Industrial Organization and Firm Strategy

Final Exam

Before the Exam:

- There are totally **5 parts** and **105 points**.
- The exam starts from **9:20 am** and will end at **12:00 pm**. After that you have at most 15 minutes to submit your exam answers, in one PDF file, to NTU Cool. In case you face any technical difficulty when uploading your file, you may instead send your exam answers, in one PDF file, to the TA's mailbox: r10323035@ntu.edu.tw.
- You have to submit your exam answers by **12:15 pm**. Late submissions will not be accepted.
- This is an open-book exam, but you are not allowed to communicate with any person (except for the TA) before 12:30 pm.
- For numerical questions, always explain how you get the answers.
- Make your arguments "to the point" and do not write down irrelevant things.
- Good luck!

Part 1. Natural Gas (20 points)

Suppose there are only two natural gas producers. In each period, firms determine how much natural gas to sell; market price is then determined by total demand and total supply. Marginal cost is given by \$77 for Firm 1 and \$74 for Firm 2. Currently, Firms 1 and 2 are producing 170 units and 200 units, respectively, whereas market price is \$94.

By making an important discovery in the process of hydraulic fracturing (or "fracking"), Firm 2 managed to cut its marginal cost from \$74 to \$68.

Whenever it helps, you may assume that the demand function is linear, e.g., $p = a - b\,Q$, where P is the market-clearing price and Q is the aggregate output level.

A. (10 points) What impact do you expect Firm 2's cost reduction to have on its market share?

Some studies suggest that Firm 2's new production process may not be environmentally sound.

B. (10 points) How much would Firm 1 be willing to pay in support of a campaign to (successfully) prevent Firm 2 from using its new fracking process?

Part 2. Contractual Clauses (25 points)

A. (8 points) Two firms are engaged in Bertrand competition. There are 100 people in the population, each of whom is willing to pay at most $5 for at most one unit of the product. Both firms have a constant marginal cost of $2. Each firm is originally allocated half the market. Customers know what prices are being charged. Law or custom restricts the firms to charging **whole-dollar** amounts.

Suppose that each firm can choose to offer a **meet-the-competition guarantee** that works as follows: if Firm *i* offers this guarantee and its competitor sets a price lower than Firm *i*, then Firm *i* is forced to offer the same low price to all of its customers.

Show that any price between cost and monopoly price can be obtained as the play of a Nash equilibrium.

B. (5 points) Briefly explain the intuition behind the result in Question A.

C. (12 points) You are a B2B seller of artificial sweeteners. Briefly explain whether the following statement is TRUE or FALSE:

"If you offer most-favored customer clauses to some of your major customers, you will make it **harder** for your rival to target any of your customers, and make it **easier** for you to target any of your rival's customers."

Part 3. Sony PlayStation and Microsoft Xbox in 2009 (40 points)

In the mid 2000s, Sony positioned the PS3 as its top video game system, based on its Blu-Ray disc player and powerful processor. There were two versions of the PS3 console. In 2006, the basic model was priced at $499 and the premium model sold for $599. Microsoft also had a low-end Xbox 360, priced at $299, and a high-end version, dubbed the Xbox 360 Elite, priced at $479.10 Nintendo launched the Wii in late 2006, priced at $249.

In the second half of 2007, things began to heat up. In August 2007, Microsoft reduced the price of the Xbox 360 Elite to $450. Two months later, Sony reacted to a loss in market share by reducing the price of each of its two PS3 consoles by $100. In September 2008, Sony cut the price of its high-end model again, to $399. In the same month, Microsoft also cut the price of the Xbox 360 Elite to $399.15 Nintendo did not change its prices.

These price levels held steady for a year. But by August 2009, as the holiday season approached and with the economy still mired in a major recession, gaming blog speculators and analysts at the Wall Street Journal debated whether one or both of the companies would cut prices in the near future. If so, they expected console price cuts of about $100, and they speculated about the resulting sales levels.

Exhibit 1 summarizes the expectations about likely sales levels for different pricing scenarios. **Exhibits 2** and **3** present the cost schedules for Sony and Microsoft. The "overhead" expenses in these exhibits represent the allocation of management and other fixed costs to the console division in each company. The "distribution" costs are negotiated with retailers on a per-unit basis. The lower distribution costs at higher levels of production reflect negotiated reductions in retailer margins available at higher sales volumes.

Exhibit 1

Prices and Projected Annual Sales Volumes for Sony PlayStation 3 and Microsoft Xbox 360 Elite

PS3 Price	Xbox 360 Price	PS3 Projected Number of Units Sold (millions)	Xbox 360 Projected Number of Units Sold (millions)
$299	$299	11.25	11.5
$299	$399	11.75	7.0
$399	$299	8.25	12.5
$399	$399	8.75	8.0

Exhibit 2

Sony PlayStation 3 Production Costs per Unit (US dollars)

Units Produced (in millions)	8.25	8.75	9.25	9.75	10.25	10.75	11.25	11.75	12.25	12.75
Production Labor	98	80	67	55	45	38	32	28	26	28
Materials & Parts	168	161	155	145	143	141	140	140	141	142
Overhead	66.67	62.86	59.46	56.41	53.66	51.16	48.89	46.81	44.90	43.14
Distribution	40	40	40	40	40	40	40	30	30	30
Per Unit Total Cost	**$372.67**	**$343.86**	**$321.46**	**$296.41**	**$281.66**	**$270.16**	**$260.89**	**$244.81**	**$241.90**	**$243.14**

Exhibit 3

Microsoft Xbox 360 Elite Production Costs per Unit (US dollars)

Units Produced (in millions)	7.00	7.50	8.00	8.50	9.00	9.50	10.00	10.50	11.00	11.50	12.00	12.50
Production Labor	78	69	62	56	52	48	46	45	44	44	44	44
Materials & Parts	180	172	167	161	156	153	149	147	146	145	144	144
Overhead	64.29	60.00	56.25	52.94	50.00	47.37	45.00	42.86	40.91	39.13	37.50	36.00
Distribution	50	50	50	40	40	40	40	40	40	30	30	30
Per Unit Total Cost	**$372.29**	**$351.00**	**$335.25**	**$309.94**	**$298.00**	**$288.37**	**$280.00**	**$274.86**	**$270.91**	**$258.13**	**$255.50**	**$254.00**

Answer the following questions:

A. (10 points) Assume that Nintendo monitors its competitors' actions, but has no plans to change its price. Given the information in **Exhibits 1**, **2**, and **3**, would you predict that Sony and/or Microsoft will want to reduce console prices by $100? In particular, write down a 2-by-2 payoff matrix and find the Nash equilibrium for this one-shot game in the short run. You payoff matrix may look like the following table; in each cell you fill in Sony's short-run profit and Microsoft's short run profit:

		Microsoft	
		$399	$299
Sony	$399	,	,
	$299	,	,

Hint: We assume that, in order to make a decision in the short run, a firm only considers variable costs and do not include fixed costs in the calculation of profits.

B. (10 points) Assume that demand curves are all linear. Calculate the own-price elasticities of demand implied by the data at prices of $299 and $399 for both Sony and Microsoft. To be specific, let P_S denote Sony's price and P_M denote Microsoft's price; your job is to calculate:

(1) Sony's own price elasticity around $P_S = \$399\$$ while $P_M = \$399$.

(2) Sony's own price elasticity around $P_S = \$299\$$ while $P_M = \$399$.

(3) Sony's own price elasticity around $P_S = \$399\$$ while $P_M = \$299$.

(4) Sony's own price elasticity around $P_S = \$299\$$ while $P_M = \$299$.

Hint: Since all demand curves are linear, you can actually draw the demand curves or derive the demand functions. Therefore, you should be able to calculate the exact elasticity numbers and do not need to use the arc elasticity formula, which will only give you a very rough estimation.

C. (10 points) Briefly explain what is the elasticity rule, and what is the major tradeoff behind it. Are your answers to Question B consistent with your understanding of the elasticity rule? Why or why not?

D. (10 points) Can you think of reasons why these firms would be particularly aggressive in pricing their consoles?

Part 4. Netflix (10 points)

Until 2020, Netflix was the dominant firm in the global SVOD/AVOD streaming market, with market share (measured in terms of subscribers) more than 50%. The following tale shows that Netflix has been spending heavily on content, including acquiring exclusive content and investing in original content. Explain why this intensive content spend, together with a subscription-based business model, could be a means to deter entry. **Hint:** In order to explain **why**, you need to clearly point out the mechanism (or different mechanisms) through which Netflix makes new comers more difficult to participate in the streaming market.

Netflix content spend

Year	Content spend
2016	$6.88 billion
2017	$8.91 billion
2018	$12 billion
2019	$13.9 billion
2020	$11.8 billion
2021	$17 billion

Part 5. Ivy League (10 points)

The endowments of the Ivy League universities have increased significantly in recent decades. This wealth notwithstanding, for yeas the universities managed to refrain from using financial incentives as a means to compete for students: the manual or the Council of Ivy League Presidents stated that the schools should "neutralize the effect of financial aid so that a student may choose among Ivy Group institutions for non-financial reasons."

In 1991, the Justice Department argued that this amounted to price collusion and forced the arrangement to end. However, no significant price competition took place until 1998, when Princeton University started offering full scholarships for students with incomes below $40,000. Stanford, MIT, Dartmouth, and Cornell followed suit.

Allegedly, Harvard sent a letter to accepted 1998 applicants stating that "we expect that some of our students will have particularly attractive offers from the institutions with new aid programs, and those students should not assume that we will not respond."

How do you interpret these events by applying theories of oligopolistic competition?