uc3m – Final Exam in Microeconomics: Multiple Choice – June 2026

Name: Reduced Group:

You have 45 minutes to answer the following 15 questions. Exactly one statement is correct in each question. You obtain 2 points for each correct answer, -0.66 points for each incorrect answer, and 0 points for each unanswered question.

Question 1: It is known that a consumer's preferences $\succsim$ satisfy axioms A.1, A.2, and A.3, and that $A = (0, 2) \succ B = (1, 1)$. Consider also the bundles $C = (1, 2)$ and $D = (1, 3)$. Therefore, we can infer the following relation between these bundles:

☒ $D \succ B$ ☐ $C \sim A$
☐ $D \sim C$ ☐ None of the other answers is correct.

Question 2: If a consumer's preferences satisfy monotonicity (axiom A.3), then her indifference curves

☐ are convex ☒ do not have a positive slope
☐ are parallel ☐ None of the other answers is correct.

Question 3: Which axiom is not satisfied by the preferences represented by the utility function $u(x, y) = 25x - 16y$?

☐ A.1 (completeness) ☐ A.2 (transitivity)
☒ A.3 (monotonicity) ☐ None of the other answers is correct.

Question 4: A consumer lexicographically prefers good x to good y. If prices are $(p_x, p_y) = (2, 1)$ and her income is $I = 12$, then her demanded bundle is:

☐ $(x, y) = (3, 6)$ ☒ $(x, y) = (6, 0)$
☐ $(x, y) = (0, 12)$ ☐ None of the other answers is correct.

Question 5: If prices were $(p_x^0, p_y^0) = (2, 4)$ in the base period and are $(p_x^1, p_y^1) = (4, 4)$ in the current period, then the Laspeyres CPI of an individual whose consumption in the base period was $(x, y) = (4, 4)$ is:

☒ $\frac{4}{3}$ ☐ $\frac{3}{2}$
☐ 1 ☐ None of the other answers is correct.

Question 6: If the preferences of the consumer in Question 5 are represented by the utility function $u(x, y) = x + 2y$, then her true CPI is:

☐ $\frac{4}{3}$ ☐ $\frac{3}{2}$
☒ 1 ☐ None of the other answers is correct.

Question 7: Elisa has Bernoulli utility function $u(x) = \sqrt{x}$. She faces a compound lottery l. With probability $\frac{1}{2}$, Elisa receives 64 euros for sure. With the remaining probability $\frac{1}{2}$, she participates in a second lottery that pays 36 euros with probability $\frac{1}{3}$ and 81 euros with probability $\frac{2}{3}$. What is the certainty equivalent of lottery l?

☐ $CE(l) = 49$ ☐ $CE(l) = 56.25$
☒ $CE(l) = 64$ ☐ None of the other answers is correct.

Question 8: The expected utility and the risk premium of the lottery l that pays $x = (0, 3, 6)$ with probabilities $p = (1/3, 1/3, 1/3)$ for a consumer whose preferences over lotteries are represented by the Bernoulli utility function $u(x) = x^2$ are:

☐ $Eu(l) = 18,\ PR(l) = 3 - \sqrt{15}$ ☐ $Eu(l) = 9,\ PR(l) = 0$
☒ $Eu(l) = 15,\ PR(l) = 3 - \sqrt{15}$ ☐ None of the other answers is correct.

Question 9: An individual with maxmin preferences must choose between three jobs. States A, B, and C occur with probabilities $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{1}{4}$, respectively. The salaries in the three states are

$$S = (10, 10, 10), \qquad R = (24, 8, 7), \qquad T = (12, 9, 9).$$

Which job does the individual choose?

☒ S ☐ R
☐ T ☐ None of the other answers is correct.

Question 10: Lolita is a competitive cow that produces milk using oats (O) and hay (H) according to the production function $F(O, H) = \left(\frac{1}{2}\sqrt{O} + \sqrt{H}\right)^4$. Therefore, as a milk producer, Lolita has

☒ decreasing marginal costs ☐ constant returns to scale
☐ diseconomies of scale ☐ None of the other answers is correct.

Question 11: A firm produces a good with labor and capital according to the production function $F(L, K) = \min\{\sqrt{L}, 2K\}$. If the prices of labor and capital are $w = 1$ and $r = 4$, respectively, then for $q > 0$ its cost functions satisfy:

☐ $MC(q) = 2q + 1$ ☐ $C(q) = 4 + q^2$
☐ $AC(q) = \frac{4}{q} + 3$ ☒ None of the other answers is correct.

Question 12: If a firm's cost functions satisfy $AC(q) > MC(q)$ for all q, then the firm has:

☒ decreasing average cost ☐ constant returns to scale
☐ diseconomies of scale ☐ None of the other answers is correct.

Question 13: All firms have access to the same technology and produce a good with cost

$$C(q) = 3q^2 + 12q + 3.$$

If market demand is $D(p) = \max\{36 - p, 0\}$, then the price in the long-run competitive equilibrium with free entry is:

☐ $p_L^* = 12$ ☒ $p_L^* = 18$

☐ $p_L^* = 20$ ☐ None of the other answers is correct.

Question 14: If a monopoly produces the good at zero cost and market demand is

$$D(p) = \max\{1 - 2p, 0\},$$

then the monopoly's Lerner index is:

☐ $L = 0$ ☐ $L = \frac{1}{4}$

☒ $L = 1$ ☐ None of the other answers is correct.

Question 15: A monopoly produces the good with cost $C(q) = q^2 + 5q$, and market demand is $D(p) = \max\{12 - p, 0\}$. The effect of a price cap of $\bar{p} = 3$ euros/unit is:

☐ a decrease in the monopoly deadweight loss

☒ a decrease in total surplus

☐ an increase in consumer surplus

☐ None of the other answers is correct.

uc3m – Final Exam Microeconomics: Exercises – June 15, 2026

Name: Reduced Group:

Note: The points indicated within each solution are a suggested allocation.

Exercise 1 (35 points). A worker's preferences over leisure and consumption are represented by the utility function $u(h, c) = h \cdot c$, where h is the number of months of leisure she enjoys, and c is her annual consumption in thousands of euros. The worker has 12 months to use as labor or leisure. Her non-labor income is $M \geq 0$, measured in thousands of euros. We denote by w the monthly wage in thousands of euros.

A. (12 points) Derive the worker's budget constraint and calculate her demand for leisure and consumption, $h(w, M)$ and $c(w, M)$, as well as her labor supply, $l(w, M)$. Is the good leisure normal, inferior, or neither? Explain in no more than two sentences.

Solution: If the worker chooses h months of leisure, she works $l = 12 - h$ months. Therefore, the budget constraint is (**2 points**)

$$c = M + w(12 - h),$$

or, equivalently, $c + wh = M + 12w$, with $0 \leq h \leq 12$.
In an interior solution, the worker maximizes hc subject to $c + wh = M + 12w$. The marginal utilities are

$$MU_h = c, \qquad MU_c = h.$$

Therefore, the marginal rate of substitution is (**2 points**)

$$MRS(h, c) = \frac{MU_h}{MU_c} = \frac{c}{h}.$$

The tangency condition is $MRS(h, c) = w$ (**1 point**), that is, $c = wh$. Using the budget constraint, we obtain (**1 point**)

$$wh + wh = M + 12w,$$

and therefore

$$h(w, M) = 6 + \frac{M}{2w}, \qquad c(w, M) = 6w + \frac{M}{2}.$$

This interior solution requires $h(w, M) \leq 12$, that is, $M \leq 12w$ (**2 points**).
If $M > 12w$, the interior solution would imply $h > 12$, which is not feasible. In that case, the worker does not work, so that (**2 points**)

$$h(w, M) = 12, \qquad c(w, M) = M.$$

Therefore, the labor supply is (**1 point**)

$$l(w, M) = 12 - h(w, M) = \begin{cases} 6 - \dfrac{M}{2w} & \text{if } M \leq 12w, \\ 0 & \text{if } M > 12w. \end{cases}$$

Leisure is a weakly normal good: its demand increases with M in the interior solution and does not decrease when the constraint $h \leq 12$ is reached. Therefore, it is not an inferior good (**1 point**).

B. (15 points) Assume that $M = 120$. Calculate the income and substitution effects on the demand for leisure of a 25% tax on labor income when the wage is $w = 16$, as well as the tax revenue.

Solution: Before the tax, $w = 16$ and $M = 120$. Since $M < 12w = 192$, the solution is interior. Therefore (**2 points**)

$$h^0 = 6 + \frac{120}{2 \cdot 16} = \frac{39}{4} = 9.75,$$

$$c^0 = 6 \cdot 16 + \frac{120}{2} = 156, \qquad l^0 = 12 - h^0 = \frac{9}{4} = 2.25.$$

The initial utility is (**1 point**)

$$u^0 = h^0 c^0 = \frac{39}{4} \cdot 156 = 1521.$$

The tax reduces the net wage to (**2 points**)

$$w^t = (1 - 0.25)16 = 12.$$

The budget constraint after the tax is

$$c = 120 + 12(12 - h),$$

or $c + 12h = 264$. Since $M = 120 < 144 = 12w^t$, the solution after the tax remains interior. Thus (**2 points**)

$$h^t = 6 + \frac{120}{2 \cdot 12} = 11,$$

$$c^t = 6 \cdot 12 + \frac{120}{2} = 132, \qquad l^t = 12 - h^t = 1.$$

To calculate the substitution effect we use the compensated demand at the new price of leisure, $w^t = 12$, keeping the initial utility $u^0 = 1521$. The compensated tangency condition is $c = 12h$. Together with $hc = 1521$, this implies (**3 points**)

$$12h^2 = 1521, \qquad \hat{h} = \sqrt{\frac{1521}{12}} = \frac{13\sqrt{3}}{2} \approx 11.258.$$

Therefore, the effects on the demand for leisure are (**3 points**)

$$SE = \hat{h} - h^0 = \frac{13\sqrt{3}}{2} - \frac{39}{4} \approx 1.508,$$

$$IE = h^t - \hat{h} = 11 - \frac{13\sqrt{3}}{2} \approx -0.258,$$

and

$$TE = h^t - h^0 = 11 - \frac{39}{4} = \frac{5}{4} = 1.25.$$

The tax revenue is the tax paid on labor income after the tax (**2 points**):

$$T = 0.25 \cdot 16 \cdot l^t = 0.25 \cdot 16 \cdot 1 = 4.$$

The revenue is, therefore, 4 thousand euros.

C. (8 points) Use your solution from part B to calculate the compensating variation CV. Explain in no more than two sentences why $CV > 0$, even though the price of consumption remains unchanged and the "price" of leisure w has decreased.

Solution: The initial utility calculated in part B is (**1 point**)

$$u^0 = 1521.$$

After the tax, the net wage is $w^t = 12$. Let CV be the monetary compensation, measured in thousands of euros. With this compensation, the budget constraint after the tax would be (**1 point**)

$$c = 120 + CV + 12(12 - h),$$

or, equivalently,

$$c + 12h = 264 + CV.$$

We seek the minimum compensation that allows reaching the initial utility $u^0 = 1521$. To this end, we look for the least-cost bundle, using the new net wage $w^t = 12$, that satisfies $hc = 1521$. In an interior solution, the tangency condition is (**1 point**)

$$\frac{c}{h} = 12,$$

so that $c = 12h$. Together with $hc = 1521$, this implies (**2 points**)

$$12h^2 = 1521, \qquad \hat{h} = \frac{13\sqrt{3}}{2}, \qquad \hat{c} = 12\hat{h} = 78\sqrt{3}.$$

The left-hand side of the budget constraint needed to purchase this bundle at the net wage $w^t = 12$ is (**1 point**)

$$\hat{c} + 12\hat{h} = 78\sqrt{3} + 12 \cdot \frac{13\sqrt{3}}{2} = 156\sqrt{3}.$$

Without compensation, the right-hand side of the budget constraint after the tax is 264. Therefore, the required compensation is (**1 point**)

$$CV = 156\sqrt{3} - 264 \approx 6.200.$$

The compensating variation is positive because the tax not only reduces the price of leisure, but also reduces the value of the worker's time endowment (**1 point**).

Exercise 2 (35 points). A monopolist produces output q using labor L and capital K. Its production function is

$$F(L, K) = \min\left\{\sqrt{L}, 2\sqrt{K}\right\}.$$

The wage is $w = 11$ and the rental rate of capital is $r = 4$.

A. (8 points) Derive the firm's cost function $C(q)$.

Solution: At the optimum, (**2 points**)

$$\sqrt{L} = 2\sqrt{K}.$$

Therefore (**2 points**)

$$\sqrt{L} = q, \qquad 2\sqrt{K} = q.$$

Solving these two conditions we obtain the conditional factor demands (**2 points**)

$$L(q) = q^2, \qquad K(q) = \frac{q^2}{4}.$$

The cost function is then (**2 points**)

$$C(q) = 11L(q) + 4K(q) = 11q^2 + 4\frac{q^2}{4} = 12q^2.$$

B. (12 points) From now on, independently of your answer in Part A, assume that the monopolist's cost function is

$$C(q) = q^2.$$

The monopolist faces inverse demand

$$p(q) = 1 - q.$$

Find the monopolist's optimal quantity and price, verifying all the conditions that characterize the solution to the profit maximization problem. Compute its profit, the Lerner index, and the deadweight loss.

Solution: The monopolist maximizes (**1 point**)

$$\pi(q) = p(q)q - C(q) = (1 - q)q - q^2 = q - 2q^2,$$

with $q \in [0, 1]$. The first-order condition for an interior solution is (**1 point**)

$$\pi'(q) = 1 - 4q = 0.$$

The second-order condition holds because (**1 point**)

$$\pi''(q) = -4 < 0.$$

Therefore (**2 points**)

$$q^M = \frac{1}{4}, \qquad p^M = 1 - q^M = \frac{3}{4}$$

and (**1 point**)

$$\pi(q^M) = \frac{1}{4} - 2\left(\frac{1}{4}\right)^2 = \frac{1}{8}.$$

Since $\pi(q^M) > \pi(0) = 0$, the solution also satisfies the shutdown condition (**1 point**). Since $MC(q) = 2q$, at the optimum $MC(q^M) = 1/2$. The Lerner index is (**2 points**)

$$L = \frac{p^M - MC(q^M)}{p^M} = \frac{\frac{3}{4} - \frac{1}{2}}{\frac{3}{4}} = \frac{1}{3}.$$

The efficient quantity satisfies $p(q) = MC(q)$, that is (**1 point**)

$$1 - q = 2q \quad \Longleftrightarrow \quad q^{EF} = \frac{1}{3}.$$

The deadweight loss is (**2 points**)

$$DWL = \frac{1}{2}\left(\frac{1}{3} - \frac{1}{4}\right)\left[p(q^M) - MC(q^M)\right] = \frac{1}{2} \cdot \frac{1}{12} \cdot \frac{1}{4} = \frac{1}{96}.$$

C. (10 points) The monopolist can invest in a new marketing technology at cost $\kappa > 0$. The return to the investment is uncertain. With probability $z = \frac{1}{3}$, demand remains unchanged. With probability $1 - z$, the investment is successful and demand becomes

$$p(q) = 1 - \frac{1}{2}q.$$

Assume that the firm maximizes expected profit. Calculate the monopolist's optimal quantity and price if the investment is made and successful. Determine under which condition the firm will invest.

Solution: If the investment is successful, the monopolist maximizes (**2 points**)

$$\pi^S(q) = \left(1 - \frac{1}{2}q\right) q - q^2 = q - \frac{3}{2}q^2,$$

with $q \in [0, 2]$. The shutdown option corresponds to $q = 0$, which gives profit $\pi^S(0) = 0$. The first-order condition is (**2 points**)

$$1 - 3q = 0,$$

and the second-order condition holds because $(\pi^S)''(q) = -3 < 0$. Therefore (**2 points**)

$$q^S = \frac{1}{3}, \qquad p^S = 1 - \frac{1}{2} \cdot \frac{1}{3} = \frac{5}{6}.$$

The solution is feasible and satisfies the shutdown condition, because the profit from producing in the successful state, before subtracting the investment cost, is positive (**1 point**):

$$\pi^S = \pi^S(q^S) = \frac{1}{3} - \frac{3}{2}\left(\frac{1}{3}\right)^2 = \frac{1}{6} > 0 = \pi^S(0).$$

If demand remains unchanged, the profit is that of part B, $\pi^M = 1/8$. Therefore, the expected profit if it invests is (**2 points**)

$$E\pi^I = \frac{1}{3} \cdot \frac{1}{8} + \frac{2}{3} \cdot \frac{1}{6} - \kappa = \frac{11}{72} - \kappa.$$

If it does not invest, it obtains $\pi^M = 1/8 = 9/72$. Therefore, it invests if (**1 point**)

$$\frac{11}{72} - \kappa > \frac{9}{72} \quad \Longleftrightarrow \quad \kappa < \frac{1}{36}.$$

With equality, the firm is indifferent.

D. (5 points) Before deciding whether to invest, the firm can buy perfect information about whether the investment will be successful. Let M denote the price of this information. Characterize the maximum price M^* the firm is willing to pay for this information.

Solution: Without perfect information, the maximum expected value before paying for information is (**1 point**)

$$V^{NI} = \max\left\{\frac{1}{8}, \frac{11}{72} - \kappa\right\}.$$

The firm invests without information if $\kappa < 1/36$.

With perfect information, if it knows the investment will fail, it does not invest and obtains $1/8$. If it knows it will succeed, it invests provided that (**1 point**)

$$\frac{1}{6} - \kappa \geq \frac{1}{8} \quad \Longleftrightarrow \quad \kappa \leq \frac{1}{24}.$$

Therefore, before paying the price of the information,

$$V^{I} = \begin{cases} \frac{1}{3}\cdot\frac{1}{8} + \frac{2}{3}\left(\frac{1}{6} - \kappa\right) & \text{if } \kappa < \frac{1}{24}, \\ \frac{1}{8} & \text{if } \kappa \geq \frac{1}{24}. \end{cases}$$

The maximum price the firm is willing to pay is $M^* = V^I - V^{NI}$. Therefore (**3 points**),

$$M^*(\kappa) = \begin{cases} \frac{\kappa}{3} & \text{if } 0 < \kappa < \frac{1}{36}, \\ \frac{1}{36} - \frac{2\kappa}{3} & \text{if } \frac{1}{36} \leq \kappa < \frac{1}{24}, \\ 0 & \text{if } \kappa \geq \frac{1}{24}. \end{cases}$$

In the first case, the information avoids paying the investment cost in the state in which the investment would fail. In the second case, the information allows investing only when success is guaranteed. In the third case, the investment is too costly even when success is guaranteed, so the information has no value.