U8216 Microeconomics and Policy Analysis
Fall 2000
Fall 1999 Midterm Solution

Short Problems

1. $U(x,y) = x^{½}y^{½}$.

True	False		
	✓	$(3,5) \succ (4,4)$	because $\sqrt{15} < \sqrt{16}$
✓		$(1,4) \sim (2,2)$	because 2 = 2
✓		$(3,5) \succ (1,9)$	because $\sqrt{15} > \sqrt{9}$
✓		$(100,4) \succ (5,5)$	because 20 > 5

2. $U(x_1,x_2) = x_1 + 2x_2$

$$\text{MRS} = \frac{MU_{x_2}}{MU_{x_1}} = \frac{dU/dx_2}{dU/dx_1} = 2$$

3. $M = 120$ $\qquad P_{x_1} = 10$ $\qquad P_{x_2} = 5$

At the x_2-axis, we spend all our money on x_2, and we can buy $\frac{M}{P_{x_2}} = \frac{120}{5} = 24\ x_2$.

Therefore, $(x_1,x_2) = (0,24)$.

4. $\text{MRS}\ (7,10) = \frac{MU_{x_1}}{MU_{x_2}} = \frac{1}{1} < \frac{2}{1} = \frac{P_{x_1}}{P_{x_2}}$.

Beth is not yet maximizing utility, and would like to consume more x_2 and less x_1. Therefore, her utility-maximizing bundle must lie <u>left and above</u> (7,10).

5. Each group thinks that their proposed action will increase revenues to cover the deficit.

The trustees think that demand is price <u>inelastic</u> since increasing prices will increase quantity demanded more-than-proportionately, so that overall revenue will increase.

The student president thinks that demand is price <u>elastic</u> since decreasing prices will increase quantity demanded more-than-proportionately, so that overall revenue will increase.

6. $$\frac{MU_{Minh,\,cheese}}{MU_{Minh,\,bread}} = \frac{3}{1} > \frac{1/2}{1} = \frac{MU_{Mukki,\,cheese}}{MU_{Mukki,\,bread}}$$

Minh relatively prefers cheese and Mukki relatively prefers bread, therefore:

True	False	
	✓	Minh will acquire more bread.
✓		Minh will acquire more cheese.
✓		Mukki will acquire more bread.
	✓	Mukki will acquire more cheese.

7. (D) is false. Every point on the contract curve is Pareto optimal, so it is impossible to make both individuals better off simultaneously.

<u>Long Problems</u>

1. $U = C^{1/2}L^{1/2}$ $\qquad wL + C = 16w$ $\qquad w = 20$

a. $$MRS = \frac{MU_C}{MU_L} = \frac{dU/dC}{dU/dL} = \frac{\frac{1}{2}C^{-\frac{1}{2}}L^{\frac{1}{2}}}{\frac{1}{2}C^{\frac{1}{2}}L^{-\frac{1}{2}}} = \frac{L}{C}$$

b. Utility-maximizing condition,

$$MRS = \frac{P_C}{P_L} = \frac{1}{w}$$

$$\frac{L}{C} = \frac{1}{20}$$

$$C = 20L$$

c.

$wL + C$	=	$16w$	substitute $C = 20L$
$wL + 20L$	=	$16w$	substitute $w = 20$
$20L + 20L$	=	16×20	
$40L$	=	320	
L	=	8	
C	=	$20L = 20 \times 8 = 160$	

d. Labor $= 16 - L = 16 - 8 = 8$

e. From part (b), $w = 40 \Rightarrow C = 40L$

From part (c),

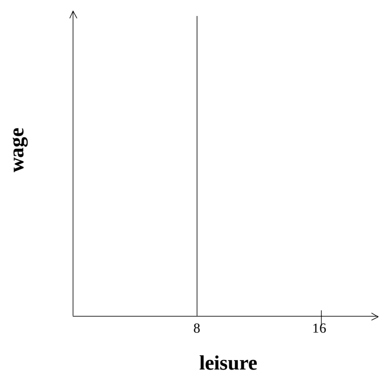
$wL + 40L$	=	$16w$		substitute $w = 40$
$40L + 40L$	=	16×40		
$80L$	=	640		
L	=	8		
Labor	=	$16 - 8$	=	8

f. From part (b), we know that $C = wL$ for all w.

$wL + C$	=	$16w$	substitute $C = wL$
$wL + wL$	=	$16w$	substitute $w = 20$
$2wL$	=	$16w$	divide by w
$2L$	=	16	
L	=	8	

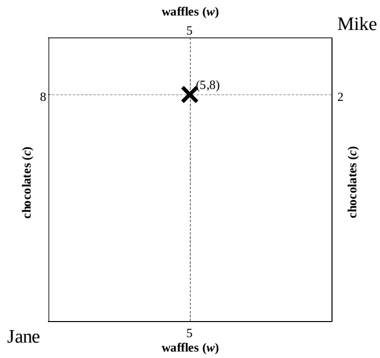
For these set of preferences, $L = 8$ irrespective of w. We conclude that the income and substitution effects of any change in wage are exactly equal and opposite.

g.



2. $U_M(c_M,w_M) = c_M + w_M$ $U_J(c_J,w_J)=c_J^{½}w_J^{½}$ $(c_M,w_M) = (2,5)$

a. Edgeworth box.

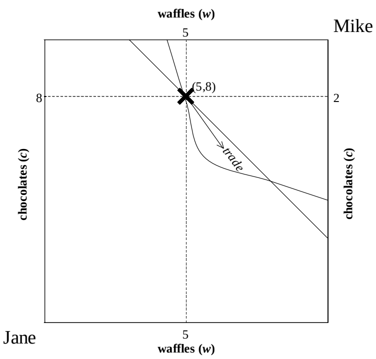


b. $$\text{MRS}_M = \frac{MU_{w,\text{ Mike}}}{MU_{c,\text{ Mike}}} = \frac{1}{1} = 1$$

$$\text{MRS}_J = \frac{MU_{w,\text{ Jane}}}{MU_{c,\text{ Jane}}} = \frac{c_J^{\frac{1}{2}} \big/ 2w_J^{\frac{1}{2}}}{w_J^{\frac{1}{2}} \big/ 2c_J^{\frac{1}{2}}} = \frac{c_J}{w_J} = \frac{8}{5}$$

c. No, it is not Pareto optimal, since $\text{MRS}_M = 1 \neq \frac{8}{5} = \text{MRS}_J$.

d. Direction of trade



- Jane and Mike will exchange chocolates and waffles at a rate $\frac{\Delta c}{\Delta w}$, wherein

$$\text{MRS}_M = 1 \leq \left|\frac{\Delta c}{\Delta w}\right| \leq \frac{8}{5} = \text{MRS}_J$$

- We can tell from the relative MRS values that Jane relatively prefers waffles to chocolates and Mike relatively prefers chocolates to waffles.
- Therefore, Jane will exchange some of her chocolates for Mike's waffles.

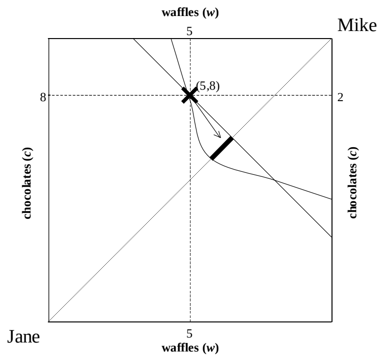
e. At equilibrium,

$$\text{MRS}_M = \text{MRS}_J$$

$$1 = \frac{c_J}{w_J}$$

$$c_J = w_J$$

f. Edgeworth box



3. Prisoners' Dilemma (less is better)

a. If Prisoner 2 confesses, Prisoner 1 would prefer to confess since 5 < 15.
If Prisoner 2 does not confess, Prisoner 1 would prefer to confess since 0 < 1.
Therefore, irrespective of Prisoner 2's strategy, Prisoner 1 is better off confessing, Prisoner 1's strictly dominant strategy is to confess.
Since the payoffs are symmetric, then Prisoner 2's strictly dominant strategy must also be to confess.

b. The only Nash equilibrium in this game is (5,5).

c. The Nash equilibrium is not Pareto optimal. Both prisoners are better off at (1,1).

4. New York State Lottery, $r = 1 - 0.1 = 0.9$

a. PDV lump sum = 3,600,000

b. 10 payments starting year 0 $\Rightarrow n = 10$

PDV 10 payments $= \dfrac{a\left(1-r^{n}\right)}{1-r}$

$= \dfrac{550{,}000\left(1-0.9^{10}\right)}{1-0.9}$

$= 3{,}582{,}268.58$

c. Infinite stream

$\text{PDV}_{\infty} = \dfrac{a}{1-r}$

$= \dfrac{300{,}000}{1-0.9}$

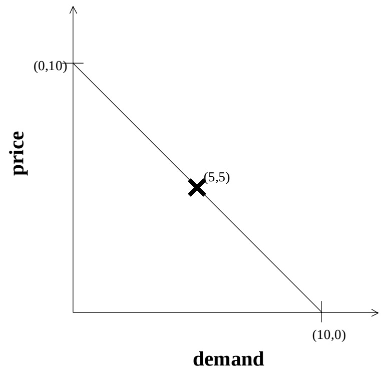
$= 3{,}000{,}000$

We would choose the lump sum payment because it has the greatest present discounted value.

5. $D(P_p) = 10 - P_p$

a. $P_p = 5$, $D(P_p) = 10 - 5 = 5$

b. Maya's demand for plantains



c. $P_{p_1} = 6$, $D(P_{p_1}) = 10 - 6 = 4$

$$\varepsilon = \left|\frac{\Delta D}{D_0} \div \frac{\Delta P_p}{P_{p0}}\right| = \left|\frac{5-4}{5} \div \frac{5-6}{5}\right| = -1$$