UG Exam Performance Feedback
Third Year
2016/2017 Semester 1

COMP36111 Advanced Algorithms — Ian Pratt-Hartmann

Comments

1. Union-find

This question was done quite well, with most candidates displaying a good knowledge of the relevant variants of Union-find and their complexity. The best answer to part a) is probably O(|V|.|E|), whichis fine if there is at least one edge. Part b) involves seeing that only small components are merged, and so the running time is linear in n, and Part c) involves seeing that ever larger components are merged, and so the running time is quadratic in n. Part d) was correctly answered by most candidates: just a matter of mentioning that the merged component double in size every time, so the number of times every vertex can have its cell re-assigned is log |V|; you needed a careful setting out of details for full marks. With part e), the key
idea was to explain path compression; most candidates did this well, too.

2. Matching and flow optimization

This question was extremely well done. (The typo in part c, which was found in the exam, did not cause any obvious problems.) When marks were lost, this was often due to carelessness---for example forgetting, in Part c, to mention that flows through edges cannot exceed capacities. Many candidates forgot to say that net flow at the source and the sink need not be zero, but I did not penalize this.

3. Linear programming and integer linear programming

Many candidates struggled with this---in my opinion, terribly easy--- question. Part a) makes it clear that we are talking about feasibility---i.e. determining whether the feasible reagion contains any (integer) points: these are not optimization problems! Candidates who said that the problem was to determine whether the maximum value of the objective function in the feasible region exceeded a certain value got the marks, as this is equivalent to the correct answer. Part b) was a bit hit or miss: candidates had to state clearly which problem was in which class to get full marks. Part c) was in fact easy: it is obvious that any rational solution can be made into an integer solution by multiplying by all the denominators. Technically, you are supposed to use the theorem which says that if there is a real solution, then there is a rational solution; but the problem was clearly beyond almost all Candidates. Part d) was also poorly done: the answer is that the figure is a trapezium in three-dimensions. Part e) was actually well done: there are in fact seven integer points in the feasible region. Candidates got partial marks if they had a few extra or a few wrong solutions.

4. Non-deterministic logarithmic space

This question got a good spread of marks, though with rather too many Candidates crashing in flames. Part a) was well done. In Part b), manycandidates gave the wrong algorithm---either DFS (too much memory because you have to mark the nodes) or the mid-point guessing algorithm (too much memory because you have to store the return addresses). Part c) was understood by many candidates, though you needed a clear and non-rambling formulation to get full marks. In
Part d), the class divided into those who understood reductions and their correctness proofs, and those who did not. In Part e), candidates still got marks for mentioning the "Immerman-something theorem".