 + Q2 + rac{Q3 \times 25}{18} + rac{Q4 \times 25}{19}$$

Here are the markers' schemes for each question, plus some comments.

- 1. (5 marks total) Since a proof was required, 3 marks for the proof structure and 2 for getting the details right is my rule of thumb, though the delineation between the two is sometimes fuzzy. Some people received only 1.5-2 marks since they came up with a formula but did not prove it correct.
- 2. (25 marks total)
 - (a) (10 marks for this part) 2 marks for coming up with the property to prove, 4 marks for inductive proof of this property (1 for basis, 1 for each case in the induction step). 1 mark for relating 3^k + 1 to the property above. 2 marks for proving something about 3^k + 1 to contradict things. 1 mark for concluding statement.
 - (b) (7 marks for this part) 2 marks for coming up with the property to prove, 4 marks for inductive proof of this property (as in part(a)). 1 mark for concluding statement.
 - (c) (8 marks for this part) Same as part (b) except 2 marks for the concluding statement, since showing that 97 is not a multiple of 3 is not as obvious as 2^{k+1} being even.

Most did well on this question. A few people lost a mark here and there for not properly justifying their contradiction, e.g. just stating that 97 not divisible by 3 without giving any reason. I wasn't expecting much, just a line or two.

- 3. (18 marks total)
 - (a) (6 marks) if you justified the closed form via the fibonnaci sequence, it was sufficient to simply note the correspondence intelligibly and get the correct closed form to get all the marks. If you found the closed form directly, this part was marked the same as part c.
 - (b) (6 marks) Here you were asked for justification explicitly, so something resembling a proof (or at least "argument") was required for full marks. Coming up with the right recurrence with no justification was worth 1.5, you could earn more if you explained it informally; you could earn as much as 4 if your explanation contained the important points that would appear in a proof. If you proved your claim you got around 4/6 for having the right structure (e.g. enumerating the cases corresponding to each term in the recurrence relation) and full marks if the details were right (e.g. exhaustive and disjoint cases, remembering to mention the base case).

(c) (6 marks) The closed form by itself was worth about 1.5 (little more than a blank paper). For full marks you had to EITHER show how you applied the magical polynomial-solving method, OR pull the closed form out of a hat and prove that it worked. (There was no penalty for doing both).

As always, I reserve the right to subtract marks for highly irrelevant and/or incorrect statements even if all elements necessary for full marks are present. A good example of this is where people had a perfectly good intuitive justification for their recurrence relation in part b) ("almost" a proof on its own) but then gave a "proof" of some irrelevant equation.

4. (19 marks total)

- (a) (out of 3). One mark for each line in the derivation
- (b) (out of 3). One mark for each line in the derivation.
- (c) (out of 5). 1 mark for basis. 0.5 marks each for IH and concluding statement. 3 marks for induction step.
- (d) (out of 3). One mark for each line in the derivation.
- (e) (out of 5). One mark for each line in the derivation.

On the whole this question was reasonably well done, at least by those that attempted it. Many said I didn't know for all or some of the parts. When people lost marks it was usually because of an algebra mistake - mainly in misapplying previous results. A common mistake in (c) was to use a basis of n = 1 instead of n = 0.