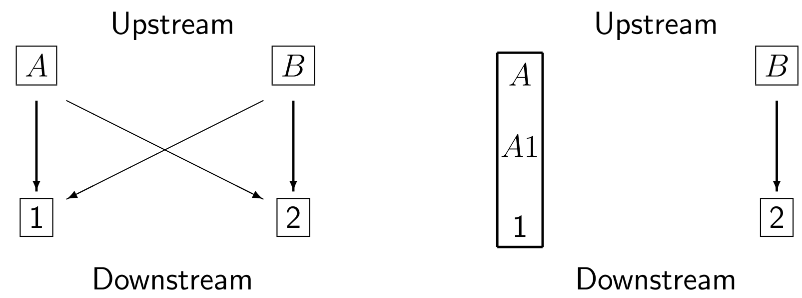
(1) [5 points] Please refer to class discussion and/or Section 8.2 of the textbook. In your answer, you should briefly describe (a) horizontal merger, (b) vertical merger, and (c) conglomerate merger.

(2) [5 points] Please refer to class discussion and/or Section 8.2.2 of the textbook.



The antitrust authority may want to check whether the merger of component supplier A with final good producer 1 may result in a foreclosure on firm 2 in the market for the final good. This may happen if, for some reason, component producer B goes out of business.

(3a) [15 points] Firm A solves

$$\max_{p_A} \pi_A = p_A(180 - 2p_A + p_B) \Longrightarrow p_A = 45 + \frac{p_B}{4}.$$

Notice that profit equals revenue since there are not costs of production in this questions. Firm B solves

$$\max_{p_B} \pi_B = p_B(120 - 2p_B + p_A) \Longrightarrow p_B = 30 + \frac{p_A}{4}.$$

Solving the two best-response functions yields $p_A^b = \$56$ and $p_B^b = \$44$. Substituting into the demand functions yields $q_A^b = 112$ and $q_B^b = 88$ pairs of A and B shoes, respectively. Finally, profits (revenues since production is costless) are $\pi_A^b = p_A^b \cdot q_A^b = \$6272$ and $\pi_B^b = p_B^b \cdot q_B^b = \$3872$. Thus, aggregate industry profit is $\Pi^b = \pi_A^b + \pi_B^b = \$10,144$.

(3b) [10 points] The merged firm sets p_A and p_B to solve

$$\max_{p_A, p_B} (\pi_A + \pi_B) = p_A(180 - 2p_A + p_B) + p_B(120 - 2p_B + p_A)$$

yielding two first-order conditions given by

$$0 = \frac{\partial(\pi_A + \pi_B)}{\partial p_A} = 2(2p_A - p_B - 90) \quad \text{and} \quad 0 = \frac{\partial(\pi_A + \pi_B)}{\partial p_B} = 2[p_A - 2(p_B - 30)].$$

Solving the two first order conditions yields $p_A^j = \$80 > \$56$ and $p_B^j = \$70 > \$44$. Substituting equilibrium prices into the profit of the merged firm yields $\pi_A^j + \pi_B^j = \$11,400 > \$10,144$. Clearly the merger enhances joint profit compared with Bertrand competition.

(4) [10 points] The solution calls for computing expected profits using increasing number of labs. Thus, $\pi(1) = \alpha V - I = \$496$.
$\pi(2) = [1-(1-\alpha)^2]V - 2I = \$736$.
$\pi(3) = [1-(1-\alpha)^3]V - 3I = \$848$.
$\pi(4) = [1-(1-\alpha)^4]V - 4I = \$896$.
$\pi(5) = [1-(1-\alpha)^5]V - 5I = \$912$.
$\pi(6) = [1-(1-\alpha)^6]V - 6I = \$912$.
$\pi(7) = [1-(1-\alpha)^7]V - 7I = \$904 < \$912$.
$\pi(8) = [1-(1-\alpha)^8]V - 8I = \$892 < \$912$.
Thus, the Lazy maximizes expected profit from R&D when it invests in 5 or 6 labs.

If you like to use Calculus, you can solve the following problem: Let n be the number of labs. The CEO sets n to solve

$$\max_n \mathsf{E}\pi = \left[1 - \left(\frac{1}{2}\right)^n\right] 1024 - 16n = 1024 - 1024 \cdot 2^{-n} - 16n.$$

The first-order condition for a maximum is

$$0 = \frac{\mathsf{d}\mathsf{E}\pi}{\mathsf{d}n} = 1024 \cdot 2^{-n} \ln(2) - 16 \Longrightarrow 2^n = 64\ln(2) \Longrightarrow n \cdot \ln(2) = \ln\left(64 \cdot \ln(2)\right).$$

Hence,

$$n = \frac{\ln\left(64 \cdot \ln(2)\right)}{\ln(2)} \approx 5.4712 \text{ labs}.$$

Since n is an integer, you only need to evaluate the expected profit for $n = 5$ and $n = 6$ labs.

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(5) [5 points] Boeing earns a higher profit when it chooses to develop regardless of the choice made by Airbus. Formally, $\pi_B(dev, dev) = 2 > 0 = \pi_B(not, dev)$ and $\pi_B(dev, not) = 50 > 0 = \pi_B(not, not)$ which means that Develop is a dominant action for Boeing. Hence, the EU cannot prevent Boeing from developing the aircraft.

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(6) [10 points] Innovation is drastic (major) if firm A can set a monopoly price, p_A^m and undercut firm B given the new cost structure. That is, innovation is major if $p_A^m(c_1) < c_0 = \$80$.

Let's check it by computing A's monopoly price. If A is a monopoly, it solves $MR = 120 - Q = c_1$. Hence, $Q_A^m = 120 - c_1$. Substituting into the inverse demand function yields

$$p_A^m(c_1) = \frac{120 + c_1}{2} < 80 \quad \text{if} \quad c_1 < 40.$$

To conclude, A's innovation is called drastic (major) if $c_1 < 40$ and minor if $c_1 \geq 40$.

(7a) [5 points] First, we check a consumer's willingness to pay for this type of warranty by evaluating the net utility

$$\rho V + (1-\rho)\rho V + (1-\rho)^2 \rho V - p \geq 0 \Longrightarrow p \leq \$210.$$

An alternative method of computing the maximum price that the monopoly can charge is to use the fact that the product fails 3 times with probability $(1-\rho)^3$. Hence, the product fails at most twice with probability $[1-(1-\rho)^3]$. Hence,

$$p \leq \left[1 - (1-\rho)^3\right] V = 240\left(1 - 0.5^3\right) = \$210.$$

Next, we compute the monopoly's expected cost to be

$$c + (1-\rho)c + (1-\rho)^2 c = \$105.$$

Therefore, expected profit is $\pi = 210 - 105 = \$105$.

(7b) [5 points] First check a consumer's willingness to pay for this warranty type.

$$\rho V - p + (1-\rho)p \geq 0 \Longrightarrow p = V = \$240.$$

That is, since the consumer is fully insured, the consumer is willing to pay her entire valuation under the money-back guaranty.

Expected cost is

$$c + (1-\rho)p = 60 + (1-0.5)240 = 180.$$

Hence, expected profit is $\pi = 240 - 180 = \$60$.

Notice that this is the same profit that the monopoly can obtain by selling without any warranty. As we learned in class, money back guaranty may not be profitable to the monopoly (as opposed to replacement warranty).

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(8) [5 points] From class discussion and/or your reading of Section 9.7, your answer should be that patents are granted for (i) products, (ii) processes, (iii) plants, and (iv) design.

The three requirements are: (i) Novelty, (ii) nonobviousness, and (iii) usefulness.

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(9) [5 points] The Dorfman-Steiner condition implies

$$\frac{A}{pQ} = \frac{20}{100} = \frac{1}{5} = \frac{\epsilon_A}{-\epsilon_p} = \frac{\epsilon_A}{2}.$$

Hence, the advertising elasticity if $\epsilon_A = 0.4$.

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(10) [5 points] Suppose that Summer is the high season. Then,

$$MR_S = 12 - q_S = r + c = 3 + 4 \Longrightarrow K = q_S = 5 \Longrightarrow p_S = 12 - \frac{5}{2} = \frac{19}{2} = \$9.5.$$

$$MR_W = 24 - 4q_W = c = 4 \Longrightarrow q_S = 5 \leq K \Longrightarrow p_W = 24 - 2 \cdot 5 = \$14.$$

Note that we have verified that Summer is indeed the high season since $q_W = 5 \leq K = q_S$. The profit over a cycle of one Summer and one Winter is

$$\pi = \frac{19}{2} \cdot 5 + 14 \cdot 5 - 5(3+4) - 5 \cdot 4 = \frac{125}{2} = \$62.5$$

(11a) [5 points] Since $\epsilon < 60$, it must be that $\phi < 60$. Hence, $60 - \epsilon > \phi - \epsilon$. Therefore, Firm A's SPE strategy is

$$s_A = \begin{cases} \text{stay} & \text{if } s_B = \text{enter (because } 60 - \epsilon > \phi - \epsilon) \\ \text{stay} & \text{if } s_B = \text{out (because } 100 - \epsilon > \phi - \epsilon) \end{cases}$$

The SPE strategy of firm B (first mover) is $s_B =$ enter (because $60 - \epsilon > 0$).

(11b) [5 points] Now, $60-\epsilon<\phi-\epsilon$. Therefore, Firm A's SPE strategy is

$$s_A = \begin{cases} \text{exit} & \text{if } s_B = \text{enter (because } 60-\epsilon<\phi-\epsilon) \\ \text{stay} & \text{if } s_B = \text{out (because } 100-\epsilon>\phi-\epsilon) \end{cases}$$

The SPE strategy of firm B (first mover) is $s_B =$ enter (because $100-\epsilon>0$).

THE END

