Coursework #4

Deadline: Monday, 3 April 2006, 11:15am

Question 1 (10 marks)

A valuation function v mapping bundles of goods to numerical values is *modular* iff we have $v(B_1 \cup B_2) = v(B_1) + v(B_2) - v(B_1 \cap B_2)$ for all bundles B_1 and B_2. Show that the WDP ceases to be intractable when all agents report modular valuations by giving a polynomial algorithm for this special case. What is the complexity of your algorithm?

Question 2 (10 marks)

Prove that the payment computed for agents that do not win any goods is always 0 in the VCG mechanism.

Question 3 (10 marks)

For this question, assume that the auctioneer can accept any combination of atomic bids from the same bidder, as long as bundles do not overlap (this is the so-called OR-language). Consider the following variation on the VCG mechanism, where payments are computed with respect to atomic bids rather than with respect to bidders: each bidder pays for each of their accepted bids the price offered, less a discount computed as the difference of the actual overall value and the overall value that would have been attainable without that bid. Is truth-telling still a dominant strategy for this modified mechanism? Either prove that it is or give an example that shows how the mechanism can be manipulated.

(Adapted from a homework question set by T. Sandholm, Carnegie Mellon University, 2005.)

Bonus Question (20 marks)

Implement an algorithm to solve the winner determination problem for combinatorial auctions using some of the ideas presented in class. The choice of programming language is yours; the only condition is that your program must run under Linux as provided by the Faculty of Science. Your submission (by email) should include the documented source code of your program, instructions how to run the system, and a couple of documented examples.