CSC236, Summer 2004, Assignment 4, marking scheme

Questions were marked out of various totals, and then scaled to be worth 15 marks each. The numbers appearing on the front of your assignment represent the original totals. Question 5 was not marked. I shifted all assignments up by 13 marks (which brought the highest mark to 75/75), which I believe was fair, since this was a long assignment.

1. This question was marked out of 15, each part was worth 3. Here are some common errors:

   C1: Needs to add $\exists x Prime(x)$ for part (a). Needs to add $\exists x \neg Prime(x)$ for part (b).

   C2: Use parentheses to indicate scope of quantifiers

   C3: You can't define new predicates, although you can introduce abbreviations

2. This question was marked out of 12, each part was worth 3. Here are some common errors

   - In part (b), does not mention that they are assuming that $\forall x F$ is equivalent to F, if F doesn't contain variable x. -1 mark
   - In part (b), messes up two xs and two ys. -2 marks.
   - In part (b) incorrectly changes $\forall$ to $\exists$ -1 or -2 marks.
   - In part (c), incorrectly says the formula is valid
   - In part (d), arrives at correct conclusion using invalid factoring of quantifiers. -2 marks.

3. This question was marked out of 10, as follows

   1 MARK: Stating an appropriate loop invariant.

   3 MARKS: Proving the loop invariant.

   2 MARKS: Proving partial correctness.

   1 MARK: Defining a sequence in $\mathbf{N}$.

   1 MARK: Proving the sequence is in $\mathbb{N}$.

   2 MARKS: Proving the sequence is decreasing, using PWO.

4. This question was marked out of 10, 8 of which was for the basic proof structure and the remaining two for crucial details.

   BASE CASE: Two marks for stating the base claim and showing that it holds (call returns if $n == 1$).

   FIRST RECURSIVE CALL: If $n > 1$, two marks for showing that the preconditions for $P(n-1)$ hold, so the first recursive call returns with correct postcondition.

   SECOND RECURSIVE CALL: Two marks for showing that the second recursive call returns with correct postcondition.

   THIRD RECURSIVE CALL: Two marks for showing that the third recursive call returns with correct postcondition.

5. Not graded (no student indicated this as their preferred question).

6. This question was graded out of 15.

   2 MARKS: State and verify basis.

   3 MARKS: Use complete induction on b.

   5 MARKS: Prove that `result[0]` is the GCD of a and b.

   5 MARKS: Prove that $\texttt{result[0]} = \texttt{result[1]} \times a + \texttt{result[2]} \times b$.