IS 609 Week 9 Homework

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1) Using the definition provided for the movement diagram, determine whether the following zero-sum games have a pure strategy Nash equilibrium. If the game does have a pure strategy Nash equilibrium, state the Nash equilibrium. Assume the row player is maximizing his payoffs which are shown in the matrices below.

a)

a.

		Colin	
		C1	C2
Rose	R1	10	10
	R2	5	0

This is a zero sume game and and if we look at the the rows then R1 is the largest for C1 and C2. If look at horizontally then R2 points 5 to 0, but R1 horizontal is neutral, ten to 10. For Colin his best strategy is to select C2. This is not a pure strategy Nash Equilibirum because neither player can benefit by departing from its strategy.

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1) Using the definition provided for the movement diagram, determine whether the following zero-sum games have a pure strategy Nash equilibrium. If the game does have a pure strategy Nash equilibrium, state the Nash equilibrium. Assume the row player is maximizing his payoffs which are shown in the matrices below.

c)

c.

		Pitcher	
		Fastball	Knuckleball
Batter	Guesses fastball	.400	.100
	Guesses knuckleball	.300	.250

Following the same methodology and investigating the vertical and horizontal rows leads us to .400. The pitcher is best throwing a knuckleball and the batter cannot unilaterally benefit from fashball to knuckleball. The Nash equilibrium is .300 (knuckleball).

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2a) For problems a-g build a linear programming model for each player's decisions and solve it both geometrically and algebraically. Assume the row player is maximizing his payoffs which are shown in the matrices below.

a.

		Colin	
		C1	C2
Rose	R1	10	10
	R2	5	0

Rose

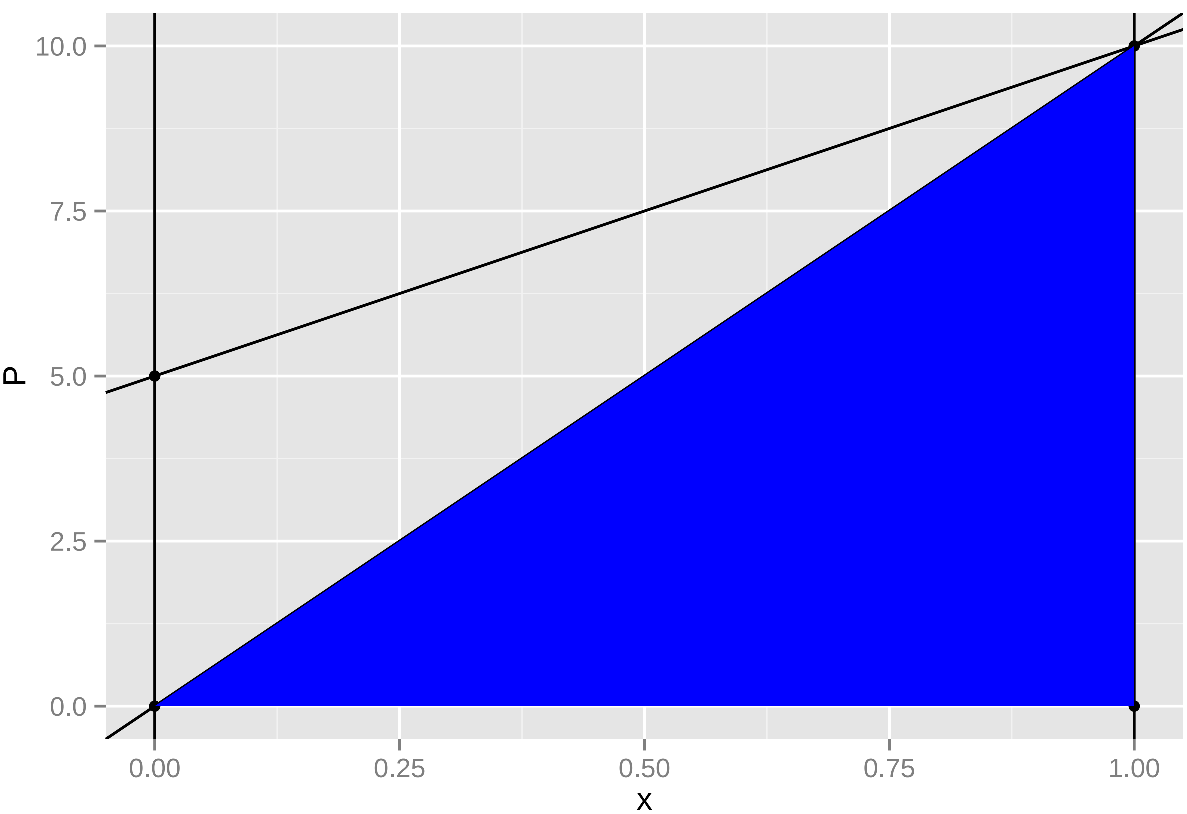
P = Rose's Payoff x = Portion of R1 strategy 1-x = Portion of R2 Strategy

x>=0 x<=1

P <= 10x + 5(1-x)

P <= 10x + 0(1-x)

```
## Warning: package 'ggplot2' was built under R version 3.1.3
```



Extreme point is (1,10)

Solve algebraically

x1 - 5x2 + y1 = 5

$x1 - 10x2 + y2 = 0$

$x2 + y3 = 1$

$-x1 + z = 0$

Solve.

The initial extreme point is $x1 = x2 = 0$, therefore $y1 = 5$, $y2 = 0$, $y3 = 1$, $z = 0$.

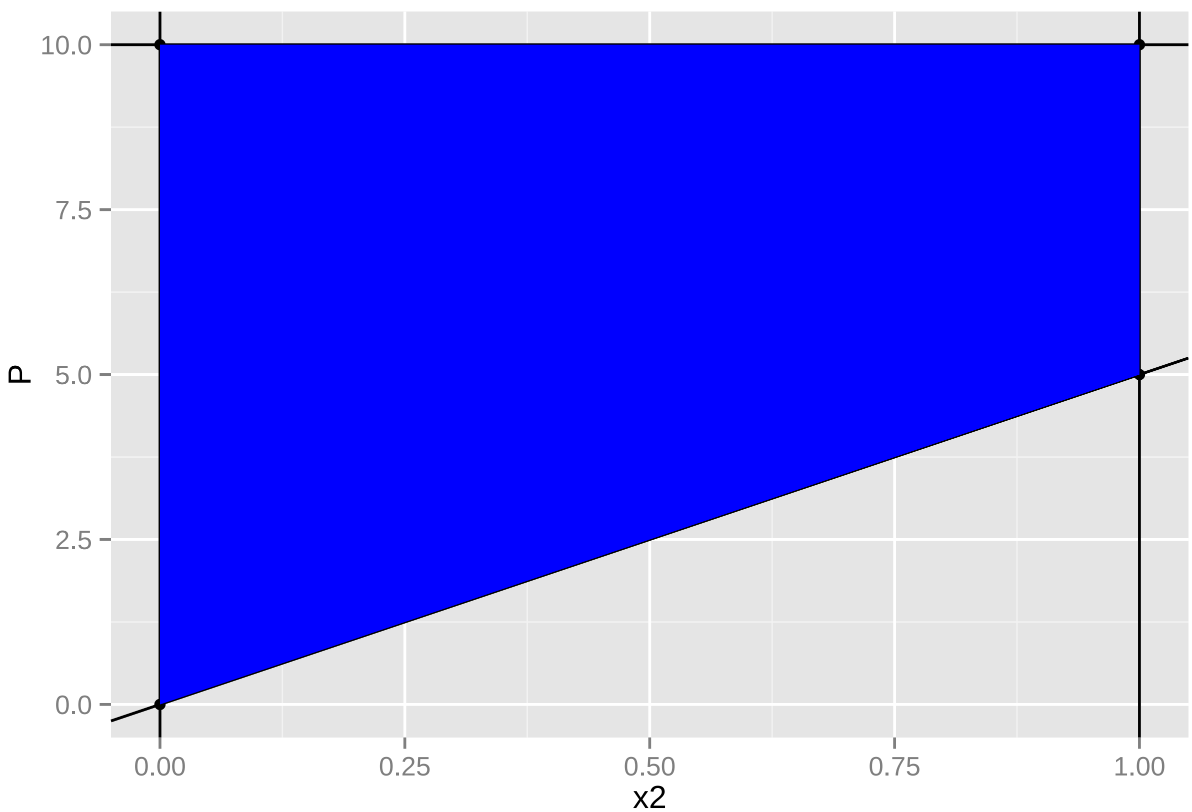
Colin

P = Rose's Payoff x2 =Portion of C1 strategy 1-x2 = Portion of C2 Strategy

```
df <- data.frame(x=c(0,0,1,1), y=c(0,10,5,10))
dfFeasible <- data.frame(x=c(0,0,1,1), y=c(0,10,10,5))

g1 <- ggplot() + geom_point(data=df, aes(x=x, y=y)) +
  geom_abline(intercept=10, slope=0) +
  geom_abline(intercept=0, slope=5) +
  geom_vline(xintercept=0) +
  geom_vline(xintercept=1) +
  geom_polygon(data=dfFeasible, aes(x=x, y=y), fill="blue") +
  labs(y="P", x="x2")

g1
```



Extreme point is (0,0)