## Problem Set 6

### *1. Even More Drug Testing*

A sports figure has been taking performance enhancing drugs. The sports authorities have decided to check on him and have asked him to take one of two tests, A and B. Both tests are wrong 10% of the time when tested on users. However, when tested on a non user Test A is wrong 40% of the time while Test B is wrong 20% of the time. Suppose that 40% of athletes in this sport use the substance. The relevant payoff to the sports authorities from banning a player are given below.

| | Banned | Not banned |
|---|---|---|
| User | 10 | -10 |
| Not User | -50 | 0 |

a) Would the sports authorities ban a player that tested positive on Test A?

b) What if the player tested positive on Test B?

c) Which test do you think the sports figure mentioned earlier would choose, given that he strictly prefers to not be banned?

d) Would your answer to part c) change if the sports figure had not been taking drugs?

### *2. Cournot with Uncertain Cost*

Consider a Cournot Duopoly with demand $p = 60 - x$. There are two possible levels of cost: with probability q, cost is low and equal to 3. With probability 1-q cost is high and is equal to 5. Assuming that each firm knows its own cost and these probabilities, in the Symmetric Bayesian Nash equilibrium of the Cournot game, what are the equilibrium strategies of the two firms?

### *3. Second Price Auctions*

There are two potential buyers, Edward and Jackson at an art auction. Edward values the painting at one of two possible prices, $v_E^L$ = \$50 (low type) or $v_E^H$ = \$100(high type), while Jacson values it at either $v_J^L$ =\$40 or $v_J^H$ = \$110. Edward is of the high type with probability 0.4, while Jackson is of the high type with probability 0.6. The rules of the auction involve both parties simultaneously submitting their bids $b_i^L$ and $b_i^H$ for $i \in \{J, E\}$. The highest bidder wins the painting but pays the other (second highest) bid. In case of a tie the painting goes to Edward. Edward and Jackson know only their own type when bidding. So if *i* of type *k* wins the painting his payoff is simply $v_i^k$ -b, where b is the second highest of the submitted bids.

Find a Bayesian Nash Equilibrium of this game.