

INR 3303 — Practice Exercises 4  
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For the following two problems, calculate a mixed strategy equilibrium (i.e., the optimal mixed strategy for each player). Payoffs are cardinal (higher is better). Remember that the optimal mixed strategy is one that plays each strategy with a probability ( $p$ ) such that the opponent is indifferent between each of its strategies. To calculate this, set the expected utility equations for the opponents strategies equal to each other and solve for  $p$ .

1. Calculate the optimal mixed strategy for **both** Row and Column (**show all work, using the back of this page if necessary for your expected utility equations**):

		Column	
		<u>Left</u>	<u>Right</u>
Row	Up	3, 3	1, 5
	Down	6, 1	0, 0

For Row:  $3p + 1(1-p) = 5p + 0(1-p)$   
 $3p + 1 - p = 5p$   
 $2p + 1 = 5p$   
 $1 = 3p$   
 $p = 1/3$

Row should play Up 1/3 of the time  
Row should play Down 2/3 of the time

For Column:  $3p + 1(1-p) = 6p + 0(1-p)$   
 $3p + 1 - p = 6p$   
 $2p + 1 = 6p$   
 $1 = 4p$   
 $p = 1/4$

Column should play Up 1/4 of the time  
Column should play Down 3/4 of the time

The mixed strategy equilibrium is (1/3 Up, 2/3 Down; 1/4 Left, 3/4 Right) for (Row; Column).

2. Suppose that corporations in 2 countries, Japan and Korea, wish to cooperate to set new standards for storing digital music. By working together, they make it easier to release a new generation of personal electronic devices. But each country's corporations would prefer that their *own* standards are adopted, rather than those of their competitors. So, sometimes they cooperate, but sometimes they "defect" by insisting on their own standards. In this way, they prevent the other country's companies from taking advantage of them. Suppose that the game diagram shows expected annual profits in billions of dollars. Calculate the optimal mixed strategies for Japan and Korea (**show all work, using the back of this page if necessary for your expected utility equations**):

		Korea	
		<u>Cooperate</u>	<u>Defect</u>
Japan	Coop.	2, 2	-1, 1
	Defect	1, -1	0, 0

For Row:  $2p - 1(1-p) = 1p + 0(1-p)$   
 $2p - 1 + p = p$   
 $3p - 1 = p$   
 $2p = 1$   
 $p = 1/2$

Japan should Cooperate 1/2 of the time  
Japan should Defect 1/2 of the time

For Column:  $2p - 1(1-p) = 1p + 0(1-p)$   
 $2p - 1 + p = p$   
 $3p - 1 = p$   
 $2p = 1$   
 $p = 1/2$

Korea should Cooperate 1/2 of the time  
Korea should Defect 1/2 of the time

The mixed strategy eq. is (1/2 Coop., 1/2 Def. 1/2 Coop., 1/2 Def.) for (Japan; Korea).