Econ 703
Intermediate Microeconomics
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Solutions to midterm 2 (Group D)

“X and Y (2pt).” means that you get 2 pts if you answered both X and Y, and no pts if you missed either (or both).

Problem 1. [Here I denote by T the state with tornado and by N the state without tornado, instead of 1 and 2.]

a) $4000 (4pt).$ b) $C_1 = 500 (2pt).$ c) $C_2 = 500 (2pt).$ d) $S = 500 (2pt).$ e) $b = 2, p_1 = 2, p_2 = 2 (2pt).$ f) $p_1 = 1, p_2 = 2 (2pt).$ g) $MRS^A = -1 = MRS^B$ and thus this equilibrium allocation is Pareto efficient (2pt). [MRS must be calculated.]

Problem 2. [Here I denote apple by 1, orange by 2, Andy by A and Bob by B. You could use another notation, as long as you clarified it.] a) The Edgeworth box should have length of 10 on each axis (1pt). The endowment is $(10, 0)$ looked from A’s origin, i.e. $(0, 10)$ from B’s origin (1pt). [This is a single point in an Edgeworth box. And, it cannot be an origin.] b) ... if none could not be better off (by another feasible allocation) unless anyone is worth off (2pt). $[MRS^A = MRS^B: 	ext{no point since it is just a mathematical equivalent property and not the definition.}^1$

c) [Need to prove the claim directly from the definition of Pareto efficiency. Arguing only slopes or tangency is wrong. Besides, logical sequence (especially starting assumptions and ending conclusions) must be clarified. The curve’s name, namely “an indifference curve”, should be clarified.] Necessity (4pt): If $MRS^A \neq MRS^B$ at an allocation $x$, both people’s indifference curves should cross each other at $x$ and thus we can find a point between them. Because this point is above each indifference curve looked from the people’s origin, this allocation is better than $x$ for both and thus the allocation $x$ is not Pareto efficient. [The proof should start with $MRS^A \neq MRS^B$ and end with Pareto inefficiency of $x$. Graph is needed. On the graph, you need to specify another allocation that improves their utilities. If you wrote two separate points and two separate curves for a single allocation, you misunderstand an Edgeworth box.]

Sufficiency (4pt): If $MRS^A = MRS^B$ at an allocation $x$, both people’s indifference curves should be tangent to each other at $x$ and thus no point is below A’s indifferent curve looked from A’s origin, i.e. worse for A than $x$, or below B’s indifferent curve looked from B’s origin, i.e. worse for B, or below both. So any point (allocation) cannot be better than $x$ for both people and $x$ is Pareto efficient. [The proof should start with $MRS^A = MRS^B$ and end with Pareto efficiency of $x$. Graph is needed. On the graph, you need to clarify who is worse off than $x$ in each region defined by the two indifference curves.]

d) $x_1^A = x_2^A \text{ or } x_1^B = x_2^B (3pt).$ [You need to clarify whose consumption it is.] The diagonal line connecting the two origins of the Edgeworth box (1pt).

e) $x_1^A = 5 (2pt).$ $x_2^A = 5 (2pt).$ $x_1^B = 5 (2pt).$ $x_2^B = 5 (2pt).$ $p_1 = 1, p_2 = 1 (2pt).$ $[p_1, p_2]$ can be any pair of two positive numbers as long as $p_1 = p_2$. No partial credit for only $p_1$ or $p_2.$ f) $p_1 = 2, p_2 = 2 (2pt).$ $[p_1, p_2]$ can be any pair of two positive numbers as long as $p_1 = p_2$ and different from your answer in e.) g) $MRS^A = -1 = MRS^B$ and thus this equilibrium allocation is Pareto efficient (2pt). [MRS must be calculated.]

Problem 3. a) $4000 (4pt).$ b) $C_1 = 500 (2pt).$ c) $C_2 = 500 (2pt).$ d) $S = 500 (2pt).$ Yes, he’s smoothing (1pt). No, he’s not tilting (1pt). [If you answered only either one question and did not clarify which question you answered, you get no point.] e) Demand: $L^D = (w/p)^{-2}$ where $p$ is the product’s price and $w$ is wage (4pt). [Thus $w/p$ is the real wage rate.] Equilibrium real wage: $w/p = 1/4 (2pt).$ The point $(L, w/p) = (16, 1/4)$ must be plotted on a graph (1pt). f) (6pt.) The annual consumption $C$ (thousand dollars) is determined from $\{1 - (0.05)^{40}\} \cdot 60/1.05 = \{1 - (0.05)^{−60}\} C/1.05.$ [Further simplification gets full points.]

Problem 4. a) DRS (1pt). This is because $F(tK, tL) = t^{1/2}K^{1/4}L^{1/4} = t^{1/2}F(K, L) < tF(K, L)$ if $t > 1$ (4pt). [Here $F(k, l)$ is the output from $K = k$ and $L = l$] b) $C = 4y^2 (4pt).$ Graph is needed on the $y-C$ plane (1pt). c) $y^{MES} = 1/\sqrt{2} (2pt).$ $ATC^{MES} = 4\sqrt{2} (2pt).$ d) (6pt for giving both the function and the graph.) The supply function $S(p)$ is $p/8$ for $p \geq 4\sqrt{2},$ and $0$ for $p < 4\sqrt{2}.$ On the $y-p$ plane, the graph is $y = p/8$ (i.e. $p = 8y$) for $p \geq 4\sqrt{2}$ and $y = 0$ (a part of the vertical axis) for $p < 4\sqrt{2}.$

$^1$A Pareto efficient allocation may not hold this equation, unless the preference is convex, monotone, and smooth.