LISBON SCHOOL OF ECONOMICS & MANAGEMENT
UNIVERSIDADE DE LISBOA

Microeconomics I

Licenciatura in Economics

24th of July of 2021
Duration: 2 hours

Regular-Period Exam — Part A

Full Name: c

Student Number: .... Class: ....

1. Mark your answers with an 'O' in the table below. You get 0.5 marks for each right answer, and a 0.5/3 (≈ 0.167) deduction for any wrong answer.
2. You cannot look up books or notes of any kind. Invigilators will not help you with the test.
3. You cannot use any calculators in this part. Switch off and put away any mobile phones, computers, and any other data storage device.
4. This test paper must be returned to the invigilator even if you decide to quit.

ANSWER TABLE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b
c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c
d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d

1. Ana is indifferent between bundles (1, 9), (7, 7) and (9, 1). Which axiom or property do Ana's preferences violate?
   a) Transitivity.
   b) Convexity.
   c) Monotonicity.
   d) None of the other options is correct.

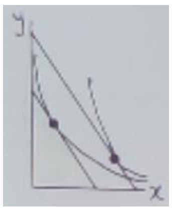
2. Which of the following is **FALSE**? If goods *X* and *Y* are perfect substitutes:
   a) Indifference curves are straight lines.
   b) Marginal rate of substitution is constant.
   c) Preferences can be represented by a function of the type $u(x, y) = ax + by$ where a and b are appropriate constants.
   d) None of the other alternatives is false.

3. Which of the following does **NOT** represent the same preferences as $u(x, y) = x^{0.5} + y^{0.5}$?
   a) $v(x, y) = 3x^{0.5} + 3y^{0.5}$.
   b) $w(x, y) = 3x^{0.5}y^{0.5}$.
   c) $z(x, y) = x^{0.5} + y^{0.5} + 30$.
   d) $t(x, y) = 3\ln(x^{0.5} + y^{0.5})$.

4. Goods *X* and *Y* are perfect complements for Ana. Then her optimal bundle (x, y) will be such that:
   a) x/y is constant (regardless of prices and income).
   b) $x/y = p_y/p_x$.
   c) $x/y = p_x/p_y$.
   d) None of the other alternatives is correct.

5. At bundle ($x = 2$, $y = 8$), Ana's marginal utility from good *X* is 6; from good *Y* is 3. This means she is willing to exchange *X* for *Y* or *Y* for *X* at the rate of:
   a) 2 units of *X* per unit of *Y*.
   b) 4 units of *X* per unit of *Y*.
   c) 2 units of *Y* per unit of *X*.
   d) 4 units of *Y* per unit of *X*.

6. The figure shows two indifference curves and two parallel budget lines. For the relevant income and prices:



   a) *X* is a Giffen good; *Y* an ordinary good.
   b) *X* is an ordinary good; *Y* a Giffen good.
   c) *X* is an inferior good; *Y* a normal good.
   d) *X* is a normal good; *Y* an inferior good.

7. At interest rate *r* Ana plans to be a saver. If the interest rate rises, Ana:
   a) Will remain a saver and be better off.
   b) Will remain a saver; may be better or worse off.
   c) Will become a borrower and be worse off.
   d) Will become a borrower; may be better or worse off.

8. Ana can work earning *w* per hour and buys a consumption good at price *p*. The slope of her budget line (with leisure on the horizontal axis) is:
   a) $-(w - p)$.
   b) $-w$.
   c) $-p$.
   d) None of the other alternatives is correct.

9. The price of good *X* rises. Ana would be willing to pay up to €90 to be able to keep buying the good at the old price. Then €90 is Ana's:
   a) Compensating variation.
   b) Equivalent variation.
   c) Income effect.
   d) Substitution effect.

10. A firm increases all its inputs by 40%, and output increases by 30%. This is an example of:
    a) Increasing returns to scale.
    b) None of the other alternatives is correct.
    c) Decreasing returns to scale.
    d) Law of diminishing marginal returns.

11. A firm has increasing returns to scale at all output levels. The firm is making a positive profit. With constant input and output prices, if the firm doubles output, profit:
    a) Will double.
    b) Will more than double.
    c) Will increase, but less than double.
    d) May increase, decrease or remain unchanged.

12. At current input and output levels, marginal product of labour is 3. The wage rate is 8, and the output price is 4. A marginal increase in the quantity of labour used will:
    a) Increase profit.
    b) Decrease profit.
    c) Leave profit unchanged.
    d) The information is insufficient to answer.

13. A firm with a U-shaped average variable cost curve is producing 9 units. Marginal cost is 8, average variable cost is 5. The output price is 7. Can the firm increase profit?
    a) Yes, by increasing output.
    b) Yes, by decreasing output.
    c) No, any change will, decrease profit.
    d) The information is insufficient to answer.

14. In the short-run, a firm will only produce if:
    a) Price equals marginal cost.
    b) Price is at least equal to average cost.
    c) Price is at least equal to average variable cost.
    d) Price is at least equal to average fixed cost.

15. $MC(y) = y$. Then $AVC(2) =$
    a) 1.
    b) 2.
    c) 4.
    d) None of the other alternatives is correct.

16. A firm's long-run cost function is: $c(y) = y^2 + A$ if $y > 0$ and $c(y) = 0$ if $y = 0$. Then, *A* is:
    a) A variable cost.
    b) A fixed cost.
    c) A quasi-fixed cost.
    d) Such a function cannot be a long-run cost function.

Regular-Period Exam — Part B

Show all relevant calculations and succinctly explain your reasoning in all questions asking for a numeric result.

a) [1] Ana's preferences can be described by the utility function $u(x, y) = x^{0.5} + y^{0.5}$. Are these preferences monotonic and convex? Explain.

b) [2] The same Ana, with the utility function $u(x, y) = x^{0.5} + y^{0.5}$, has income $m = 60$, and the prices are $p_x = 2$ and $p_y = 1$. Find Ana's optimal consumption bundle and illustrate it in a graph.

c) [1] Bob has strictly convex preferences. Bundles (2, 12) and (10, 5) are on his budget line, and he is indifferent between them. Can any of these bundles be his optimal one? Explain and illustrate in a graph.

d) [2] Carla's preferences can be described by the utility function $u(x, y) = xy$. Her demand functions are $x(p_x, p_x, m) = 0.5m/p_x$ and $y(p_x, p_x, m) = 0.5m/p_y$. She has income $m = 20$, and at first the prices are $p_x = p_y = 1$, and her optimal bundle is (10, 10). Then the price of good X rises to $p_x' = 4$. Find the compensating variation and explain what it means.

e) [1] Can a technology exhibit the law of diminishing marginal returns for all its inputs and increasing returns to scale at the same time? Explain, and if your answer is yes give an example.

f) [2] A firm operates with the production function $y = f(K, L) = K^2L$. Input prices are $w_K = 1$ and $w_L = 4$. Find the long-run cost of producing $y = 500$.

g) [2] There are 20 firms each operating with the cost function $c(y) = 100 + 5y + 0.5y^2$. Find the individual and market supply curves.

h) [1] Consider a firm that uses only variable inputs and has constant returns to scale. Can such a firm have a positive profit while maximising profit? Explain. (Hint: consider what would happen if the firm increased output.)

Answers to Part A

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
b	d	b	a	c	d	a	d	b	c	b	a	b	c	a	c

Answers to Part B

a) $MRS = -MU_x/MU_y = -0.5x^{-0.5}/(0.5y^{-0.5}) = -y^{0.5}/x^{0.5}$. As y decreases and x increases as we move down along the indifference curve, MRS falls (in absolute values); therefore preferences are convex. They are also monotonic: when the quantity of any of the goods increases, utility increases.

b) As preferences are convex, at the optimal bundle indifference curve must be tangent to the budget line, so $MRS = -p_x/p_y$, so (calculations omitted), $y = 4x$. The optimal bundle must be on the budget line, so $p_x x + p_y y = m$, or $2x + y = 60$; substitute $y = 4x$ to obtain $x = 10$ and $y = 40$. Preferences are convex, so the graph shows a convex indifference curve tangent to the budget line at (10, 40).

c) No. He is indifferent between (2, 12) and (10, 5), so they are on the same indifference curve, This indifference curves crosses the budget line at these bundles (as both are on the budget line). As preferences are strictly convex any bundle on the budget line between (2, 12) and (10, 5) (excluding them) is strictly preferred to them, so they are not optimal; namely there is a higher indifference curve that is tangent to the budget line between (2, 12) and (10, 5); that tangency point is the only optimal bundle. (Varian illustrates this in chapter 5, figure 5.1; there, too, the lower indifference curve intersects the budget line at two points; clearly none of them is the optimal bundle.)

d) The compensating variation, CV, is the extra income Carla would need to keep her old utility with the new prices. Let us define $m' = m + CV = 20 + CV$; so m' is the income she would need to keep her utility with the new prices. With income m', $p_x' = 4$, and $p_y = 1$, she would maximise utility with bundle $(0.5m'/4, 0.5m'/1)$, and have utility $u(0.5m'/4, 0.5m'/1) = m'^2/16$. We want m' such that she gets her old utility, so $m'^2/16 = u(10, 10) = 100 \Leftrightarrow m' = 40$. So $CV = m' - m = 20$.

e) Yes, for instance $f(L, K) = L^{0.6}K^{0.6}$ has decreasing marginal products: $MP_L = 0.6/L^{0.4}$ and $MP_K = 0.6/K^{0.4}$, so when any of the inputs increases, its marginal product (the extra output you get while keeping the other input constant) falls; so this technology exhibits the law of diminishing marginal returns. But if we increase both inputs simultaneously, say multiplying both by $t > 1$, then $f(tL, tK) = t^{1.2}L^{0.6}K^{0.6} = t^{1.2}f(tL, tK) > tf(tL, tK)$; that is,if we multiply both inputs by $t > 1$, output multiplies by $t^{1.2}$ a greater proportion ($t^{1.2} > t$ for all $t > 1$), so the technology exhibits increasing returns to scale.

f) To minimise cost:
$MP_L/MP_K = w_L/w_K \Leftrightarrow K/(2L)\ 4/1 = \Leftrightarrow K = 8L$ (1)
Substituting in the technological constraint we get:
$K^2L = 500 \Leftrightarrow (8L)^2L = 500 \Leftrightarrow L = 1.8125$.
$K = 8L = 15.8741$.
The cost of 500 is then $K + 4L = 23.811$.

g) The firm does not produce if the price is less than the minimum average variable cost: $AVC = VC(y)/y = 5 + 0.5y$; this is an increasing function, and its minimum is at $y = 0$, with $AVC(0) = 5$. So quantity supplied is zero if $p < 5$. For $p > 5$, the firm maximises profit with $MC = p$, or $5 + y = p \Leftrightarrow y = p - 5$. So the firm's supply curve is $y(p) = p - 5$ for $p \geq 5$, $y(p) = 0$ for $p < 5$. With 20 identical firms, the industry supply curve is $Y(p) = 20y(p) = 20p - 100$ for $p \geq 5$, $Y(p) = 0$ for $p < 5$.

h) No, if the firm is making a positive profit, then it is not maximising profit (it could increase profit even more simply by producing more). See Varian, chapter "Profit maximisation", section "Profit maximisation and returns to scale). This of course assumes that the firms is perfectly competitive (that is a price-taker in both input and output markets).