cus commerce undergraduate society

COMM 295

FINAL EXAM REVIEW SESSION

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Monopoly and Pricing With Market Power

Monopoly: a sole supplier of a good for which there is no close substitute.

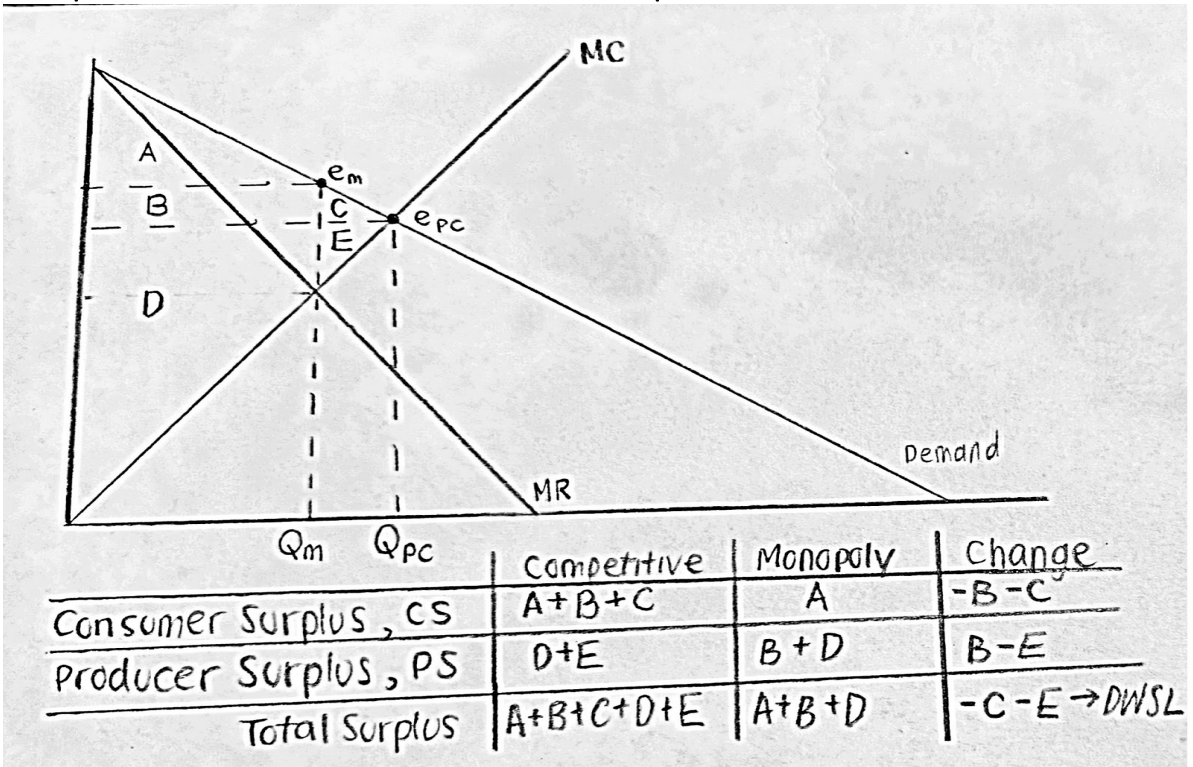
- As a single supplier, a monopolist faces the entire (downward sloping) market demand.
- A monopoly's output is the market output

- Profit Maximization: MR=MC

Profit-maximizing managers sets its quantity according to this formula:

$$MR = p\left(1 + \frac{1}{\varepsilon}\right) = MC.$$

Comparison of Consumer and Producer Surplus



	Competitive	Monopoly	Change
Consumer Surplus, CS	A+B+C	A	-B-C
Producer Surplus, PS	D+E	B+D	B-E
Total Surplus	A+B+C+D+E	A+B+D	-C-E → DWSL

Pricing with Market Power

Perfect price discrimination: Monopolist charges the maximum price that each consumer is willing to pay.
Multi-group price discrimination: Splitting consumers into two or more groups based on their demand curve and charging different prices to each group.
Individual price discrimination: charging individual-specific prices to different consumers, which may or may not exactly equal consumers' reservation prices
Non-linear price discrimination: Charging different prices based on the quantity
Two-Part Pricing: Charging an entry fee and a usage fee

Bundling: selling products together in sets

- Pure bundling: works when there is a negative correlation between the demands of consumers.
    - Charges lower price, but increases the number of consumers.
- Mixed bundling: allow the customer to buy the pure bundle or any of the bundle's components separately

Peak Load Pricing: charging higher prices during periods of peak demand in other periods

- used when there is a capacity constraint
- increases profits and spreads demand during off-peak time

Monopoly and Pricing with Market Power

Question 1: Consider a Bugatti dealership in Vancouver that negotiates with every single customer wanting to purchase a car. The dealership is unsure of each customer's maximum willingness to pay. (This situation accurately describes most car dealerships.) Which of the following statements is true?

A. The dealership engages in perfect price discrimination.
B. The dealership engages in individual price discrimination.
C. The dealership is likely to use two-part pricing.
D. None of the above.

Perfect price discrimination: Monopolist charges the maximum price that each consumer is willing to pay.
Multi-group price discrimination: Splitting consumers into two or more groups based on their demand curve and charging different prices to each group.
Individual price discrimination: charging individual-specific prices to different consumers, which may or may not exactly equal consumers' reservation prices
Non-linear price discrimination: Charging different prices based on the quantity

- Car salesperson uses the information of a buyer to try to determine and estimate each individual's reservation price

Question 2: A profit-maximizing monopoly firm sells hockey tape and pucks. Assume costs are zero. The willingness to pay for these two products by four customers is as follows:

	Hockey Tape	Pucks
Brock	$1.20	X
Caleb	$1.10	$0.90
Darron	$0.90	$1.10
Ethan	X	$1.20

A. Stand-alone pricing and pure bundling are equally profitable if X = $0.60.
B. Mixed bundling is more profitable than pure bundling if X = $0.50.
C. **Profits from optimal pricing are the same for X = $0.30 and X = $0.40.**
D. None of the above.

Stand Alone Pricing when X = $0.60 → $0.95 x 3 + $0.95 x 3 = $5.70
Pure Bundling when X = $1.80 x 4 = $7.20

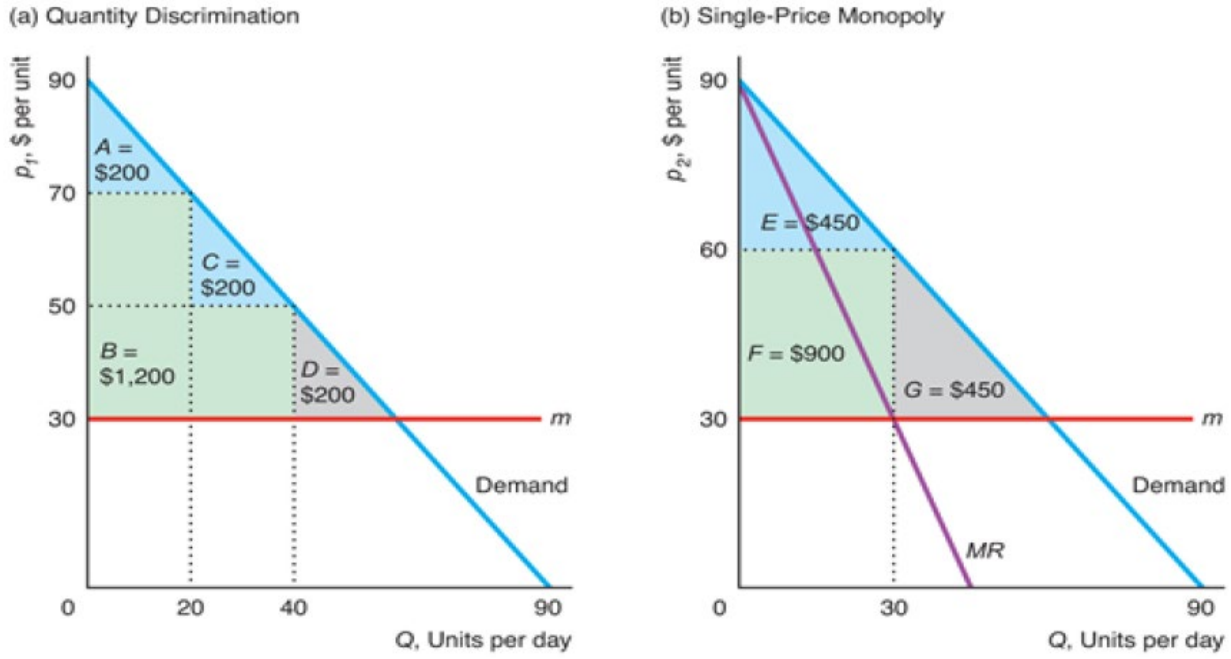
Mixed Bundling when X = $0.50 → $2 + $2 + $1.20 (hockey tape) + $1.20 (puck) = $6.40
Pure Bundling when X = $0.50 → $1.70 x 4 = $6.80

Pure Bundling Pricing when X = $0.30 → $1.50 x 4 = $6.00
Mixed Bundling Pricing when X = $0.30 → $2 + $2 + $1.20x2 = $6.40

Pure Bundling Pricing when X = $0.40 → $1.60 x 4 = $6.40
Mixed Bundling Pricing when X = $0.40 → $2 + $2 + $1.20x2 = $6.40

Question 3: Alan's demand curve is denoted by p = 90 – Q. The graph below:

1. Shows the outcome of quantity-based price discrimination if the firm charges $70 each for the first 20 units and $50 each for additional units.
2. Shows the outcome of profit-maximizing single price monopoly when the marginal cost is $30.



Which of the following statements is true:

A. The average price paid under situation (a) is the same as situation (b)

B. Revenue under situation (a) is double the revenue of situation (b) false

C. Profits are higher in situation (b) than with situation (a) false

D. None of the above

*Average price paid in (a) is ($70 * 20 + $50 * 20)/40 = $60*

Average price paid in (b) is $60

Question 4: A scooter-sharing company charges an annual membership fee of $20 and a fee per minute of $0.40. The marginal cost per minute (for maintenance, depreciation, etc.) is $0.10.

A. Consumers who buy one or more hours for any given trip get a discount on the per-minute price. This is best described as group price discrimination.
B. This pricing structure is an example of two-part pricing.
C. The pricing structure suggests consumers in this market are close to identical.
D. B and C.

- Access fee + per-unit fee
- Can't assume that the customers are identical; the pricing structure does not suggest anything about the similarity of consumers

Oligopolies

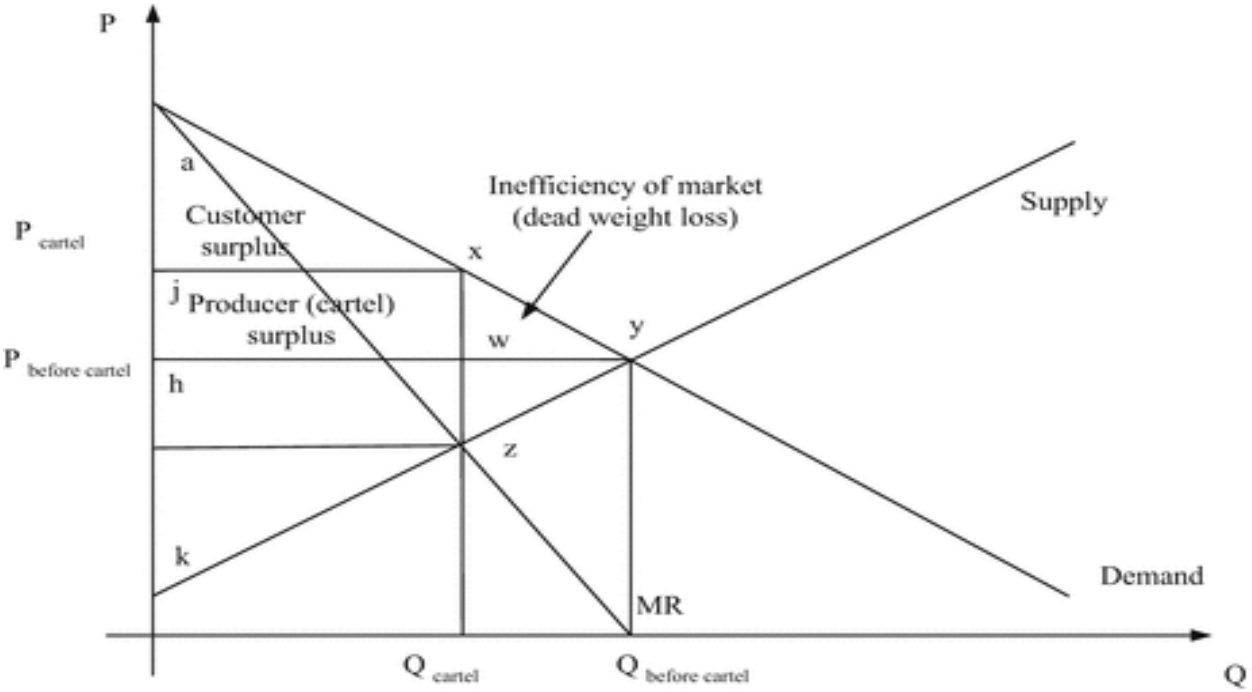
Oligopolies are characterized by few sellers, limited entry, homogeneous or differentiated products, and firm's awareness of strategic interdependence between each other.

Cartels: formed when oligopolistic firms collude in setting prices or quantities to raise their profits

- Oligopolistic firms have incentives to form cartel (collude) to increase their profits.
  - Each member agrees to reduce its output from the level of output if it acted independently → market price rises and firms earn higher profits
- Cartels tend to produce the output analogous to monopolies → helps achieve the highest possible collective profit
- Producers in a cartel explicitly agree or collude to cooperate in setting prices and output to make more profits.
  - Cartels only work when all firms produce the same amount

Collusion

- If demand is sufficiently inelastic and cartel is enforceable, prices may be well above competitive levels.
- Since price is higher than competitive price, cartels leads to DWL in the economy.
  - E.g. OPEC



Why Cartels Fail?

- Antitrust Laws (US) or Competitive Laws (Canada) prohibits the formation of cartels. The motivation behind such laws is to foster competition in the market and protect consumers
- A cartel may fail if non-cartel members can readily undercut prices or can replace the supply reduction undertaken by cartels.
- It may also fail when members cheat. In a cartel, members have incentives to cheat as they can gain by cheating.

Maintaining Cartels – Conditions for Success

1. *Enforcement and Detection*: Temptation to cheat may be deterred by threat of retaliation.

- There must be a mechanism for detection of cheating and punishment for violators.
- GE and Westinghouse included "most-favored-customer" clauses in their purchase agreements that ensured that the seller would not offer a lower price to any other current or future buyer without offering the same price decrease to the firms that signed these contracts → if company cheats by cutting prices, it has to lower prices to all previous buyers as well.

2. *Potential for Monopoly Power*: Cartels can be more successful when demand is more inelastic.

- Government support or exemption from competition laws can help foster cartels.

3. *Barriers to entry*: limit the number of firms in a market

- When new firms enter the market, the cartel is likely to fail.
- The fewer the firms in a market, the more likely it is that other firms will know if a given firm cheats and the easier it is to impose penalties

4. *Fringe firm consideration*: Members of cartel must consider the actions of non-members (fringe firms) when making pricing decisions.

Management challenges: Strategic actions to deter entry.

- e.g. Threatening to decrease price against new competitors by keeping excess capacity.

Rival behavior: Each firm must consider how its actions (pricing or output decisions) will affect its rivals and in turn how these rivals will react.

Cournot Duopoly: two firms compete in choosing quantities (more realistic)
Bertrand Duopoly: two firms compete in choosing prices

Best Response Functions: shows the firm's best output as a function of the other firm's output and depends on the firm's marginal cost.

Nash-Cournot Equilibrium: the set of quantities chosen by firms where no firm can obtain higher profits by choosing a different quantity (holding the quantities of all other firms constant) → intersection of best-response curves

Solving Cournot Model and Deriving Best Response Functions:

Step 1: Find the residual demand function
Step 2: Use the residual demand function to find the MR equation of each firm
Step 3: Set MR = MC for both firms
Step 4: Solve for Q_A and Q_B
Step 5: Use Q to find the price

Explanations of Steps:

Step 1: For *Cournot oligopolies*, where there are only two firms that are identical in marginal cost and their demand curves (this is also called a duopoly), we look for their residual demand curves so we can solve for the best-response functions.

- Because the two firms compete with one another, they consider each other's behavior when choosing profit-maximizing output.
    - The firms are concerned with the residual demand curve, which shows the market demand that is not met by other sellers at any given price.

Step 2: Once we know the residual demand function, we want to find the MR equation of each firm so we can set the profit maximizing condition that a firm should follow to maximize its profit given the behavior of the other firm

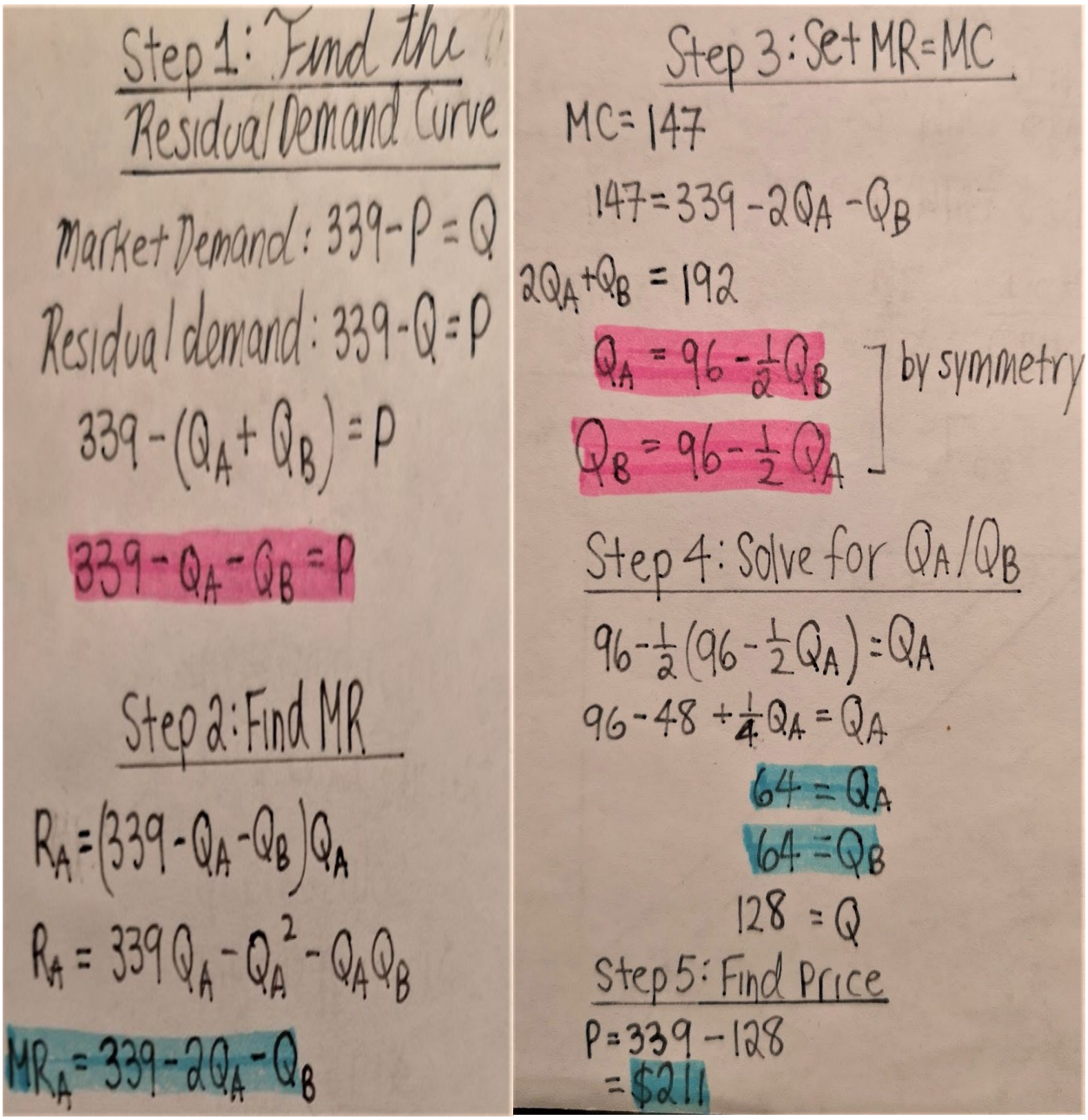
- The firm's best response - its profit maximizing output given the output of the other firm - is the output that equates its marginal revenue and its marginal cost
- Because the two firms have the same marginal cost and demand curves, their best-response functions will be identical

Step 3: Set MR=MC and solve for the best response functions

Step 4: To solve for Q_A and Q_B, we take the best response functions of one firm and plug it into another. This will give us the quantity a firm should produce in response of another.

Oligopolies

Question 5: There are two firms in a Cournot duopoly. The market demand function is Q = 339 – P and the cost function is C = 147Q. Find the equilibrium price, the quantity produced by each firm, and the profit of each firm.



Question 6: In the airline example in the textbook, American and United are duopolists, each with marginal cost equal to $147 per passenger and jointly facing market demand $P = 339 - q_A - q_B$. The Nash-Cournot equilibrium quantities and price were calculated as $q_A = q_B = 64$ and P* = $211. Suppose American and United successfully form a cartel and agree to share the market demand equally:

A. Each firm would reduce the quantity supplied by 25 percent.
B. If American decided to cheat within the cartel, it would raise its price above that set by United.
C. The deadweight loss per passenger in this market will decrease.
D. The cartel arrangement can be described as a prisoners' dilemma.

P= 339 - Q

$R = 339Q-Q^2$

MR = MC

339 - 2Q = 147

Q= 96, each firm produces 48

- *If American decided to cheat within the cartel, it would cut its price above that set by United.*
- *The deadweight loss per passenger in this market will increase*
- *The cartel arrangement cannot be described as a prisoners' dilemma.*
    - *No dominant strategy solution*

Question 7: Assume that Intel and Nvidia are the only two firms that produce graphics cards that are used in high end computers. In this market, Intel and Nvidia's products differ physically. From Intel's long-standing advertising campaign, it has convinced some of the consumers in this market of its superiority. Therefore, consumers view Nvidia and Intel's graphic cards as imperfect substitutes, which is reflected in their different estimated inverse demand functions:

$$p_N = 197\text{-}15.1_{qN}\text{-}0.3_{qI}$$
$$p_I = 490\text{-}10_{qI} - 6_{qN}$$

where price is dollars per graphics card, quantity is in millions of graphics cards, the subscript I indicates Intel, and the subscript N represents Nvidia. Assume that each firm faces a constant marginal cost of $40 per unit and has no fixed cost. The two firms compete by setting quantities simultaneously.

Derive each firm's best response function. Solve for the Nash equilibrium quantities and prices.

Different demand equations, imperfect substitutes → therefore, we will work with profit to find the best response functions

Profit in this case is $\pi = (P\text{-}MC)Q$

The firms' profit functions are

$\pi_N = (197 - 15.1q_N - 0.3q_I - 40)\, q_N$

$\pi_I = (490 - 10q_I - 6q_N - 40)\, q_I$

Simplified profit functions:

$\pi_N = 157q_N - 15.1q_N^2 - 0.3q_Iq_N$

$\pi_I = 450q_I - 10q_I^2 - 6q_Nq_I$

Find best response functions by taking the derivative of the profit functions and setting them equal to 0.

$d\pi_N/dq_N = 157 - 30.2q_N - 0.3q_I = 0$

$q_N = (157 - 0.3\,q_I)\,/30.2 \rightarrow$ *best response function for Nvidia*

$d\pi_I / dq_i = 450 - 20q_I - 6q_N = 0$

$q_I = (450-6q_N)/20 \rightarrow$ *best response function for Intel*

<u>Substitute best response function into each other:</u>

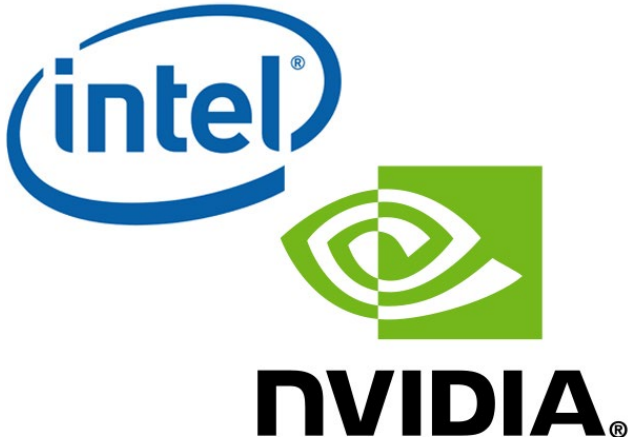
$q_N = 15, 025/3011$

$q_I = 63240/3011$

Find price by substituting these quantities back into the original estimated inverse demand functions

$P_A = \$115.2$

$P_I = 250.$



Game Theory Pt. 1

Game Theory: tries to determine the optimal strategy for each player
A game consists of:

1. Players (i.e. firms)
2. Rules (simultaneous, sequential)
3. Strategies (price and quantity decisions, given the other's move)
4. Payoffs (what each player receives for the combination of strategies)

Cooperative Game: Players negotiate binding contracts that allow them to plan join strategies.

- e.g. Buyer and seller negotiating the price of a good/service or a joint venture by two firms.

Non-Cooperative Game: Negotiation or enforcement of binding contracts between players is not possible.

Static game: each player acts once and at the same time
Dynamic Game: arises when players move sequentially or repeatedly

- Stackelberg: Sequentially, one player goes first followed by the other
- Cournot: Repeatedly, multiple rounds of the game

Dominant Strategy: the strategy that is best no matter what one's rival does
Nash Equilibrium: the set of strategies such that each player is doing the best it can, GIVEN the strategy of the rival player(s)

When at least one player has a dominant strategy then the outcome is a unique Nash equilibrium.

Prisoner's Dilemma Game:

1. There is a dominant strategy solution
2. An alternative outcome exists that provides higher payoffs for all players

- In a prisoner's dilemma game, the Nash Equilibrium can be worse than a possible outcome in the game
    - There can be another possible outcome that can give better payoffs than the Nash Equilibrium, but is not achieved

Player B

Player A	Confess	Don't Confess
Confess	**-2, -2**	**0,-3**
Don't Confess	**-3,0**	**-1,-1**

Maximin Strategy: risk averse strategy that maximizes the minimum possible payoff

- "What is the minimum payoff I can get if I use this strategy?"
    - The player then choose the strategy with the highest minimum payoff
- A maximin solution occurs when both players play the maximin strategy

Tit-for-Tat Strategy: repeated game strategy in which a player responds in kind to an opponent's previous move, cooperating with cooperative rivals and retaliating against uncooperative ones.

Bed Bath and Beyond

Kohls	Low Price	High Price
Low Price	10, 10	80, -50
High Price	-50, 80	50, 50

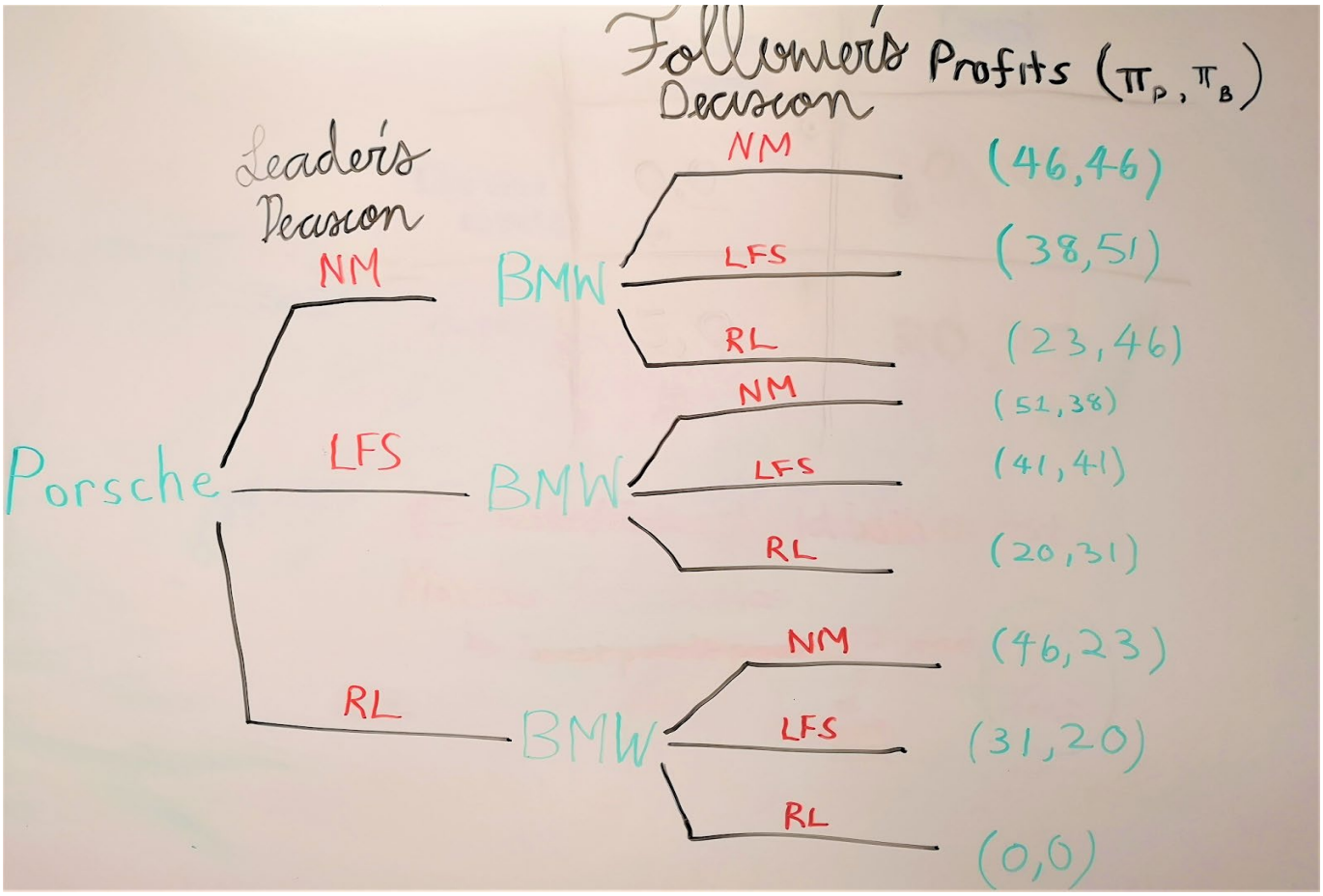
- If both Kohls and BBBY play a "tit for tat" strategy, they start by cooperating (high price) and then do what the rival did before.
- If Kohl "defects" and chooses a low price, Firm 1 gains 30 (=80-50) in the first period. But then it loses 40 (=50-10) in the subsequent period if it plays low
    - It will lose 100 ((50-(-50)) if it plays high. Therefore, it would not want to defect.

Stackelberg Oligopoly: A sequential game in an oligopoly where there is one leader and one follower (could have several followers).

- The leader sets its output first, and then the followers will make its best response to the leader's output decision
- If a leader can predict what the follower will do before the follower acts, then the leader can choose their output level to manipulate their followers and benefit at the follower's expense
- Can be illustrated with a game tree
- First mover has an advantage

		BMW		
		Reduce Lineup	**Lease/Finance Sale**	**New Model**
PORSCHE	**Reduce Lineup**	0, 0	31, 20	46, 23
	Lease/Finance Sale	20, 31	41, 41	51, 38
	New Model	23, 46	38, 51	46, 46

New Model → NM
Lease/Finance Sale → LFS
Reduce Lineup → RL



- It is easier to find the Nash equilibrium if we show the game in extensive form (game tree).
- The Stackelberg Equilibrium is a Nash equilibrium in the sequential game where Porsche goes first
    - In this example, the Stackelberg Equilibrium is for Porsche to reduce their lineup and for BMW to introduce a new model

The strategy for BMW is a contingent strategy:
i) Choose Lease/Finance Sale if Porsche chooses New Model
ii) Choose Lease/Finance Sale if Porsche chooses Lease/Finance Sale
iii) Choose New Model if Porsche chooses to Reduce Lineup

Game Theory Pt. 1

The following diagram below shows the payoff matrix for the decisions of you and your professor.

		Professor		
		Test	Quiz	Cancel Class
You	Eat	0,0	8,3	18,6
	Study	3,8	18,18	23,12
	Sleep	6,18	12,23	21,21

What is the Nash Equilibrium?

Nash Equilibrium: the set of strategies such that each player is doing the best it can, GIVEN the strategy of the rival player(s)

You: ***Study***

Professor: ***Quiz***

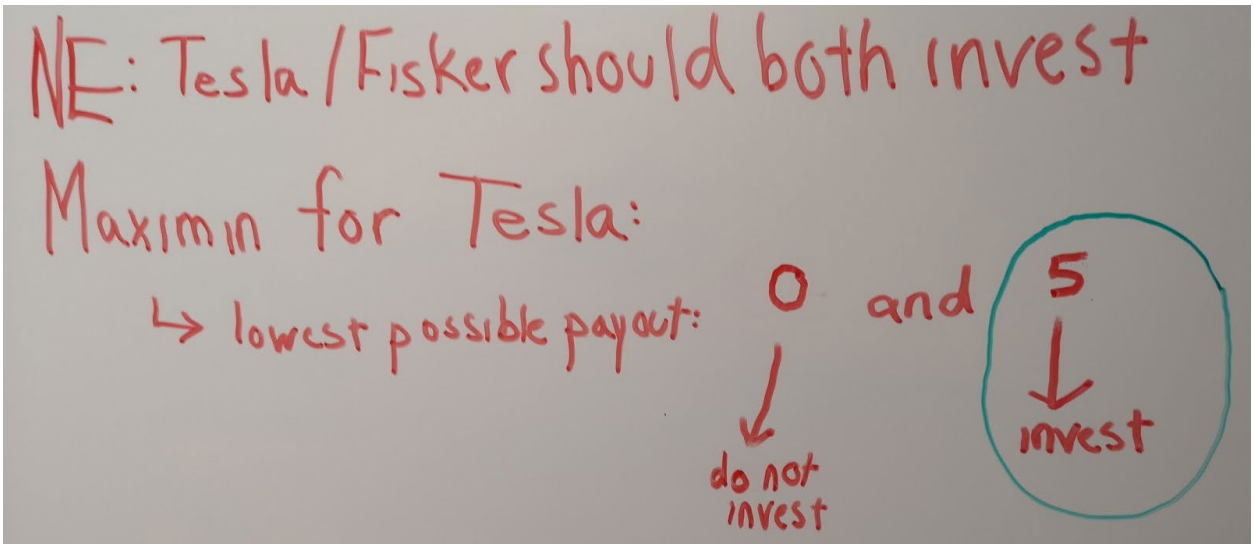
Is this a Prisoner's Dilemma Game?

No, there is no dominated strategy solution.

Question 9:

		Fisker: Do not Invest	Fisker: Invest
Tesla	Do not Invest	0, 0	0, -25
	Invest	5, 0	20, 20

a. The maximin solution is also a Nash equilibrium in this case.
b. The maximin solutions provides a payoff of 20 to Fisker.
c. **The maximin solution provides a payoff of 5 to Tesla**.
d. Neither firm has a dominant strategy in this game
e. None of the above



Question 10: The following repeated game is played indefinitely

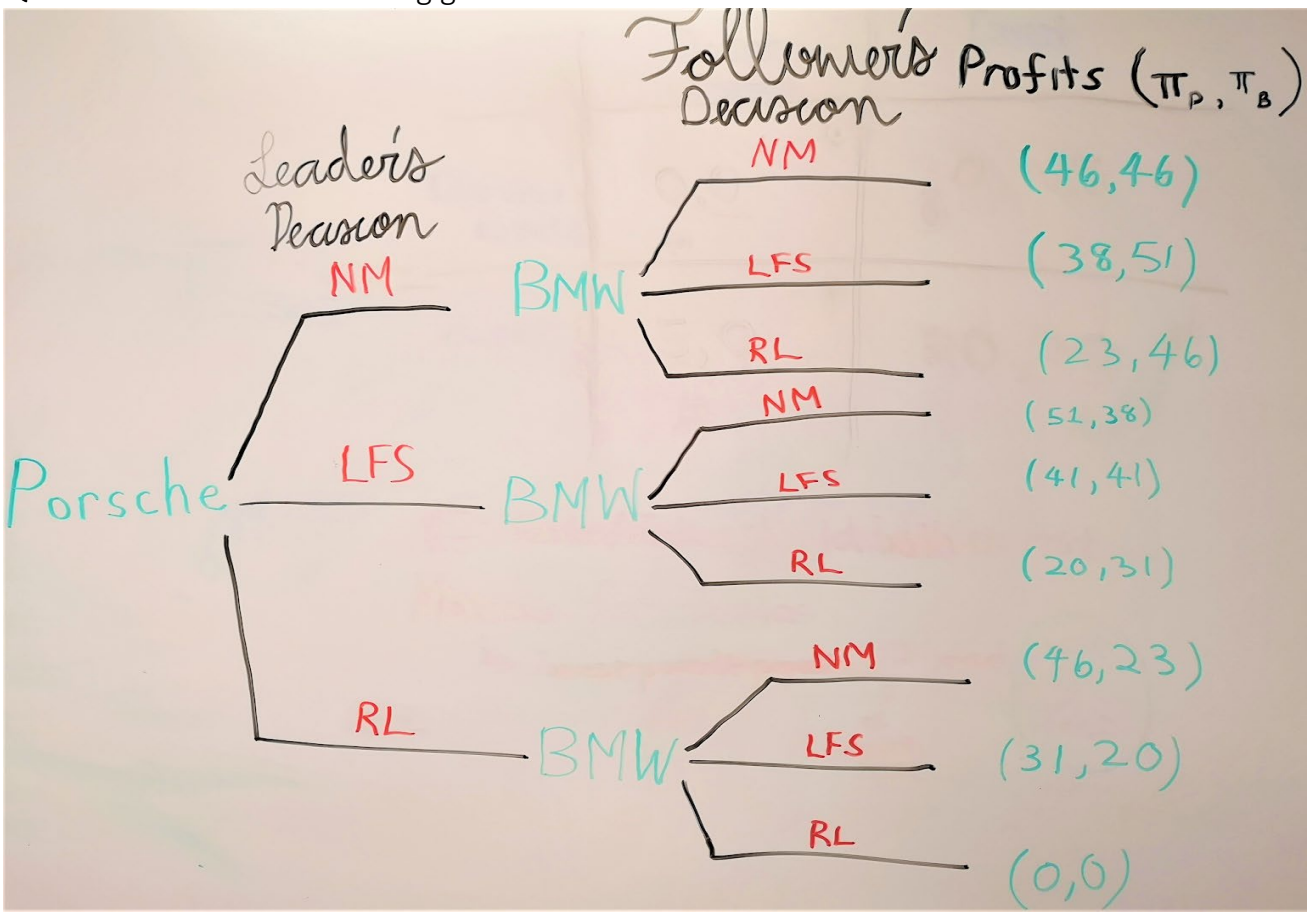
		Bed Bath and Beyond	
		Low Price	High Price
Kohls	Low Price	10, 10	80, -50
	High Price	-50, 80	50, 50

A. Tit-for-tat strategies are the only Nash equilibrium.
B. A tit-for-tat strategy cannot be part of a Nash equilibrium.
C. **The cooperative equilibrium (50, 50) can be achieved as a Nash equilibrium.**
D. b. and c.
E. None of the above.

- *In repeated games of indefinite length it is possible for cooperation to be maintained using contingent strategies such as "tit for tat" strategies*
  - *The game does not have to be infinite. All that is needed is that each period, the game has a high enough probability of continuing to the next period.*
- *Tit-for-tat strategies are not the only Nash equilibrium.*

A tit-for-tat strategy can be a part of a Nash equilibrium (i.e. to cooperate)

Question 11: Use the following game tree to choose the best answer.



A. If Porsche chooses New Model instead of Reduce Lineup, BMW's best response strategy changes.

B. If Porsche chooses New Model instead of Reduce Lineup, BMW's best action or move changes.

C. The question of who goes first makes no difference to each firm's payoff.

D. None of the above.

Strategy doesn't change, but BMW's best action or move changes

Game Theory Pt. 2

Referring back to our Stackelberg oligopoly example, there are *subgames* within it
Subgame: consists of all the subsequent actions that players can take (given the actions already taken) and the corresponding payoffs
Subgame-perfect Nash equilibrium: can be found through backwards induction; occurs when the players' strategies form a Nash equilibrium in every subgame (including the overall game)

- the set of strategies such that each player is doing the best it can, GIVEN the strategy of the rival player(s)

Credible Threat: for a threat to be credible, the rival must believe that it is in the player's best interest to use it

- In simultaneous games, firms will produce the Nash equilibrium quantity
    - Threats will not be credible if output hasn't been produced yet

Commitment: changes a non-credible threat into a credible threat

Entry Deterrence: in some markets, an established firm (also known as incumbent) firm might be able to act strategically to prevent rivals from entering the market by moving first

Four Methods of Deterring Entrance

1. *Paying to prevent entry using exclusion contracts:* incumbent firm will pay to prevent entrance

2. *Limit pricing*: setting low enough price (or high enough output) so that another firm cannot enter profitably

- Only credible if incumbent has some advantage over its rival (lower costs)
    - Incumbent would not lower price if it makes them unprofitable

3. *Reputation effects in repeated games*: if a game is played only once, players are rational, and payoffs and rationality are common knowledge, then entry cannot be deterred

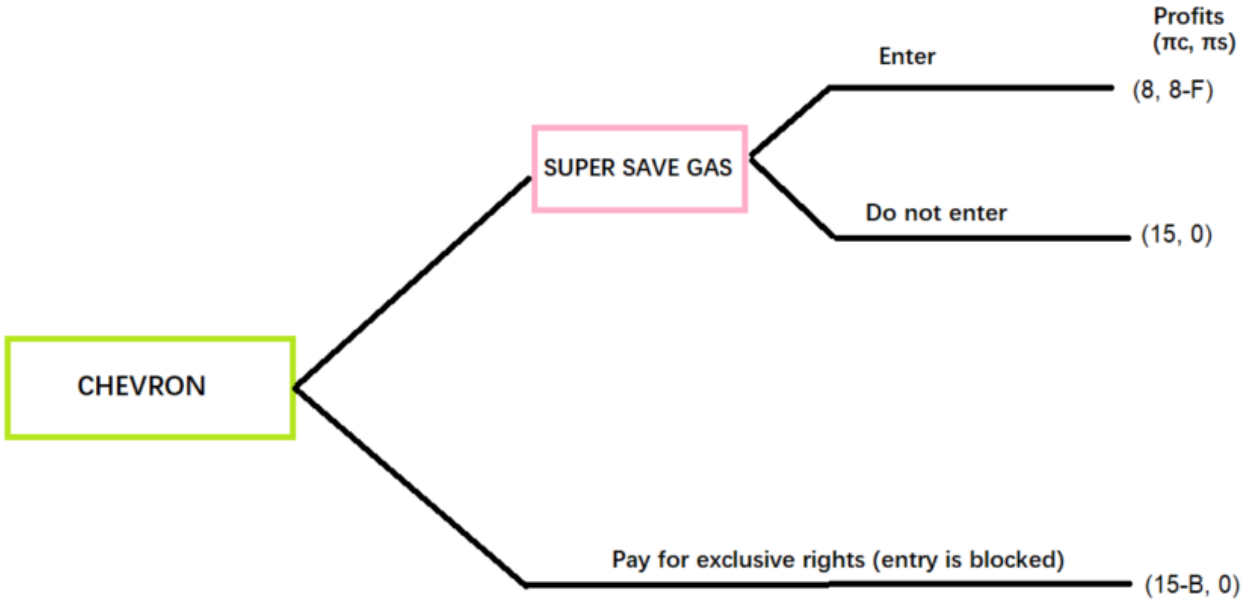
- If the game is repeated and if the incumbent's payoffs are not known by the potential entrant, then entry may be deterred
- In a repeated game, even if it is not profitable for a firm to fight, it may be a good strategy if its profits are not common knowledge and the potential rivals have incomplete information
    - Incumbent develops a reputation for being a tough competitor

4. *Investments to lower marginal cost*: incumbent makes costly investment that lowest marginal cost

- Incumbent becomes more difficult firm to compete against if entry occurs
    - Used to deter entry

Game Theory Pt. 2

Question 12:



F → fixed cost of Super Save Gas
B → payment to the provincial government to prevent entry (exclusivity fee)

What range of values (for F and B) would effectively block entry?

Entry is blocked when F>=8 or when B<=7

What range of values (for B) would Super Save Gas to enter?

F<=8 and when B>=7

Question 13: In British Columbia, Visions and The Source compete in the market for electronics. The matrix below shows profits for the firms for quantities set according to a Cournot duopoly and a Cartel agreement. (In each cell, the payoff to Visions is on the left)

The Source

Visions		Cartel Quantity	Cournot Quantity
	Cartel Quantity	?, ?	500, 750
	Cournot Quantity	750, 500	600, 600

The game is a prisoner's dilemma when ? takes the following range of values:

Prisoner's Dilemma Game:

1. *There is a dominant strategy solution*
2. *An alternative outcome exists that provides higher payoffs for all players*

- *In a prisoner's dilemma game, the Nash Equilibrium can be worse than a possible outcome in the game*

There can be another possible outcome that can give better payoffs than the Nash Equilibrium, but is not achieved

600 < ? < 750

If X= 650, the Nash Equilibrium payoffs are:

600, 600

Question 14: Consider the following game with a police officer and Carlos.

		Carlos	
		Drive Slow	Drive Fast
Police Officer	Set up speed trap	0, 0	3, -1
	Go home and grab donuts	1, 2	x, y

Drive Slow → DS

Drive Slow → DS Set up speed trap → ST
Drive Fast → DF Go home and grab donuts → GD

A. Find all values of x and y such that the game has a dominant strategy solution.
Only Grab Donuts can be the dominant strategy for the Police Officer and Drive Slow for Carlos. Hence, x > 3 and y < 2.

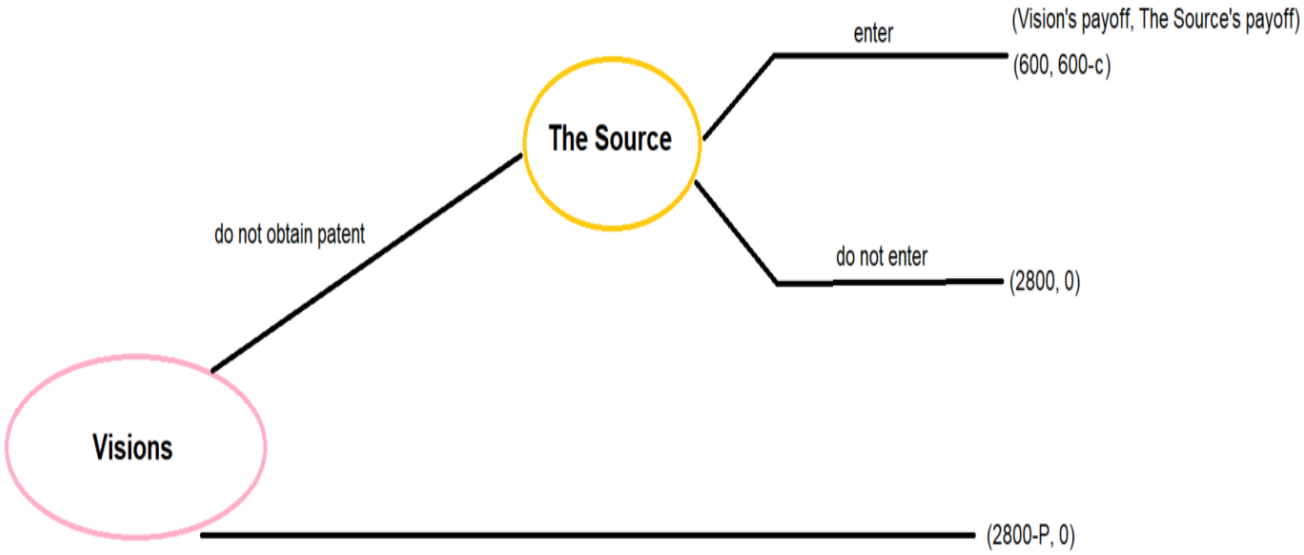
B. Find all values of x and y such that (Speed Trap, Drive Slow) is a Nash equilibrium.
No values of x and y can make this possible, because when Carlos drives slow, set up a speed trap is not a best response for the Police Officer

C. Find all values of x and y such that (Grab Donuts, Drive Slow) is a Nash equilibrium.
As long as y< 2 and x E R, (Grab Donuts, Drive Slow) is a NE.

D. Find all values of x and y such that (Grab Donuts, Drive Fast) is a Nash equilibrium
As long as x >3 and y>2, (Grab Donuts, Drive Fast) is a NE.

Question 15: Suppose that Visions is initially the only firm in this market and earns a profit of 2800 if it remains a monopolist. However, The Source can enter the market with the following two conditions: (i) The Source pays an up-front fixed investment cost of C; and (ii) Visions chooses to not obtain a patent prior to The Source's entry decision. If entry occurs, Visions and The Source will produce the Cournot quantity, 600. The cost to Visions of obtaining a patent is P. If The Source does not enter, its payoff is zero.

Draw the extensive form for this sequential game.



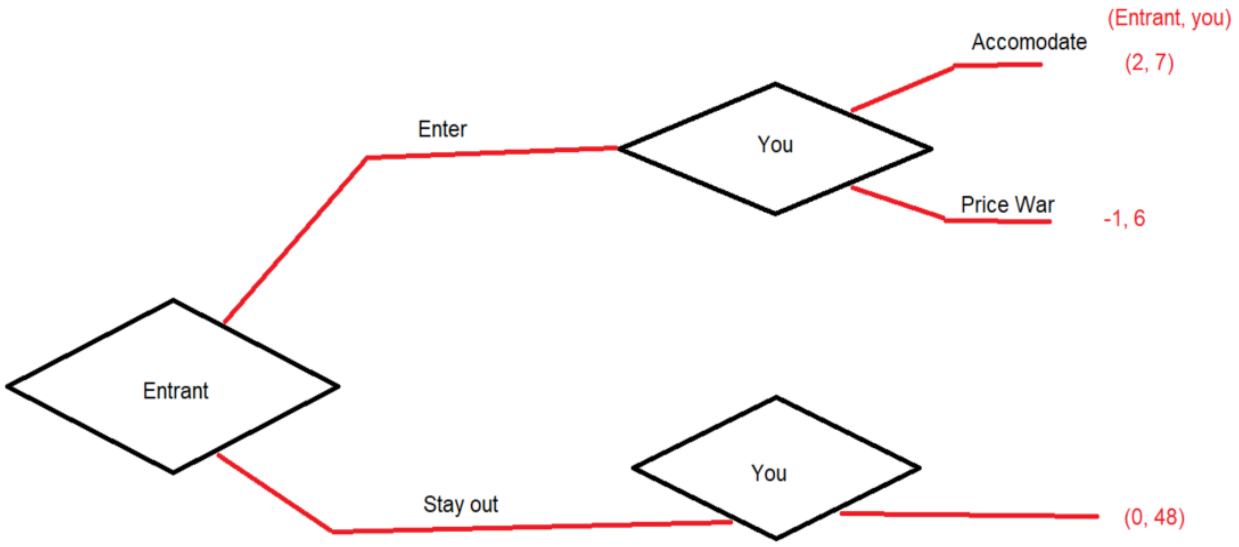
For what range of values for C and P will The Source enter the market?

C=<600 and P>2200

Explain briefly:

If C>600, entry is not profitable for The Source, therefore, The Source would not enter. When C=<600 and P=<2200, Visions could obtain a patent to deter entry and receive a payoff higher than if it did not obtain patent.

Question 16: Suppose that you own a convenience store called Corner 38 in Maple Ridge. Another entrepreneur in the same area is thinking about opening a convenience store as well. You threaten the potential entrant with a price war if it enters.



Is your threat credible? Explain.

Your threat is NOT credible.

It is not credible because if entry occurs, you get 7 by accommodating and only 6 in price war. You get more by accommodating. You therefore have an incentive to accommodate and do not have an incentive to start a price war.

How much are you willing to pay the potential entrant to keep it out of the market? (The maximum amount you are willing to pay.) Explain.

You would be willing to offer up to a maximum of 41 to keep the entrant out of the market. The reason is that you get 48 if the entrant stays out and only 7 if it enters. As 48 – 7 = 41, you would gain as long as the payment is equal to or less than 41.

Will the potential entrant accept your offer? Explain.

The potential entrant will accept your offer as long as it exceeds 2 because the entrant gets 2 if it enters and would be willing to stay out as long as it gets more than 2 for staying out.

Uncertainty

To measure risk, we must know:
1. All the possible outcomes.
2. The probability that each outcome will occur.

Two measures to help describe and compare risky choices are:

1. Expected value E(X)

The weighted average of the values resulting from all possible outcomes.
Assume n possible outcomes
Values of possible outcomes: X_1, X_2, ..., X_n.
Probability of each outcome: P_1, P_2, ..., P_n.
$E(X) = P_1X_1 + P_2X_2 + ... + P_nX_n$

2. Variability

Variability comes from deviations in actual payoffs relative to the expected payoff.

- Greater variability of actual payoffs the expected value signals greater risk.
- Variance or Standard Deviation measures variability.

Variance: $\sigma^2 = P_1(X_1-E(X))^2 + P_2(X_2-E(X))^2 + ... + P_n(X_n-E(X))^2$
Standard Deviation: Take the square root of variance

Attitude Towards Risk
Risk averse: unwilling to take a fair bet

- Utility function is concave to the wealth axis; utility rises with wealth, but at a diminishing rate
    - diminishing marginal utility of wealth: extra pleasure from each extra dollar of wealth is smaller than the extra pleasure from the previous dollar
    - e.g. if a stock (high risk) and a GOC bond (zero risk) has the same return/expected value, a risk adverse person would choose the bond

- If you dislike risk, then you may choose a riskier investment only if it gives you sufficiently higher expected value than the less risky alternative
    - choose the option that gives the highest expected utility.

Risk Premium: maximum amount that a decision maker would pay to avoid taking a risk

- The minimum extra compensation (premium) that a decision maker would require to willingly incur a risk

Uncertainty

Question 17: If Tina invests the money she has in her savings account in a GOC bond, her future wealth is equal to $100,000 and she faces zero risk (hypothetically). If she instead invests in Brookfield Renewable Partners LP's stock (more volatile and riskier investment), her future wealth is equal to $50,000 with probability 0.4 and $175,000 with probability 0.6. If Tina chooses the GOC rather than investing in shares of Brookfield Renewable Partners LP, then we can conclude that her risk premium is at least as large as X.

Calculate X.

The expected value of investing in Brookfield Renewable Partners LP's is 0.6x175,000 + 0.4x50,000 = 125,000.

Tina's risk premium is calculated by subtracting her certainty equivalent future wealth from her expected future wealth with the Brookfield Renewable Partners LP's stock. Based on the previous results we can conclude that Tina's risk premium is at least as large as 125,000 – 100,000 = 25,000.

- *If Tina's risk premium is less than 25,000, then she would choose to invest in Brookfield Renewable Partners*

Question 18: Suppose Carl has $70 and has the opportunity to invest it in a risky asset that pays him $100 with probability 1/4 and $60 with probability 3/4.

Calculate the expected value and the variance of the risky asset.

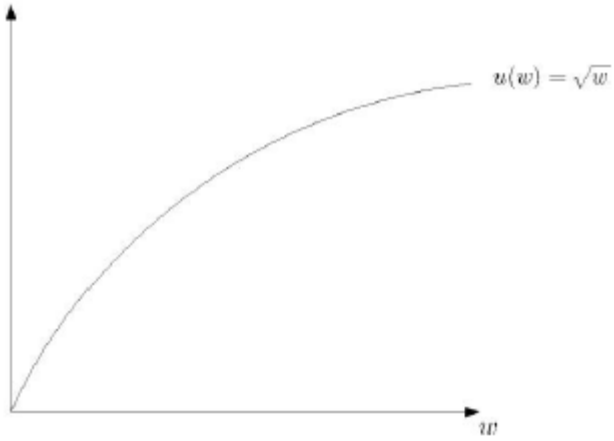
Expected Value = 0.25*100 + 0.75*60 = 70

Variance = 0.25*(100-70)^2 + 0.75*(60-70)^2 = 300

If Carl is risk averse, will he want to buy this asset? Explain

Carl will not buy because a risk averse individual will prefer a guaranteed amount of $70 over a gamble with an expected value of $70.

Suppose we can represent Carl's preferences with the utility function $u(w)=\sqrt{w}$. Illustrate this utility function in a diagram below



Based on the shape of this function we can conclude that Carl is risk averse.

Carl's expected utility is 8.309475.

Expected Utility = (0.25)√100+(0.75)√60 = 8.309475

Asymmetric Information

Asymmetric Information: a situation where one party knows more than others

- Many markets such as insurance, financial credit and employment are characterized by asymmetric information about product quality
- Two types of informational asymmetry: hidden characteristics and hidden actions

Such asymmetric information leads to opportunistic behavior:

1. Adverse selection or lemons problem.
2. Moral hazard.

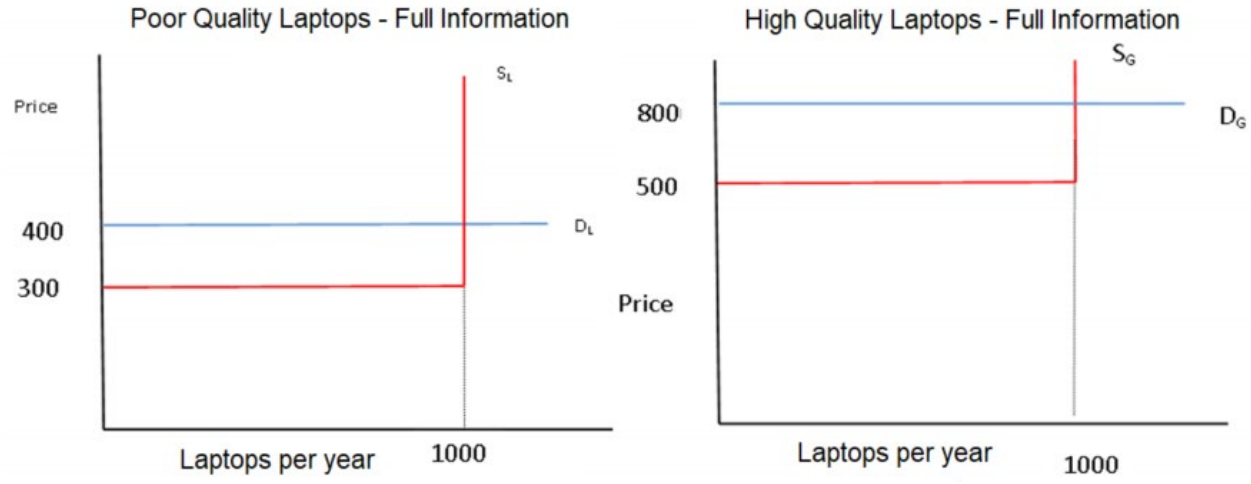
Adverse Selection - Used Laptops (also known as the Lemon Problem)

- Two kinds of laptops – high quality and low quality (lemons)
- Buyers and sellers can distinguish between the laptops (full Information). Everyone is risk neutral.

There are 1000 low quality laptops and 1000 high quality used laptops.

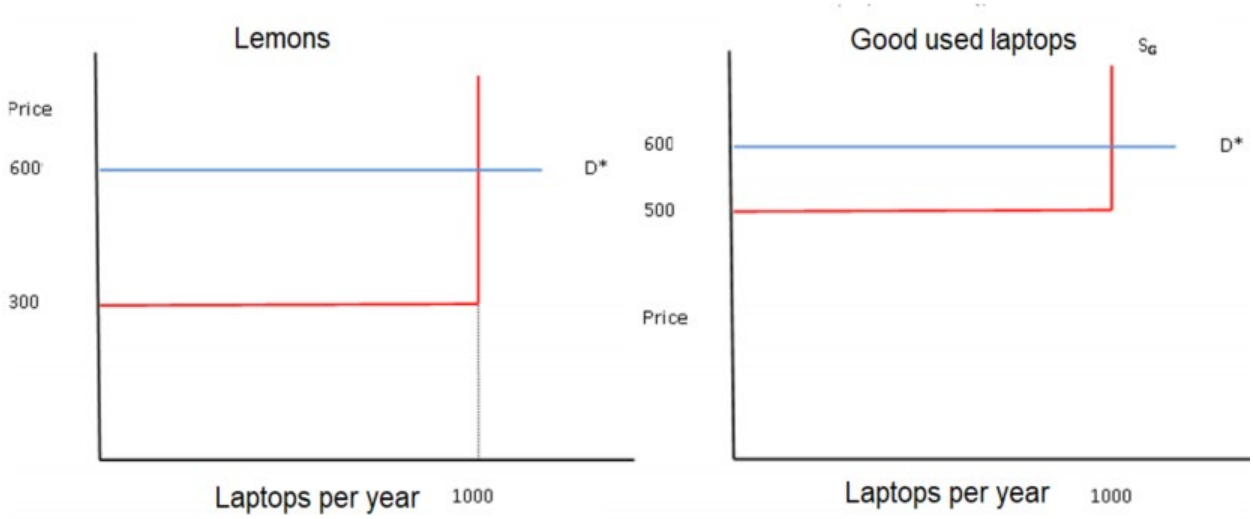
- Owners (sellers) of lemons have a reservation price of $300.
- Owners of good used laptops have a reservation price of $500.

Demand for both types of laptops is perfectly elastic:
For lemons, consumers are willing to pay $400.
For good used laptops, consumers are willing to pay $800.



- Two separate markets. Supply = demand in both.
- Price = $400 in lemon's market
- Price = $800 for good used laptops
- 1000 laptops sold in each market. Surplus is maximized and goes to sellers.

Asymmetric Information with Uninformed Buyers



- Buyers don't know which laptops are good or bad
    - Therefore, buyers are willing to pay the average value for any laptop, as they cannot distinguish between good and bad.
- All laptops sell for $600.
- All surplus goes to sellers, but sellers of lemons get more.

- Classic example of adverse selection -- low quality items dominate the market in that they are over-represented in transactions.
- Inefficient → potential surplus is lost.
    - Sellers of good used laptops have no surplus and everyone else is no better off than with full information, so there is a deadweight loss from adverse selection.

Actuarially fair price: expected payout equals price

Asymmetric Information

Question 19: Consider a market for used laptops where sellers know the quality of laptops and buyers do not. There are many potential buyers. Good used laptops are worth $1000 to buyers and lemons are worth only $500 to buyers. Sellers of good laptops will accept $800 (or more) and sellers of lemons will accept $300 or more. There are 100 laptops of each type potentially for sale. Buyers and sellers are risk neutral.

In equilibrium,

A. The price of lemons will be 500.
B. 100 laptops will be sold.
C. There is a deadweight loss due to adverse selection of $20,000.
D. All of the above.
E. None of the above

- Buyers don't know if they are buying good laptops or lemons, so the most that they are willing to pay is $750 (expected value of laptop: 0.5*1000+0.5*500)
- $750 is less than the reservation price of good laptop sellers (will accept $800 or more)
- Therefore, only 100 lemons are sold at $500 each

- Customers are willing to pay $1000 for good laptops, buyers are willing to sell at $800
    - Because good laptops aren't sold, there is a DWSL of 200*100 = $20,000

Question 20: The expected cost per year is $500 for healthy people and $1000 for unhealthy people. People know if they are healthy but Great West Life does not. The share of healthy people is s = 0.6. Consumers are risk averse. The risk premium is $100 for each person so a healthy person would pay up to $600 for insurance.

A. If everyone is insured the actuarially fair price of insurance is $700.
B. If the price of insurance is $700 then healthy people will not buy insurance.
C. The equilibrium in this case provides insurance only for unhealthy people.
D. a. and b.
E. All of the above.

Actuarially fair price: expected payout equals price

- *The actuarially fair price for the insurance company is $500*0.6 + $1000*0.4 = $700*

If the price of insurance is $700, then healthy people will not buy insurance

- *Remember that the customers are risk averse and have a risk premium of $100 (willing to pay $100 more than expected value for insurance)*
- *Expected value= $500 + $100 = $600 → 700>600*

The equilibrium in this case provides insurance only for unhealthy people because healthy people aren't willing to pay more than $600