# Econ 300 Final Review (last third of course only)

Professor Cramton

For the next two questions, the consumer's utility $U(x, y) = -3x^2 - y^2 + 4xy$ depends on the consumption of two goods $x$ and $y$. Assume the consumer selects $x$ and $y$ to maximize utility subject to the budget constraint $x + y = 4$.

1. Using the substitution method, determine the utility function $\bar{U}(x)$ that internalizes the constraint by solving to remove the y variable.

   A. $\bar{U}(x) = -4x^2 + 24x - 8$

   B. $\bar{U}(x) = -6x^2 + 8x - 16$

   C. $\bar{U}(x) = -8x - 16$

   D. $\bar{U}(x) = -8x^2 + 24x - 16$

   E. None of the above

For the next two questions, the consumer's utility $U(x, y) = -3x^2 - y^2 + 4xy$ depends on the consumption of two goods $x$ and $y$. Assume the consumer selects $x$ and $y$ to maximize utility subject to the budget constraint $x + y = 4$.

2. What are the optimum values of the variables $x$ and $y$?

   A. $x = 3, y = 1$
   B. $x = 2/3, y = 10/3$
   C. $x = 3/2, y = 5/2$
   D. $x = 2, y = 2$
   E. None of the above

For the next three questions, we have the same consumer's utility $U(x, y) = -3x^2 - y^2 + 4xy$ but different constraint $x + 2y = 1$.

3. What is the Lagrangian function for the constrained situation?

   A. $-3x^2 - y^2 + 4xy - \lambda(x + 2y - 1)$

   B. $-3x^2 - y^2 + 4xy + \lambda(x + 2y - 1)$

   C. $3x^2 + y^2 - 4xy - \lambda(x + 2y - 1)$

   D. $-3x^2 - y^2 + 4xy - \lambda x - \lambda \cdot 2y$

   E. None of the above

For the next three questions, we have the same consumer's utility $U(x, y) = -3x^2 - y^2 + 4xy$ but different constraint $x + 2y = 1$.

4. The marginal utility of good $y$ is

A. $3x^2 + 2y - 4x$
B. $6x + 2y - 4x$
C. $4x - 2y$
D. $x + 2y$
E. None of the above

For the next three questions, we have the same consumer's utility $U(x, y) = -3x^2 - y^2 + 4xy$ but different constraint $x + 2y = 1$.

5. What is the utility maximizing level of $x$ and $y$?

   A. $x = 1/3, y = 2/3$
   B. $x = 2/3, y = 1/3$
   C. $x = 8/21, y = 5/21$
   D. $x = 5/21, y = 8/21$
   E. None of the above

6. A company has a cost function $C = 2x^2 - 9x + 15$, where $x$ is the quantity of the raw material. Because of the limited supply, the quantity of the raw material $x$ cannot exceed 8 units. The company wants to determine the material supply level such that the cost can be minimized. What is the Lagrangian function in this constrained situation?

A. $2x^2 - 9x + 15 - \lambda(x - 8)$

B. $2x^2 - 9x + 15 + \lambda(x - 8)$

C. $-2x^2 + 9x - 15 - \lambda(x - 8)$

D. $-2x^2 + 9x - 15 + \lambda(x - 8)$

E. None of the above

For the next two questions, suppose you have \$18 to buy apples $x$ and oranges $y$. The price of apple is \$1/lb and the price of orange is \$2/lb. Your utility is $U(x, y) = \ln 2x + 4 \ln y$. You seek to maximize utility subject to your budget constraint that the total cost cannot exceed \$18.

7. What is the Lagrangian for this problem?

   A. $\ln 2x + 4 \ln y - \lambda(x + 2y - 18)$
   B. $\ln 2x + 4 \ln y + \lambda(x + 2y - 18)$
   C. $\ln 2x + 4 \ln y - \lambda(18 - (x + 2y))$
   D. $x + 2y - 18 - \lambda(\ln 2x + 4 \ln y)$
   E. None of the above

For the next two questions, suppose you have \$18 to buy apples $x$ and oranges $y$. The price of apple is \$1/lb and the price of orange is \$2/lb. Your utility is $U(x, y) = \ln 2x + 4 \ln y$. You seek to maximize utility subject to your budget constraint that the total cost cannot exceed \$18.

8. What are the utility maximizing levels of $x$ and $y$?

   A. $x = 0$ and $y = 9$
   B. $x = 18$ and $y = 0$
   C. $x = 18/5$ and $y = 36/5$
   D. $x = 9$ and $y = 4.5$
   E. None of the above

For the next two questions, you want to choose $x$ and $y$ to maximize the utility function $U(x,y)=2x^{1/2}y^{1/2}$ subject to the constraints $x+2y\le 10$ and $x^2\ge 16$.

9. What is the Lagrangian for this problem?

A. $2x^{1/2}y^{1/2}-\lambda(x+2y-10)-\mu(x^2-16)$

B. $2x^{1/2}y^{1/2}-\lambda(x+2y-10)+\mu(x^2-16)$

C. $2x^{1/2}y^{1/2}-\lambda(x+2y+10)-\mu(x^2+16)$

D. $2x^{1/2}y^{1/2}+\lambda(x+2y-10)-\mu(16-x^2)$

E. None of the above

For the next two questions, you want to choose $x$ and $y$ to maximize the utility function $U(x,y) = 2x^{1/2}y^{1/2}$ subject to the constraints $x + 2y \leq 10$ and $x^2 \geq 16$.

10. What is the optimal choice for $x$ and $y$?

A. $x = 5/2, y = 5$
B. $x = 3, y = 4$
C. $x = 5, y = 5/2$
D. $x = 4, y = 3$
E. C and D

For the next two questions, suppose you have current wealth of \$20,000 and face a 30% chance of losing your laptop worth \$1,500. Your utility function is $U(x) = \ln(x)$.

11. What is your expected utility?

A. $0.7\ln(20,000) + 0.3\ln(18,500)$
B. $\ln(0.7 \cdot 20,000) + \ln(0.3 \cdot 18,500)$
C. $\ln(0.7 \cdot 20,000 + 0.3 \cdot 18,500)$
D. $0.3 \cdot \ln(1500)$
E. None of the above

For the next two questions, suppose you have current wealth of \$20,000 and face a 30% chance of losing your laptop worth \$1,500. Your utility function is $U(x) = \ln(x)$.

12. What is the maximum insurance premium you are willing to pay to be insured from this loss?

A. \$46.23
B. \$462.34
C. \$123.40
D. \$1234.00
E. None of the above

13. Three fair coins are tossed. What is the probability of at least two tails?

A. 1/8
B. 2/8
C. 3/8
D. 4/8
E. 5/8

14. Three fair coins are tossed. What is the probability of exactly one head?

A. 1/8
B. 2/8
C. 3/8
D. 4/8
E. 5/8

15. The number of copies of *USA Today* that are sold daily by a convenience store is a random variable X that has the following probability distribution.

| **x** | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| **p(x)** | 0.1 | 0.12 | 0.25 | 0.3 | 0.2 | 0.03 |

The store needs to sell at least three copies per day to make a profit. What is the probability that the store will make a profit?

A. 0.30
B. 0.50
C. 0.53
D. 0.47
E. 0.75

For next three questions, consider the following scenario. A man buys a racehorse for $30,000, and enters it in two races. He plans to sell the horse afterward, hoping to make a profit. If the horse wins both races, its value will jump to $100,000. If it wins one of the races, it will be worth $50,000. If it loses both races, it will be worth only $10,000. The man believes there is a 60% chance that the horse will win the first race and a 30% chance it will win the second one. Assume that the two races are independent events.

16. What is the probability that the horse will win both races?

A. 0.10
B. 0.18
C. 0.28
D. 0.60
E. None of the above

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17. What is the probability that the horse will win neither of the two races?

A. 0.10
B. 0.18
C. 0.28
D. 0.60
E. None of the above

For next three questions, consider the following scenario. A man buys a racehorse for $30,000, and enters it in two races. He plans to sell the horse afterward, hoping to make a profit. If the horse wins both races, its value will jump to $100,000. If it wins one of the races, it will be worth $50,000. If it loses both races, it will be worth only $10,000. The man believes there is a 60% chance that the horse will win the first race and a 30% chance it will win the second one. Assume that the two races are independent events.

18. What is the probability that the horse will win one of the races?

A. 0.10
B. 0.18
C. 0.28
D. 0.54
E. None of the above

For next three questions, consider the following scenario. A man buys a racehorse for $30,000, and enters it in two races. He plans to sell the horse afterward, hoping to make a profit. If the horse wins both races, its value will jump to $100,000. If it wins one of the races, it will be worth $50,000. If it loses both races, it will be worth only $10,000. The man believes there is a 60% chance that the horse will win the first race and a 30% chance it will win the second one. Assume that the two races are independent events.

19. Find the man's expected profit.

A. $10,600
B. $17,800
C. $23,500
D. $30,000
E. None of the above

20. If a person is risk averse, then her utility function is

A. Convex
B. Concave
C. Linear
D. Indeterminate
E. None of the above

For the next three questions, two firms (1 and 2) are engaged in Cournot competition. The two firms simultaneously select quantity ($x_1$ and $x_2$). The market price $P=100 - x_1 - x_2$. Each firm has a quadratic cost structure: $TC_i = 2x_i^2$.

21. State firm 1's profit as a function of the two quantity choices.

A. $\pi_1 = (100 - x_1 + x_2)x_1$
B. $\pi_1 = (100 - x_1)x_1 - 2x_1^2$
C. $\pi_1 = (100 - x_1 - x_2) - 2x_1^2$
D. $\pi_1 = (100 - x_1 - x_2)x_1 - 2x_1^2$
E. $\pi_1 = (100 - x_1)x_1$

For the next three questions, two firms (1 and 2) are engaged in Cournot competition. The two firms simultaneously select quantity ($x_1$ and $x_2$). The market price $P=100 - x_1 - x_2$. Each firm has a quadratic cost structure: $TC_i = 2x_i^2$.

22. Find firm 1's best response to the quantity choice of firm 2.

A. $BR_1(x_2) = \frac{100 - x_2}{6}$
B. $BR_1(x_2) = 100 - x_2$
C. $BR_1(x_2) = 100/6 - x_2$
D. $BR_1(x_2) = x_2$
E. None of the above

For the next three questions, two firms (1 and 2) are engaged in Cournot competition. The two firms simultaneously select quantity ($x_1$ and $x_2$). The market price $P=100 - x_1 - x_2$. Each firm has a quadratic cost structure: $TC_i = 2x_i^2$.

23. What is the Nash equilibrium of this game of Cournot competition

A. $x_1 = 100, x_2 = 100/7$
B. $x_1 = \frac{100}{6}, x_2 = 200$
C. $x_1 = x_2 = 100/7$
D. $x_1 = x_2 = 100/6$
E. None of the above

For the next three questions consider the following "relationship game":

| | | Player II: Go | Player II: Stay |
|---|---|---|---|
| Player I | Go | 3,1 | 0.0 |
| | Stay | 0,0 | 1,2 |

24. How many Nash Equilibria are there ?

A. Only 2 pure strategies
B. Only 1 mixed strategy
C. 2 pure strategies, 1 mixed
D. No Nash equilibrium exists
E. Only 1 pure strategy

For the next three questions consider the following "relationship game":

| | | Player II | |
|---|---|---|---|
| | | Go | Stay |
| Player I | Go | 3,1 | 0.0 |
| | Stay | 0,0 | 1,2 |

25. List the Nash pure strategies of this game:

A. (Go,Stay), (Go,Stay)
B. (Go,Go), (Stay,Stay)
C. (Stay,Stay), (Go,Stay)
D. (Go,Go)
E. (Stay,Stay)

For the next three questions consider the following "relationship game":

| | | Player II: Go | Player II: Stay |
|---|---|---|---|
| Player I | Go | 3,1 | 0.0 |
| | Stay | 0,0 | 1,2 |

26. Find the Nash Equilibrium in mixed strategies for this game:

A. Player 1 chooses Go with probability 2/3, and Stay with probability 1/3; Player 2 chooses Go with probability 1/4, and Stay with probability 3/4.
B. Player 1 chooses Go with probability 1/4, and Stay with probability 3/4; Player 2 chooses Go with probability 2/3, and Stay with probability 1/3.
C. Player 1 chooses Go with probability 1/4, and Stay with probability 1/4; Player 2 chooses Go with probability 2/3, and Stay with probability 1/3.
D. Player 1 chooses Go with probability 2/3, and Stay with probability 2/3; Player 2 chooses Go with probability 1/4, and Stay with probability 1/4.
E. None of the above

For the next two questions consider the following 3-strategy game:

| | | Player II | | |
|---|---|---|---|---|
| | | L | C | R |
| Player I | T | 0,4 | 4,0 | 5,3 |
| | M | 4,0 | 0,4 | 5,3 |
| | B | 3,5 | 3,5 | 6,6 |

27. Are there any strictly dominated strategies for Player I ?

A. T
B. M
C. B
D. L
E. None

For the next two questions consider the following 3-strategy game:

| | | Player II | | |
|---|---|---|---|---|
| | | L | C | R |
| Player I | T | 0,4 | 4,0 | 5,3 |
| | M | 4,0 | 0,4 | 5,3 |
| | B | 3,5 | 3,5 | 6,6 |

28. What is the pure strategy Nash equilibrium for this game?

A. (T,L)
B. (M,L)
C. (M,C)
D. (B,R)
E. None of the above

For the next two questions consider the following game:

| | | Player II | | |
|---|---|---|---|---|
| | | Home | Beach | Hike |
| Player I | Home | 0,0 | 0,1 | 0,2 |
| | Beach | 1,0 | 3,2 | 0,3 |
| | Hike | 3,0 | 2,0 | 3,3 |

29. Are there any *strictly dominant* strategies for Player I ?

A. Hike
B. Beach
C. Home
D. Hike and Beach
E. None

For the next two questions consider the following game:

| | | Player II | | |
|---|---|---|---|---|
| | | Home | Beach | Hike |
| Player I | Home | 0,0 | 0,1 | 0,2 |
| | Beach | 1,0 | 3,2 | 0,3 |
| | Hike | 3,0 | 2,0 | 3,3 |

30. What is the pure strategy Nash equilibrium for this game

A. (Hike, Hike)
B. (Home, Home)
C. (Beach, Beach)
D. (Beach, Hike)
E. (Hike, Beach)