

## Problem Set 8

Due: Monday, November 20 (10:00am EST)

You are encouraged to work together on the problem sets, but you must write up your own solutions. Consulting solutions from previous semesters (released by the instructor or written by other students) is prohibited. Problem sets must be submitted electronically through Canvas.

Late problem sets submitted within 24 hours of the deadline will be accepted with a 50% penalty. Problem sets more than 24 hours late will not be accepted. Make sure to allow yourself enough time to complete the submission process. (If you have technical difficulties, you may email your problem set to the TA by the deadline.)

**Problem 1.** There are two firms who compete to develop a antiviral pill to treat Covid. Simultaneously, each firm  $i$  chooses a budget  $x_i$  for developing the treatment. Each firm  $i$  succeeds in developing a treatment with probability  $\theta_i \sqrt{x_i}$ , where success of one firm is stochastically independent from the success of the other firm and  $\theta_i \in \{1/2, 1\}$  is the effectiveness of the mechanism firm  $i$  uses for its treatment.

Firm  $i$  gets payoff  $1 - x_i$  if it develops a treatment and the other firm does not; otherwise, it gets payoff  $-x_i$ .<sup>1</sup> Assume that each firm  $i$  privately knows  $\theta_i$ . The two values of  $\theta_i$  are each realized with probability  $1/2$ , independent of  $\theta_j$ , for  $i \neq j$ . Compute a Bayesian Nash equilibrium.

**Problem 2.** Exercise 14.9.

**Problem 3.** Exercise 14.11.

**Problem 4.** Exercise 14.26.

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<sup>1</sup>Each firm can get revenue 1 as a monopolist, but gets zero revenue if (a) it faces competition from the other firm or (b) its treatment fails.