Exam Performance Feedback Form

COMP11212—Section A

2010/2011

The following only concerns Section A of this exam.

General remarks: 159 students answered questions from this part. The average mark for this part was 11 marks out of 20. 40 students received a mark of 7 or fewer; of these two had 0 marks, two had 1 mark, and one student had 2 marks—these candidates seem to have done very little to prepare for the exam. 57 students received a mark of 14 or better, one of these got 20 out of 20.

Comments on exam technique: Firstly I am rather surprised at how few students answered Question 3. This makes me wonder whether many students just do the first two questions for no better reason that they appear first on the script. Students should always read all the questions and then decide which ones they're best equipped to answer. While working on past papers it would be a good idea to keep track of what kind of questions you do particularly well on and which ones you tend to struggle with. That will help making decisions when you are sitting the actual exam.

Secondly it was good to see students starting to use sample words to test their solutions, and I noticed a few cases where students managed to correct their answer based on such tests. Other students, however, were not very creative in coming up with sample words.

Question 1. 150 students attempted this question. The average mark was 5.6 out of 10. 17 students received 2 marks or fewer, 35 students got 8 marks or higher. This is a noticeable improvement on last year.

a) Most students could answer this correctly in the affirmative. The arguments given weren't always convincing. The mark for it was awarded if a student pointed out that the language in question consisted of words where 0 and 1 alternate and which start and end with a 0, or that for every natural number n, $(01)^n0 = 0(10)^n$, or a similarly convincing reason.

b) Quite a few students answered this correctly. The smallest automaton possible has six states (it has to remember how many cs modulo 3 have been seen and whether an a has occurred), and a very regular structure. Where mistakes were made typically the student's automaton did not keep this information straight. Most answers only accepted words which were in the language, but often they left out infinitely many valid choices (the a mentioned can occur anywhere in the word, not just at the start or end, b transitions have to be included, etc). With test words such as *cabcc*, *cbcac* and so on they could have found these mistakes. Some automata did not require the letter a to be included in all words accepted (accepting for example *ccc*), while others drew transitions labelled c which meant that divisibility by 3 became messed up (accepting for example *acccc* or *accccc*). Some did not read the question closely enough and submitted two automata, one for each criterion, but did not go on to combine the two in the product.

c) A valid answer is $(01|1)^*(00|0|\epsilon)(10|1)^*$. Many answers were variations of this, often having only 00 in the middle and therefore excluding those words that do not contain the string 00 at all. More typically, however, mistakes were made when it came to making sure that every string not containing 00 could be formed to either side of 00 (for example, 1^*001^*, or some combination of $1^*(01)^*$ on the left of 00, neither of which is sufficient).

Question 2. This question was attempted by 136 students. The average mark was 5.5 out of ten. 31 students received a mark of 2 or lower, while 42 students got a mark of eight or more.

Most students started by drawing an NFA with ϵ-transitions, and the correct one was worth three marks. Three further marks were available for removing the ϵ-transitions and four for turning the result into a DFA. Students who tried to cut short the process (for example, by not having ϵ-transitions in their first automaton) typically made mistakes. There were surprisingly many incorrect NFAs in the first step. It seems that quite a few students missed the difference between $(a|b)^*$ and $(ab)^*$, both of which appear in the regular expression given. Some students seemed to mis-parse the expression given—it is a choice between $(a|b)^*a$ (that is all words which end in a) and $(ab)^*b$. Students often also did not seem to follow the algorithm for turning a regular expression into an automaton, and those who did often forgot that the Kleene $*$ might be matched 0 times (so the automaton should accept the single letter words a and b). In many cases, further mistakes were then made in turning the automaton from the first step into a DFA, losing additional marks. Most direct attempts at coming up with a DFA for the regular expression did not come close to being correct, and some weren't deterministic.

If the original automaton was incorrect, but it was correctly turned into a DFA then the marks for these steps were given, provided the process was about as complex as that for a valid automaton. Few students managed to do this without introducing further mistakes.

Question 3. This question was attempted by only 32 students. It had an average mark of 5.4 out of 10. Three students received a mark of at most 2, while eight managed 8 or more.

a) There were many incorrect answers here. Either they allowed creating infinitely many invalid words, or they missed infinitely many valid ones. There is an example in the notes of a language where the number of as is equal to the number of bs, and this doesn't require a lot of change to turn it into an answer to this question.

b) Most students could do this part, but some only because their grammar of part a) allowed them to create almost any word. Some parse trees were not described appropriately.

c) Most students could answer correctly that this is impossible, and many could give the correct reason that an automaton for the language in question would require infinitely many states to keep track of the number of as and b/cs seen.

d) Most students could answer this correctly, typically by working out that a correct regular expression for the language in question is given by $(01)^*|(10)^*$—it was very good to see that very few people fell into the trap of assuming the argument for d) can be applied here!