## Lecture 9 3 Oct 07

Last: new idea [MIXED STRATEGIES] time e.g.  $(\frac{1}{3}, \frac{1}{3}, \frac{1}{3})$  in RPS

Defn . A mixed strategy P: is a randomization over i's pure strategies

· Pi(si) is the probability that fi assigns to pure strategy si

•  $P_i(s_i)$  could be zero eg  $(\frac{1}{2}, \frac{1}{2}, 0)$ 

· Pi(si) could be one ie a pure strategy

## Payoffs from Mixed Strategy

The expected payoff of the mixed strategy pi is the weighted average of the expected payoffs of each of the pure strategies in the mix

What is p's expected payoff?

(1) Ask EU,  $(A,q) = [2](\frac{1}{2}) + [0](\frac{1}{2}) = 1$ EU,  $(B,q) = [0](\frac{1}{2}) + [1](\frac{1}{2}) = \frac{1}{2}$ (2) EU,  $(\rho,q) = (\frac{1}{5}) EU, (A,q) + (\frac{4}{5}) EU, (B,q)$   $= (\frac{1}{5})[1] + (\frac{4}{5})[\frac{1}{2}]$   $= \frac{3}{5}$ 

Lesson If a mixed strategy is a BR,

then each of the pure strategies in the mix

must themselves be a BR.

In particular, each must yield the same expected

Defn

A mixed strategy profile (p\*, p\*, ..., p\*) is a mixed strategy NE if for each player i, p;\* is a BR to p.\*

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10 Defn A mixed strategy profile... >>

10 lesson => If  $\rho_i^*(s_i) > 0$  then  $s_i^*$  is also a BR. to  $\rho_i^*$ 

Example Tennis Venus and Serena Williams

S at net

There is no pure strategy NE

Let's find a mixed - strategy NE

• Trick To find Serena's NE mix (q,1-q)
look at Venus's payoffs

V's payoffs against  $q: L \rightarrow [50]q + [80](1-q)$   $= R \rightarrow [90]q + [20](1-q)$ If Venus is mixing in NE

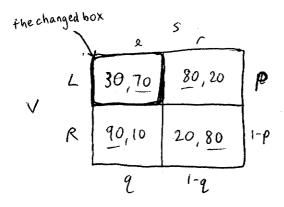
If Venus is mixing in NE then the payoffs to L and R must be equal 50q + 80(1-q) = 90q + 20(1-q)

60(1-q) = 40q + 20(1-q) 60(1-q) = 40q 60 = 100q 0.6 = 9Serena's mix

· To find Venus' NE mix, use Serena's payoffs

S's payoffs:  $l \rightarrow [50]p + [10](1-p)$   $r \rightarrow [20]p + [80](1-p)$  30p = 70(1-p) 100p = 70p = 0.7 Venus' mix

NE = [ (.7,.3), (.6,.4)]



To find the new e for Serena, use Venus' payoffs

V: 
$$L \rightarrow [30]q + [80](1-q)$$
 $R \rightarrow [90]q + [20](1-q)$ 
 $60q = 60(1-q)$ 
 $\boxed{9=.5}$  q went b

Strategic effect is bigger

$$S: \ell \to 70\rho + 10(1-\rho)$$

$$F \to 20\rho + 80(1-\rho)$$

$$50\rho = 70(1-\rho)$$

$$\rho = \frac{7}{12} < \frac{7}{10}$$

< Comparative Statics >> << Bringing each other back into equilibrium >7

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