

Passed Solution Review

6. Imagine that a zealous prosecutor (P) has accused a defendant (D) of committing a crime. Suppose that the trial involves evidence production by both parties and that by producing evidence, a litigant increases the probability of winning the trial. Specifically, suppose that the probability that the defendant wins is given by $e_D / (e_D + e_P)$, where e_D is the expenditure on evidence production by the defendant and e_P is the expenditure on evidence production by the prosecutor. Assume that e_D and e_P are greater than or equal to 0. The defendant must pay 8 if he is found guilty, whereas he pays 0 if he is found innocent. The prosecutor receives 8 if she wins and 0 if she loses the case.

(a) Represent this game in normal form.

Prosecutor		Wins	Loses
Defendant	Guilty	$-8, 8$	$-8, 0$
	Not Guilty	$0, 8$	$0, 0$

~~This doesn't happen~~

$$u_P(e_P, e_D) = 8e_P / (e_P + e_D) - e_P$$

$$u_D(e_P, e_D) = 8e_D / (e_P + e_D) - e_D$$

(b) Write the first-order condition and derive the best-response function for each player.

$$du = 8 / (e_P + e_D) - 8e_P / (e_P + e_D)^2 - 1 = 0$$

$$8 / (p + d) - 8p / (p + d)^2 = 1$$

$$8(p + d) - 8p = (p + d)^2 \quad \text{or} \quad 8d = (p + d)^2$$

$$p = 2\sqrt{2d} - d$$

$$d = 2\sqrt{2p} - p$$

(c) Find the Nash equilibrium of this game. What is the probability that the defendant wins in equilibrium.

$$p = 2\sqrt{2p} - p = d = 2$$

$$\text{Probability} = 1/2$$

(d) Is this outcome efficient? Why?

No why? $e_D - e_P = .001$ gives the same probability but costs much less. This hinges on both sides spending nearly equal amounts.