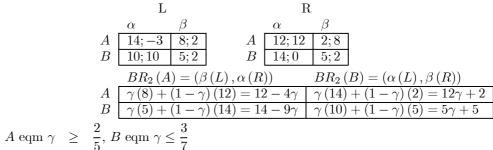# ECON 204 Sec 01
Quiz 4
Dr. Kevin Hasker

1. *(2 Points)* Please read and sign the following statement:

   I promise that my answers to this test are based on my own work without reference to any notes, books, or the assistance of any other person during the test. I also promise neither to help others nor to use calculators or other electronic devices.

   Name and Surname: _

   Student ID: _

   Signature:

   _

2. *(18 points)* Consider the following stage game. In this game player 2 (the column player) knows whether the state is L or R, player one only knows that the probability of L is γ.

	L			R	
	α	β		α	β
A	$8;4$	$14;-5$	A	$4;8$	$10;10$
B	$3;4$	$12;12$	B	$9;4$	$14;0$

	$BR_2(A) = (\alpha(L), \beta(R))$	$BR_2(B) = (\beta(L), \alpha(R))$
A	$\gamma(8) + (1-\gamma)(10) = 10 - 2\gamma$	$\gamma(14) + (1-\gamma)(4) = 10\gamma + 4$
B	$\gamma(3) + (1-\gamma)(14) = 14 - 11\gamma$	$\gamma(12) + (1-\gamma)(9) = 3\gamma + 9$

A eqm $\gamma \geq \dfrac{4}{9}$, B eqm $\gamma \leq \dfrac{5}{7}$

	L			R	
	α	β		α	β
A	$9;7$	$2;3$	A	$14;0$	$7;3$
B	$14;-4$	$6;3$	B	$11;11$	$3;6$

	$BR_2(A) = (\alpha(L), \beta(R))$	$BR_2(B) = (\beta(L), \alpha(R))$
A	$\gamma(9) + (1-\gamma)(7) = 2\gamma + 7$	$\gamma(2) + (1-\gamma)(14) = 14 - 12\gamma$
B	$\gamma(14) + (1-\gamma)(3) = 11\gamma + 3$	$\gamma(6) + (1-\gamma)(11) = 11 - 5\gamma$

A eqm $\gamma \leq \dfrac{4}{9}$, B eqm $\gamma \geq \dfrac{3}{7}$

$$\begin{array}{cc} & \text{L} \\ & \begin{array}{cc} \alpha & \beta \end{array} \\ \begin{array}{c} A \\ B \end{array} & \begin{array}{|c|c|} \hline 14;-3 & 8;2 \\ \hline 10;10 & 5;2 \\ \hline \end{array} \end{array} \qquad \begin{array}{cc} & \text{R} \\ & \begin{array}{cc} \alpha & \beta \end{array} \\ \begin{array}{c} A \\ B \end{array} & \begin{array}{|c|c|} \hline 12;12 & 2;8 \\ \hline 14;0 & 5;2 \\ \hline \end{array} \end{array}$$

	$BR_2(A) = (\beta(L), \alpha(R))$	$BR_2(B) = (\alpha(L), \beta(R))$
A	$\gamma(8) + (1-\gamma)(12) = 12 - 4\gamma$	$\gamma(14) + (1-\gamma)(2) = 12\gamma + 2$
B	$\gamma(5) + (1-\gamma)(14) = 14 - 9\gamma$	$\gamma(10) + (1-\gamma)(5) = 5\gamma + 5$

A eqm $\gamma \geq \dfrac{2}{5}$, B eqm $\gamma \leq \dfrac{3}{7}$

$$\begin{array}{cc} & \text{L} \\ & \begin{array}{cc} \alpha & \beta \end{array} \\ \begin{array}{c} A \\ B \end{array} & \begin{array}{|c|c|} \hline 6;5 & 14;-2 \\ \hline 4;5 & 11;11 \\ \hline \end{array} \end{array} \qquad \begin{array}{cc} & \text{R} \\ & \begin{array}{cc} \alpha & \beta \end{array} \\ \begin{array}{c} A \\ B \end{array} & \begin{array}{|c|c|} \hline 5;6 & 9;9 \\ \hline 7;5 & 14;0 \\ \hline \end{array} \end{array}$$

	$BR_2(A) = (\alpha(L), \beta(R))$	$BR_2(B) = (\beta(L), \alpha(R))$
A	$\gamma(6) + (1-\gamma)(9) = 9 - 3\gamma$	$\gamma(14) + (1-\gamma)(5) = 9\gamma + 5$
B	$\gamma(4) + (1-\gamma)(14) = 14 - 10\gamma$	$\gamma(11) + (1-\gamma)(7) = 4\gamma + 7$

A eqm $\gamma \geq \dfrac{5}{7}$, B eqm $\gamma \leq \dfrac{2}{5}$

(a) *(4 points)* Write down all the strategies of player 2, be sure to indicate in which state the actions are being taken.

Solution 1 $S_2 = \{(\alpha(L), \alpha(R)), (\alpha(L), \beta(R)), (\beta(L), \alpha(R)), (\beta(L), \beta(R))\}$
If they are not clear mark them down at least half of the credit.

(b) *(4 points)* Write below the best response of player 2 to A and B.

Solution 2 *See the tables above.*

(c) *(4 points)* In the table below, write down the expected utility of both strategies to the best response of player 2, they should be a function of γ:

	$BR_2(A)$	$BR_2(A)$
A	_____	_____
B	_____	_____

Solution 3 *See the tables above. Note typo of not writing B in the second column, I corrected this during the quiz.*

(d) *(1 point)* If $\gamma = \frac{1}{10}$, what is the Nash equilibrium?

Solution 4 *Above I solve for the conditions where $(A, BR_2(A))$ and $(B, BR_2(B))$. In all cases one of them will be the equilibrium when $\gamma = \frac{1}{10}$ and the other when $\gamma = \frac{9}{10}$.*

(e) *(1 point)* If $\gamma = \frac{9}{10}$, what is the Nash equilibrium?

Remark 5 *Notice the small amount of credit for parts d and e. The point should be given for work towards the correct answer, in all honesty to be fair these should be about three points each.*

Just to illustrate I would give credit to "if $\gamma = \frac{1}{10}$ ($\frac{9}{10}$ respectfully) then players will basically be playing the game R (L respectively) and so the strategy of player 1 in that game's Nash equilibrium will probably be the equilibrium in this case."