UG Exam Performance Feedback
First Year
2013/2014 Semester 1

Comments
Section A: please see the attached.

Section B: Students performed fairly well in Q3 and Q4.
Some found the proofs for Q4 difficult.
This question was where most students lost marks.

COMP11120 Mathematical Techniques for Computer Science
Andrea Schalk
Saralees Nadarajah

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First some general remarks. 199 students sat the exam. The median mark was 36 out of 60 (or 60%), and the average 36.5 (61%). Thirty-two students had a failing mark. Twelve students had a mark below 15 (which is below 30%), with a lowest mark of 1. On the top end, seventy-eight students achieved first class marks with a top mark of 60, which is 100%.

Looking at the distribution among questions, 152 students answered Question 1, 108 Question 2, 182 Question 3 and 155 Question 4.

Statistical analysis of individual questions:

**Question 1.** This had an average mark of 11.5 (57.5%), with 31 students on a failing and 53 students on a first class mark.

**Question 2.** This had an average mark of 12.4 (62%), with 21 students on a failing and 51 students on a first class mark.

**Question 3.** This had an average of 14.5 (72.5%), with 28 students on a failing, and 105 on a first class mark (64 students achieved full marks on this question).

**Question 4.** This had an average of 10 (50%), with 58 students on a failing, and 44 students on a first class mark.

The following only concerns Questions from Section A.

**Question 1.** Overall this question was reasonably well answered, but there were a large number of students with very low marks (11 students had a mark of four or lower). Five students managed full marks.

a) The given function is both injective and surjective, and so bijective. One may either prove these properties separately, or provide an inverse function. Three marks were available for giving the correct properties, and three marks for a proof. The most common reason students with otherwise competent answers lost marks was that they divided by a complex number (division has not been defined as an operation for complex numbers!), which surprised me a bit since this was pointed out as an issue in the test.

b) This was well answered by and large. The main reason students lost marks were making a statement that wasn’t precise enough in the first part (‘the order doesn’t matter’). The best way of answering this is to state the property from the notes, but I was reasonably generous. For the second part, students should have not just named an operation, but also the set it operates on, but again I was generous with this.

c) The given operation is neither commutative nor associative. Two marks were awarded for stating this correctly, one for showing the first, and two for the second. What is required here is a concrete counter example. Many students carried out calculations to a point and then stopped by saying that ‘clearly’ the results weren’t the same. Not only is a counter example more convincing, but it’s also quite easy to find these. The simplest counter examples are made up from numbers with only a real, or only a complex, part, and the resulting calculations then become quite easy.

d) This is bookwork. I required the definition from the notes for the first part. An example for the second part is the set of integers, which appears in the notes with a suitable injection into \( \mathbb{N} \). Other correct answers were
given. Some students were giving \( \mathbb{R} \) or \( \mathbb{C} \) here—these sets are uncountable. I was fairly generous on the proof that the given function is an injection from the chosen set to \( \mathbb{N} \), but the set and the function had to be correct.

**Question 2.** By and large the quality of answers for this question was good. Eight students has a mark of four or lower, three students got full marks.

a) A few students were confused when applying the rule for removing the implication symbol, and the next big hurdle was the application of the correct distributivity law. In the simplest form, the CNF for the given proposition consists of four pairs of propositional variables with a \( \vee \) between each pair.

The given proposition is no tautology. As a proof I required a valuation which gives an interpretation of 0. Saying ‘it does not simplify to \( \top \)’ was not sufficient. The resulting proposition is satisfiable, and as a proof I required a valuation which gives it the interpretation 1. Students who made a mistake in their simplification could still get marks for answering the two questions correctly, but usually any valuations they offered did not work for the original proposition.

b) Many students were confused about \( D(x, y) \) and switched the order of the arguments. The answer to the part is \( \forall x. D(1, x) \). If this is the only mistake students made in this part they still received full marks. Some students had problems picking appropriate connectives. Part (iv) was the one most frequently answered incorrectly: The existential quantifier needs to be with the equality statement, and can’t appear in front of the part about divisibility.

The next three parts were well answered, and very few made mistakes with the last two of these. Those who had the order mixed up for the divisibility predicate might have made a mistake in the last part. The first part caused confusion regarding 0: This number is divisible by every natural number other than 0. Also, we cannot use \( y = x \) as a witness for the given statement because 0 does not divide 0.