UG Exam Performance Feedback
First Year
2016/2017 Semester 2

COMP11212 Fundamentals of Computation

Sean Bechhofer
Giles Reger

Comments See the attached report.

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Sean Bechhofer
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General Remarks

There were 237 students who sat the exam. The exam was marked out of 60, with the mean mark 34.4 (57%).

Table 1 below gives an overview of the performance across questions.

	Marks	
Question	Mean	%
Q1	6.2 (8)	78
Q2	4.8 (6)	81
Q3	0.7 (4)	17
Q4	4.4 (5)	89
Q5	4.7 (7)	67
Q6	4.5 (10)	45
Q7	2.4 (4)	60
Q8	2.8 (7)	40
Q9	3.9 (9)	43

Table 1: Performance breakdown

Section A

Question 1

The overall performance on Question 1 was good, with a mean of 6.2 (78%) and median score of 8 (100%).

In general, most answers were consistent and correct. A common error was to interpret clause b(ii) of the description of the language as requiring *bb* to occur in the word, rather than there being two *b*s somewhere in the word. Where this happened, if later answers were consistent, the marking was lenient.

Question 2

The overall performance on Question 2 was good, with a mean of 4.8 (81%) and median score of 6 (100%).

The most common error here was providing an automaton that accepted words of the form a^*bc^*, e.g. *aabcc*. If working was shown, then a small penalty was applied. If the DFA had simply been drawn with no working, then a larger penalty was applied.

Question 3

This question was the least well answered for Section A, with a mean of 0.7 (17%) and median score of 0 (0%).

This question was in general answered poorly. Many answers simply claimed distributivity and applied a circular argument to give "proof". Another common error was to make an argument based on the distributive law as applied to set intersection and union (which is not so relevant here). Answers which did receive credit were in general those which used the definitions of matching and reasoning by cases.

Question 4

The overall performance on Question 4 was good, with a mean of 4.4 (89%) and median score of 5 (100%).

Most students correctly identified that merging the two accepting states would provide an equivalent automaton, and that providing a simulation between the two automata was sufficient to demonstrate equivalence.

Question 5

The overall performance on Question 5 was fair, with a mean of 4.7 (67%) and median score of 5 (71%).

Parts a) and b) were answered well here, although many answers to b) described the language as having an a and a b, without explicitly saying that an a had to appear before a b. Part c) was less well answered, with answers failing to provide a correct grammar, or providing a grammar which was ambiguous. Many correct answers went via a DFA and the the algorithm for converting a DFA to a grammar (which ensures non-ambiguity).

Section B

Question 6

Question 6 had a mean mark of 4.5 (45%) with a standard deviation of 2.6. The median mark was 4.

This question tested key concepts that were highlighted strongly in lectures. There was a clear divide between those who recalled the standard answers and those who did not. There were also common mistakes as highlighted below:

a) Many students argued that $\mathsf{Int32} \to \mathsf{Int32}$ is a subset of $\mathbb{N} \to \mathbb{N}$ and therefore the former set must contain some uncomputable functions present in the latter set, but the argument does not work in this direction. Another mistake was to argue that functions on numbers not fitting into 32-bit integers could not be computed, but such functions do not belong to the given type.

b) This question was about problems we know can halt e.g. those without loops. A common mistake was to discuss the lack of a general halting tester.

c) Many students got the first part of this question correct. The second part was less successfully answered.

d) This question tested understanding of the definition of partial correctness. A common mistake was to misunderstand the meaning of *true* and *false* here, or to forget that partial correctness is restricted to terminating programs.

e) One mistake here was a misunderstanding of the notion of space complexity. Another mistake was to argue by specific example when the question was about general definitions.

Question 7

Question 7 had a mean mark of 2.42 (60.7%) with a standard deviation of 1.2. The median mark was 2.

For part (a) a common mistake was to put $n \log n$ as less complex than $100n$ and to place 2^n in various places not as the most complex. Most students correctly identified $(2n)^2$ and $\left(\frac{n}{10}\right)^2$ as belonging to the same Big-O class.

For part (b) there were two common mistakes. The first was to fail to put the values 500 and 1000 into the functions to compare their value. The second was to ignore $\left(\frac{n}{10}\right)^2$ and only compare $n \log n$ and $100n$.

Question 8

Question 8 had a mean mark of 2.8 (40%) with a standard deviation of 2.8. The median mark was 3.

Part (b) was answered more successfully than part (a). For part (a) a common mistake was to argue in terms of specific Java programs that do not work; this is not our notion of computable function. Some students stated the Halting Problem without arguing for its uncomputability. However, there were also some very thorough and well presented answers to (a). For part (b) the most common mistake was to state that the *Church-Turing Thesis* was that a function is computable if one can write a program for it without referring to the fact that the programming language does not matter. Without this second part this is the definition of computable function. Many students forgot to answer the second sentence of (b).

Question 9

Question 9 had a mean mark of 3.9 (43.4%) with a standard deviation of 3.9. The median mark was 4.

Whilst there was a mistake in parts (c) and (d) of this question, not many students attempted these parts. In light of the error, these parts were marked generously.

Part (a) was answered well in general, with the only common mistake being to not use the given semantic rules. A common mistake in part (b) was to define the postcondition Q as $y = y - x$ instead of using the auxiliary variables a and b. A common mistake in part (c) was to only answer one of the two parts. Those who answered question (d) generally answered well, although there were not a large number of students who attempted this question. Part (e) was answered well.