Homework 3
Solutions

ECON 101

Summer I 2016

Name: _____

ONYEN: _____

PID: _____

This homework is due on **May 26** by **1PM**. Show work for all questions that require it (including multiple choice questions), attaching extra sheets as necessary. Multiple choice answers should be bubbled in on a scantron. For the short answer section, write legibly and make sure to box final answers. The total number of points available on this assignment is **100**.

Multiple Choice [2 pts each]

1. If a profit-maximizing competitive firm is producing a quantity at which marginal cost is between average variable cost and average total cost, it will
   (a) keep producing in the short run, but exit the market in the long run.
   (b) shut down in the short run, but return to production in the long run.
   (c) shut down in the short run and exit in the long run.
   (d) keep producing in both the short run and the long run.

   Solution: A competitive firm produces where $P = MC$. For prices where $AVC < P < ATC$, the firm produces in the short-run, but will shut down in the long-run.

2. Profit for a firm in a perfectly competitive market is positive whenever
   (a) $P < ATC$.
   (b) $P < MC$.
   (c) $P > MC$.
   (d) $P > ATC$.

Solution: $\Pi = TR - TC = (P - ATC) \cdot Q \Rightarrow \Pi > 0 \iff P > ATC$.

3. Consultants hired by Sunnyside Eggs find that the firm has total fixed costs of \$50,000, total variable costs of \$25,000, and total revenues of \$40,000. Given this, in the short run the firm should _____and make _____profit.
   (a) shut down; negative
   (b) shut down; zero
   (c) stay open; negative
   (d) stay open; positive

Solution: Short-run decision: Shut down if $TR < VC$, operate if $TR > VC$. Firm should operate in the short run. $\Pi = TR - TC = \$40,000 - (50,000 + 25,000) = -\$35,000$.

For questions 4 and 5, refer to Table 1.

Table 1: Competitive Firm

Quantity	Total Revenue	Total Cost
0	\$0	\$30
1	\$80	\$50
2	\$160	\$80
3	\$240	\$120
4	\$320	\$170
5	\$400	\$230
6	\$480	\$300
7	\$560	\$380
8	\$640	\$470

4. What is the marginal cost at the profit maximizing quantity?
   (a) \$50
   (b) \$80
   (c) \$230
   (d) \$300

Solution: Maximize profit at Q where $MR = MC$.

5. What is the average fixed cost at the profit maximizing quantity?
   (a) \$54.30
   (b) \$4.28
   (c) \$50
   (d) \$80

Solution: $Q^* = 7$ (where $MR = MC$). $FC = \$30$ (total cost at $Q = 0$). $AFC = FC/Q = \$30/7 = \$4.28$.

6. Natalie the baker wants to establish a pie factory in a competitive market. The cost of leasing the factory is \$800 a day. The profit maximizing quantity of pies is 1,000 a day, each pie sells for \$3, and has a variable cost of only \$1.50. Which of the following is true?
   (a) Natalie should enter the industry.
   (b) Natalie should not enter the industry.
   (c) Natalie would enjoy profits of \$3,000 a day.
   (d) Both (a) and (c) are true.

   Solution: Enter market if $TR \geq TC \iff P \geq ATC$. $TR = \$3 \cdot 1,000 = \$3,000$ and $TC = \$800 + \$1.50 \cdot 1,000 = \$2,300$. Thus, Natalie should enter the market and will make a profit of $\$3,000 - \$2,300 = \$700$/day.

7. In order to maximize profit, a firm in a perfectly competitive market will produce at the quantity where
   (a) $AR = MC$.
   (b) $P = ATC$.
   (c) $P = AVC$.
   (d) $MR = ATC$.

   Solution: Always produce where $MR = MC$. For competitive firms, $MR = P = AR$.

8. Al's Burgers is a firm in a competitive market and faces the cost structure shown in Figure 1.

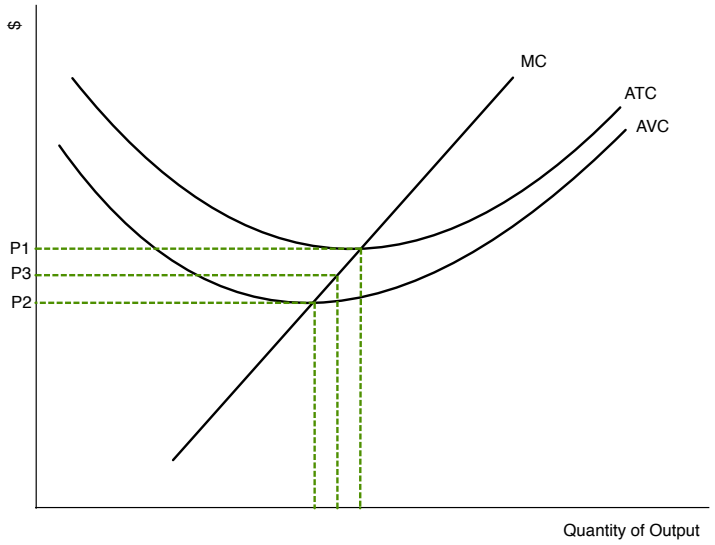

Figure 1: Al's Burgers

The firm decides to operate in the short run, but incurs economic losses. Thus, the market price must be

(a) less than P2.

(b) greater than P2 but less than P3.

(c) greater than P3 but less than P1.

(d) greater than P2 but less than P1.

(e) greater than P1.

Solution: Operate in SR along MC curve above AVC. If operating at a loss, $P < ATC$ and so price must be $P2 < P < P1$.

9. Suppose the market for corn is perfectly competitive. Which of the following represents the long-run relationship between the price, marginal cost, and average total cost at the profit-maximizing quantity?

(a) $P > MC = ATC$

(b) $P = MC > ATC$

(c) $P = MC = ATC$

(d) $P > MC > ATC$

Solution: Firms in PC produce where $P = MC$. In the long run, firms in PC make zero economic profit so $P = ATC$.

10. Assuming the same cost structure, a competitive market produces _____output at _____prices than a monopoly market.

(a) less; lower

(b) more; lower

(c) less; higher

(d) more; higher

Solution: Monopolies charge a mark-up over the marginal cost and produce less than a competitive market.

Refer to Table 2 for questions 11 and 12.

11. What is the marginal cost of the 6^{th} shirt?

(a) \$44

(b) \$46

(c) \$55

(d) \$60

Solution: $MC = \Delta TC/\Delta Q$. At $Q = 6$, $MC = 395 - 335 = \$60$.

12. What is total profit at the profit-maximizing quantity?

Table 2: Monopolist Environment

Price	Quantity Demanded	Total Cost
\$170	0	\$100
\$160	1	\$140
\$150	2	\$184
\$140	3	\$230
\$130	4	\$280
\$120	5	\$335
\$110	6	\$395
\$100	7	\$475
\$90	8	\$565

(a) \$100

(b) \$245

(c) \$265

(d) \$395

Solution: Maximize profit where $MC = MR$. $MR = \Delta TR/\Delta Q$, so need to find $TR = P \times Q$ at each price first, then find MR. $MR = MC = \$60$ at $Q = 6$, so $Q^* = 6$ and $\Pi = \$660 - 395 = \$265$.

Use Figure 2, which represents the environment faced by a monopoly, for questions 13 and 14.

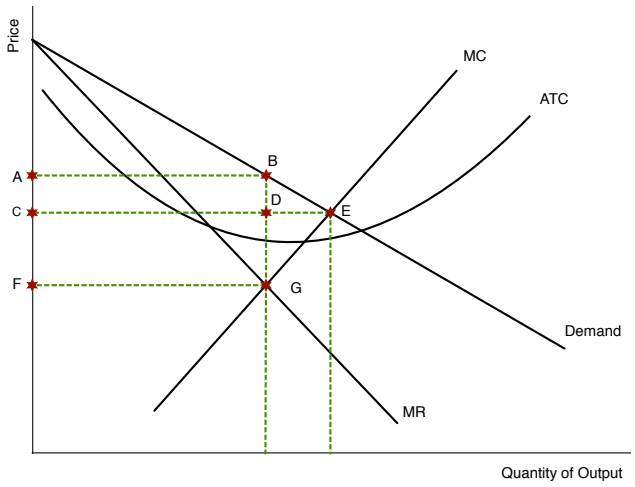

Figure 2: Monopolist Environment

13. Which of the following represents the lost trade that is responsible for the deadweight loss?

(a) Distance ab

(b) Distance ce

(c) Distance de

(d) Distance cd

Solution: Optimal quantity where MC = Demand. Monopolist produces where $MR = MC$. Lost trades between distance de.

14. Which of the following areas represents the deadweight loss due to monopoly pricing?
    (a) Triangle bge
    (b) Triangle bde
    (c) Rectangle acdb
    (d) Rectangle cfgd

Solution: DWL comes from those trades that are not taking place where demand is above MC.

15. Consider Figure 3, which shows the cost structure of a monopolist.

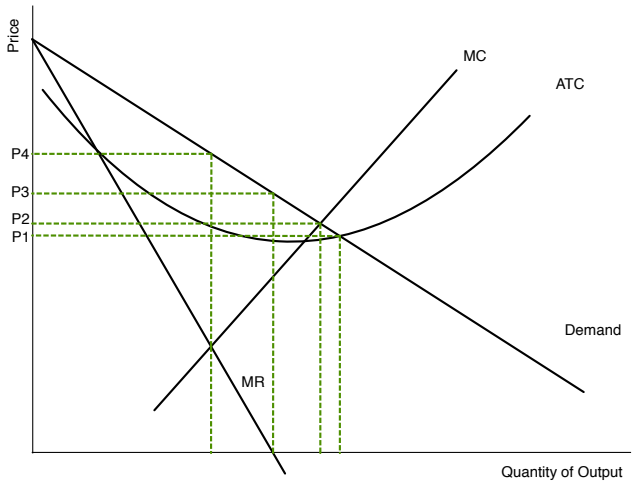

Figure 3: Monopolist Environment

If the firm wishes to maximize total revenue, it should charge price _____, while the price it should charge to maximize output while not making losses is _____.
    (a) P4; P2
    (b) P3; P1
    (c) P2; P4
    (d) P3; P2
    (e) None of the above

Solution: Maximize TR where at Q where $MR = 0$. Trace up to demand curve to find price ($P3$). Losses occur when $P < ATC$. Lower price until $P = ATC$ to maximize output while not making losses. $P = P1$.

16. A profit-maximizing monopolist will produce the level of output at which
    (a) average revenue is equal to average total cost.

(b) price is equal to marginal cost.

(c) marginal revenue is equal to marginal cost.

(d) total revenue is equal to opportunity cost.

Solution: Any firm should produce where $MR = MC$ in order to maximize profits. This holds true in any type of market structure. (b) is only true for firms in a perfectly competitive market.

17. If economies of scale exist, and government regulators force the monopolist to set price equal to marginal cost,

    (a) the monopolist will still earn a profit, just smaller than with no regulation.

    (b) there will be no incentive to innovate.

    (c) the market will be less efficient than if regulators set prices equal to average total cost.

    (d) the monopolist will be taking a loss.

    Solution: For monopolies with economies of scale, $MC < ATC$. If the government forces the monopolist to charge $P = MC$ (this is the point where the demand and MC curve meet), then $P < ATC$ and $\Pi < 0$.

18. Which of the following conditions does NOT describe a firm in a monopolistically competitive market?

    (a) It makes a product different from its competitors.

    (b) It takes its price as given by market conditions.

    (c) It maximizes profit both in the short run and in the long run.

    (d) It has the freedom to enter or exit in the long run.

    Solution: See class notes.

19. Firms in monopolistically competitive markets are similar to monopolies in that they both _____and are similar to firms in perfectly competitive markets in that they both _____.

    (a) make positive profits in the short and long run; are price takers

    (b) charge a price above the marginal cost; produce at the efficient scale in the long run

    (c) are price makers; make zero economic profit in the long run

    (d) are in markets with barriers to entry; produce at the efficient quantity

    Solution: See class notes.

20. A monopolistically competitive firm will decrease its production if

    (a) marginal revenue is less than average total cost.

    (b) price is less than marginal cost.

    (c) marginal revenue is less than marginal cost.

    (d) price is less than average total cost.

Solution: See class notes.

21. For a firm in a monopolistically competitive market, which of the following accurately describes the relationship between the price, average total cost, and marginal cost in the short run given that the firm is making a negative profit?

    (a) $ATC = P = MC$

    (b) $ATC > P = MC$

    (c) $ATC = P > MC$

    (d) $ATC > P > MC$

    Solution: Firms in monopolistically competitive markets charge a mark-up over MC, so $P > MC$. If making a loss, $P < ATC$.

22. For a firm in a monopolistically competitive market, which of the following accurately describes the relationship between the price, average total cost, and marginal cost in the long run?

    (a) $P = ATC = MC$

    (b) $P > ATC = MC$

    (c) $P = ATC > MC$

    (d) $P > ATC > MC$

    Solution: In long run, firms in monopolistically competitive markets make zero economic profit so $P = ATC$. Still charge mark-up over MC so $P > MC$.

23. Consider the environment faced by Sparkle, one of the many toothpaste brands in the market for toothpaste, shown in Figure 4.

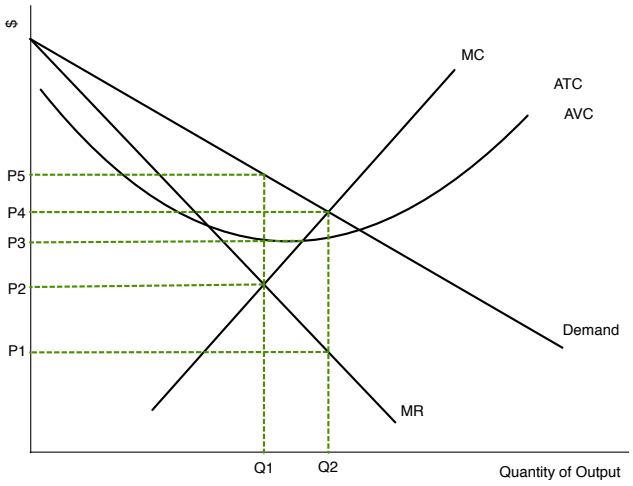

Figure 4: Environment for Sparkle

The quantity produced by the firm is _____ and it charges a markup of _____.

(a) $Q2; P4 - P3$

(b) $Q2; P4 - P1$

(c) $Q1; P3 - P2$

(d) $Q1; P5 - P2$

Solution: Produce at Q where $MR = MC$ ($Q1$). Price is point on demand curve at $Q1$ which is $P5$. Mark-up over the marginal cost = $P5 - P2$

24. If an oligopolistic industry organizes itself as a cooperative cartel, it will produce a quantity of output that is _____the competitive level and _____the monopoly level.

(a) less than; more than

(b) more than; less than

(c) less than; equal to

(d) equal to; more than

Solution: When acting as a cartel, firms act like a monopolist. The monopolist quantity is less than the competitive quantity.

25. If an oligopoly does not cooperate and each firm chooses its own quantity, the industry will produce a quantity of output that is _____the competitive level and _____the monopoly level.

(a) less than; more than

(b) more than; less than

(c) less than; equal to

(d) equal to; more than

Solution: Self-interest drives firms to break cartel agreement and produce more, but will still produce less than in perfect competition.

For questions 26 and 27, consider the simultaneous move game below.

		United States	
		Low tariffs	High Tariffs
Mexico	Low tariffs	\$25M, \$25M	\$10M, \$30M
	High tariffs	\$30M, \$10M	\$20M, \$20M

26. The dominant strategy for Mexico is _____and the dominant strategy for the US is _____.

(a) low tariffs; low tariffs

(b) high tariffs; low tariffs

(c) low tariffs; high tariffs

(d) high tariffs; high tariffs

Solution: If US plays low tariffs, Mexico better of choosing high tariffs (30>25). If US plays high tariffs, Mexico still better off playing high tariffs (20>10). HT is dominant strategy for Mexico. Same for US.

27. Thus, the Nash Equilibrium is where the United States plays _____and Mexico plays _____.

(a) low tariffs; low tariffs

(b) high tariffs; low tariffs

(c) low tariffs; high tariffs

(d) high tariffs; high tariffs

Solution: Neither country can do better given the other country's strategy at (HT, HT).

28. Intel and AMD each decide to either invest heavily in R&D ("High R&D") or to not ("Low R&D"). Their decisions affect both their profits and those of the other company. Assume that there is perfect information so that each knows the payoffs of the other given the strategies chosen by each. Their profits are summarized in the game table below, where the first number in each block is AMD's profit and the second number is Intel's profit.

		Intel	
		High R&D	Low R&D
AMD	High R&D	\$15,000, \$20,000	\$18,000, \$15,000
	Low R&D	\$16,000, \$18,000	\$16,000, \$15,000

If this game was played once and Intel and AMD are both rational, what would be the outcome?

(a) Intel would invest heavily in R&D and AMD would not.

(b) Both Intel and AMD would invest heavily in R&D.

(c) AMD would invest heavily in R&D and Intel would not.

(d) Both Intel and AMD would choose to not invest heavily in R&D.

Solution: AMD has no dominant strategy, but Intel has dominant strategy of high R&D. Since AMD knows the payoffs, they know Intel has dominant strategy and that Intel will choose high R&D. AMD's best response to this is Low R&D. Nash eq: (low, high).

29. Consider the simultaneous move game between Righty and Lefty shown below, where the first number in each block is the payoff to Lefty and the second is the payoff to Righty.

If this particular game has **no** Nash equilibrium, then possible values of x and y are

(a) $x = 1$ and $y = 2$.

(b) $x = 1$ and $y = 4$.

		Righty: Swerve	Righty: Straight
Lefty: Swerve		2, 2	x, 4
Lefty: Straight		1, y	2, 3

(c) $x = 3$ and $y = 2$.

(d) $x = 3$ and $y = 4$.

Solution: Lefty: If Righty chooses swerve, Lefty will choose swerve (2>1). Needs to pick Straight if Righty chooses Straight in order to not have dominant strategy $\Rightarrow x < 2$.
Righty: If Lefty chooses Swerve, Righty will choose straight (4>2). Needs to pick Swerve if Lefty chooses Straight in order to not have dominant strategy $\Rightarrow y > 3$.

30. Consider the simultaneous move game between Jim and Bob shown below, where the first number in each block is the payoff to Bob and the second is the payoff to Jim.

		Jim: Left	Jim: Right
Bob: Top		2, 4	x, 2
Bob: Bottom		1, y	2, 3

If "Top" is the dominant strategy for Bob and "Left" is the dominant strategy for Jim, then possible values of x and y are

(a) $x = 1$ and $y = 2$.

(b) $x = 1$ and $y = 4$.

(c) $x = 3$ and $y = 2$.

(d) $x = 3$ and $y = 4$.

Solution: Bob: Needs to choose Top when Jim chooses Right $\Rightarrow x > 2$.
Jim: Needs to choose Left when Bob chooses Bottom $\Rightarrow y > 3$.

Short Answer

1. Natalie's Ball Bearings, Inc. faces the following costs of production outlined in Table 3.

(a) Suppose the market for ball bearings is perfectly competitive and the price of a case is \$50. The CEO sees that he can't make a profit, and so decides to shut down operations. What is the firm's profit (or loss) as a result of this decision? Do you agree with the CEO's decision? Why or why not? **[4 pts]**

Solution: If firm shuts down, $TR = 0$, $VC = 0$, and $FC = \$100$ so $\Pi = -\$100$.
To find optimal quantity, use variable cost column to compute MC. $MC = \$50$ at $Q = 1$ and $Q = 4$. At $Q = 1$, $\Pi = \$50 \times 1 - \$150 = -\$100$. At $Q = 4$, $\Pi = \$50 \times 4 - \$240 = -\$40$. Don't agree since $TR > VC$ at $Q = 4$, the firm should produce in the SR even if it is making losses since it would lose more by shutting down.

Table 3: Cost of Ball Bearings

Quantity (in cases)	Total Fixed Costs	Total Variable Costs
0	\$100	
1		\$50
2		\$70
3		\$90
4		\$140
5		\$200
6		\$360

(b) If instead the CEO decided to produce 1 case of ball bearings, what would be the firm's profit (or loss)? Is this the best decision? Why? **[4 pts]**

Solution: See (a). Always produce on part of MC curve past its minimum. MC decreases from $Q = 1$ to $Q = 2$, so $Q = 1$ cannot be optimal quantity.

2. Sleek Sneakers Co. is one of the many firms in the market for shoes, where each company sells differentiated products.

(a) Assume that Sleek is currently earning short-run profit. On a clearly labeled diagram, show the company's profit maximizing output and price, as well as the area representing profit. **[2 pts]**

Solution: See class notes. If profit is positive, $P > ATC$ at the profit maximizing quantity, which is given by where $MR = MC$.

(b) What happens to Sleek's price, output, and profit in the long run? Show this in a new diagram. **[2 pts]**

Solution: In the long run, other firms enter the market. Demand for Sleek shoes decreases and becomes more elastic. In LR, demand and ATC are tangent at the profit maximizing quantity since firms make zero economic profit. Price, output, and profit decreases.

(c) On your diagram for the firm in the long run, show the consumer surplus derived from the purchase of Sleek shoes and the deadweight loss relative to the efficient level of output. **[2 pts]**

Solution: See class notes. CS is area above the price and below the demand curve. DWL comes from lost trades where demand is above MC.

(d) If the government forced Sleek to produce the efficient level of output, what would happen to the firm? **[2 pts]**

Solution: Efficient level of output is where $P = MC$, or where demand and MC intersect. But at this price, $P < ATC$ and so the firm would be making a loss.

3. Jack and Jill are the only lemonade providers in Jurassic World. They face the environment outlined in Table 4.

(a) The two friends currently have an agreement where they produce 600 drinks in total and split production evenly. What will be the profit realized by each individual? **[2 pts]**

Solution: To sell 600 drinks, they will charge price of \$.80 and realize total profit of $\Pi = (.80 - .30) \times 600 = \$300$. Since they split production, profit of each will be \$150.

Table 4: Demand Schedule and Costs Lemonade

Price	Quantity Demanded	Average Total Cost
\$1.10	300	\$.30
\$1.00	400	\$.30
\$.90	500	\$.30
\$.80	600	\$.30
\$.70	700	\$.30
\$.60	800	\$.30

(b) If Jack were to break this agreement and increase his lemonade stand's production by 100 drinks, while Jill stuck to the original agreement, what will be the profit realized by each? **[2 pts]**

Solution: With quantity demanded of 700, price will decrease to \$.70. Jack will realize profit of $\Pi = (.70 - .30) \times 400 = \$160$, while Jill will only realize profit of $\Pi = (.70 - .30) \times 300 = \$120$.

(c) What will be the profit realized by each if both choose to increase production by 100 units? **[4 pts]**

Solution: New price will be \$.60 since quantity demanded is 800. Profit for each is $\Pi = (.60 - .30) \times 400 = \$120$.

4. Consider the three person simultaneous move game below. Each person can decide to either work or shirk. Alice chooses the row, Bob chooses the column, and Curt chooses the matrix. For example, if Alice decides to work, Bob decides to shirk, and Curt decides to work, the payoffs are given by the top row of the right column of the top matrix. Alice would get a payoff of $-1/2$, Bob would get a payoff of $3/2$, and Curt would get a payoff of 1.

Curt: Work

		Bob: Work	Bob: Shirk
Alice	Work	1, 1, 1	$-1/2$, $3/2$, 1
	Shirk	$3/2$, 1, $-1/2$	0, $3/2$, $-1/2$

Curt: Shirk

		Bob: Work	Bob: Shirk
Alice	Work	1, $-1/2$, $3/2$	$-1/2$, 0, $3/2$
	Shirk	$3/2$, $-1/2$, 0	0, 0, 0

(a) Does Alice have a dominant strategy? If so, what is it? **[2 pts]**

Solution: Top matrix: Curt chooses work. If Bob works, Alice better off shirking (3/2>1). If Bob shirks, Alice is better off shirking (0>−1/2).
Bottom matrix: Curt chooses shirk. If Bob works, Alice is better off shirking (3/2>1). If Bob shirks, Alice is better off shirking (0>−1/2).
Since Alice is better off shirking regardless of the other players' strategies, her dominant strategy is to shirk.

(b) Does Bob have a dominant strategy? If so, what is it? **[2 pts]**

Solution: Similar analysis to (a). Dominant strategy is to shirk.

(c) Does Curt have a dominant strategy? If so, what is it? **[2 pts]**

Solution: A little trickier, as you have to compare entries across the matrices. For example, if Alice and Bob both work, Curt's payoffs are either 1 if he works (3rd entry of top left corner of top matrix) or 3/2 (3rd entry of top left corner of bottom matrix). Continuing this way for each Alice and Bob strategy combination, Curt's dominant strategy is also to shirk.

(d) If there is one, what is the Nash equilibrium in this game? **[2 pts]**

Solution: Nash eq. is (shirk, shirk, shirk). Payoff are given by bottom right corner of the bottom matrix.

5. What topics or questions gave you the most trouble on this homework assignment or the class material it encompassed?