CPSC 532L, Winter 2011
Homework #4

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1. **[20 points]** Consider the AGV mechanism introduced in the book (Section 10.4.7) and, without appealing to the Myerson-Satterthwaite impossibility theorem, prove that:

   (a) AGV is truthful in *ex-interim* Bayes Nash equilibrium.

   (b) AGV is *ex-post* budget-balanced.

   (c) AGV is not *ex-interim* individual-rational.

2. **[20 points]** Consider a first-price auction with two bidders. Assume that they have IPV valuations drawn uniformly from the interval $[0, 10]$, and that they are risk-neutral. In class (and in the textbook) we saw that $s_1(v_1) = \frac{1}{2}v_1$ and $s_2(v_2) = \frac{1}{2}v_2$ together form a Bayes-Nash equilibrium for this game.

   (a) Assuming that bidder 2 is instead using the bidding strategy $s_2(v_2) = v_2$ (i.e., she bids his valuation), what is the best response bidding strategy $s_1(v_1)$ for player 1? Show your work at a level similar to that used in class and in the textbook.

   (b) Now consider instead a *second-price* auction. However, suppose the mechanism has a buggy implementation of max: most of the time the mechanism works correctly, but with some probability p which is strictly less than $1/3$ it awards the object to the second-highest bidder (instead of the highest bidder). In all cases it correctly calculates price as the second highest bid. Assuming that bidder 2 is still bidding truthfully, compute the best-response strategy for bidder 1. Is it still truthful? Show your work at the same level as in your answer to the first part.

3. **[26 points]** Consider the following lobbying problem. There are n different companies, each of which wants the government to pass legislation that will benefit that company and will have no direct effect on the other companies. If the legislation that favours company i is passed, i's profit will be v_i; otherwise it will be 0. In order to try to influence government policy, each company i considers making a donation of some amount d_i to the government. Let's consider the case where all v_i are independent random variables distributed uniformly on $[0, 1]$. Somewhat cynically, the government will pass the single piece of legislation that benefits its biggest donor; of course, it will keep all the donations it receives.

   (a) Model this problem as an auction. State all the relevant assumptions that you make in building this model, and explain why they are reasonable. You do not have to restate the assumptions given above. (This part is not hard, and requires only a short answer.)

   (b) Find a symmetric Bayes-Nash equilibrium of this game. You may assume that for this game there exists a symmetric, pure-strategy equilibrium for which the bid amount is a monotonically increasing function of the agent's valuation.

Academic Honesty Form

For this assignment, it is acceptable to collaborate with other students provided that you write up your solutions independently. The only reference materials that you can use are the course notes and textbook, and the reference textbooks listed on the course web page. In particular, getting help from students or course materials from previous years is not acceptable.

List any people you collaborated with:

List any non-course materials you refered to:

Signature:

Fill in this page and include it with your assignment submission.