

PGT Exam Performance Feedback

2016/2017 Semester 2

COMP60332 Automated Reasoning and Verification

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Comments Question 1

- a) Answered by most students correctly.
- b) Many students had problems with writing down the definition of lexicographic combination of two orderings and showing that such combination is well-founded provided that given orderings are well-founded.
- c) Answered generally well. A number of students failed to add the name of the whole formula "n_1" to the resulting clause set (without this the resulting set of clauses will always be satisfiable.). Some errors in transformation of definitions into CNF and counting the number of resulting clauses.
- d) Common mistake is failing to apply simplifications before splitting. A couple of students confused splitting tree with parsing tree.

Question 2

- a) Many struggled to express properties using propositional logic.
- b) Most of students answered correctly. Some incorrectly applied backjumping.
- c) Most of students had a mix of correct and wrong answers for different subquestions. Most problematic subquestions were: iv) express using LTL the property that a formula F holds in at least two states and iii) Sometime in the future F holds and until then $\sim G$ holds.

Question 3

This question had an average mark of 73%. Of the 30 students who attempted the question 4 had marks below 50% and 22 students had first class marks. The best mark was 19 which two students achieved.

(a) Students struggled with this subquestion. Parts i) and ii) were easiest, but most answers contained mistakes. Typical mistakes:

- Using S (which was specified to a predicate) like a function symbol in an argument. Predicate symbols cannot appear in argument positions. Predicate symbols are used to encode properties and relations: being a sports car, one person knowing another. They are used to encode information which is either true or false.
- Leaving some variables unquantified. The answer is expected to a FOL formula without any free variables.

Part iii) was hard and I did not expect a lot of correct answers, but 2 students had correct answers and gained full marks.

(b) The quality of answers was generally very good. Some mistakes for which marks were lost were:

- i) - Deriving only the CNF and not giving the clause set.
 - Making mistakes when pushing negation inwards over a conjunction or implication.
 - Pulling a universal quantifier underneath a negation to the front requires the quantifier to change into an existential quantifier.

ii) - Insufficient explanation or mistakes in the explanation.

(c) I was very pleased with the answers to this question. Few mistakes were made in i) and ii). If mistakes were made then in iii), where the rules were at the back of the exam paper (so these were a bit surprising).

(d) i) and ii) posed little problems and were mostly answered perfectly, but marks were lost for mistakes in explanations.

iii) and iv) were harder because the formulas were not ground. For a non-ground clause to be true in an interpretation, every ground instantiation of the formula must be true in the interpretation.

iv) was easier because it sufficed to give one ground instantiation for which the formula is false, and since the formula was conjunction this is not that difficult.

Question 4

This question had an average mark of 65%. Of the 15 students who attempted the question 2 had marks below 50% and 6 students had first class marks. The best mark was 17 which one student achieved.

(a) This was the bookwork question, where only 2 of the concepts needed to be described. A surprising number of students did not notice that there was this choice and answered all 4 subquestions.

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(b) i. Everybody who answered the question had a perfect answer.

ii. Common mistakes for which marks were lost:

- Extending the partial interpretation I_C when the clause C is true in I_C .
- $\neg P(a) \vee \neg Q \vee P(f(a))$ is true in $\{Q\}$ and does not need to be extended.
 - There is no need for applying factoring or resolution.

(c) This question proved to be harder; but two students got full marks. The question required a longer derivation of the empty clause to be given. Some students seem to get confused since the second clause has two strictly maximal literals. This is ok, and means that resolution inferences with the clause must be considered upon both literals. However for deriving the empty clause it turned out that inferences on one was sufficient (this can be seen by imagining we select one of these).

Some mistakes made:

- Not realising there are further inference possibilities and stopping too early.
- Forgetting to rename clauses apart before applying the resolution rule.
- Mistakes in computing the resolvent
- Not performing factoring explicitly

(d) The answers were mixed. Most got i) right, but struggled to give an explanation for ii) though giving the correct answer. Two students got full marks.
