Econ 301
Exam #2 (100 pts.)
Spring 2000

**Thought for the Day:** "Is that your FINAL answer?" (Regis Philbin, host of *Who Wants to be a Millionaire?* tv show).

**Instructions:** There are 21 numbered questions on this test; answer any 20 (5 pts. each). If you answer all questions, all will be graded. If you leave all questions blank, all will also be graded and you probably won’t get a very good score. Show your work to receive full credit where calculations are required.

In the figure below, for a given consumer assume 1) the line aa represents an original budget line (before the establishment of a tax), 2) the line ba represents a second or new budget line (after the establishment of a tax).

![Graph showing budget lines](image)

**1.** Define and describe the type of tax that has been imposed. Explain when this tax would not lower the given consumer’s utility.

*Type a tax = per unit tax on Y (like a P*)

*Would not lower consumer’s U if they were not buying any Y (i.e., all X)*

**2.** Assume that, given a consumer’s utility function and prices for $x =$ hamburgers and $y =$ french fries, the optimal quantities of burgers and fries are such that $x = 2y$. If the consumer’s income constraint is $10$, $P_x = $2, and $P_y = $1, what is the utility maximizing consumption levels of $x$ and $y$?

\[\begin{align*}
\mathcal{I} - P_x x - P_y y &= 0 \\
10 - 2x - y &= 0 \\
\Rightarrow 10 - 5y &= 0 \\
\Rightarrow y &= 2 \\
\Rightarrow x &= 2y = 4
\end{align*}\]
3. If \( r = 8\% \), what is the future value 20 years from now of ten successive $1,000 annual payments with the first payment taking place 5 years from now?

\[
P(V) = 1000 \left( \frac{PVIFA_{0.08,14}}{PVIFA_{0.08,4}} \right) - 1000 \left( \frac{PVIFA_{0.08,4}}{PVIFA_{0.08,4}} \right)
\]

\[= 1000 \left( \frac{8.2442}{3.3121} \right) - 1000 \left( \frac{3.3121}{3.3121} \right)
\]

\[= 2442 - 1000 = 1442
\]

\[
FV = P(V) \times (PVIF_{0.08,10})
\]

\[= 1442 \times (PVIF_{0.08,10}) = 2,988
\]

4. Define the term annuity.

- a series of \( n \) successive and equal annual payments

5. Assume that the graph below, for a given consumer, contains an original budget line \( (I_1) \), an original maximum attainable utility \( (U^*) \), a second or new budget line \( I_2 \), and a corresponding new maximum level of utility \( (U^*) \). Show and label in the graph, the substitution effect (label S), the income effect (label I), and the total effect (label T).
6. Assuming that the initial price of X in Q. 5 is $8, which of the following is a P_X combination on the consumer’s demand curve for X?
   a. P_X = 8, X = 18
   b. P_X = 4, X = 10
   c. P_X = 16, X = 10
   d. P_X = 4, X = 18
   e. P_X = 16, X = 18

Assume Cy, likes to tailgate at home football games and drink his/her own wine coolers that she/he makes by always mixing 1 oz. of Seven-Up (S) with 4 oz. of wine (W). Cy’s utility is given as U = min [W, 4S]. Assume P_S = $.25/oz., P_W = $.50/oz., and Cy’s “wine cooler” budget constraint per game is $18. Use this information to answer questions #7 through #9.

7. Draw in the graph above Cy’s indifference curve for U = 24 (label U = 24).
8. Solve for the utility maximizing quantity of S and W that Cy will purchase in question #7 above given his/her constraint above (hint: use $W = 4S$ and the equation of the budget constraint).

$$18 = .25S + .5W \Rightarrow 18 = .25S + .5(4S)$$
$$\Rightarrow 18 = 2.25S \Rightarrow S^* = 8$$
$$\Rightarrow W^* = 4S^* = 32$$

9. Assume that Cy's best friend will bring Seven-Up to the tailgate and give Cy all the S that he/she wants at no charge or cost to Cy. Draw and label as $I_1$ in the graph in question #7 above, Cy's new budget constraint (i.e. Cy must still buy the wine and he/she has only $18 to spend on W). Show graphically, Cy's new point of utility maximization.

$$\Rightarrow \text{spend all } I \text{ on } W \Rightarrow \text{max } W = \frac{I}{P_W} = \frac{18}{15} = 36 \Rightarrow W^* = 36$$
$$\Rightarrow S^* = 9$$

10. Assume that the graph below contains an original budget constraint ($I_1$) and a new or second budget constraint ($I_2$) in our labor-leisure model.

Which of the following most likely might have caused the parallel shift in the budget constraint:

a. an increase in the wage rate
b. a decrease in the price of consumer goods

\[ \bigcirc \]

c. an increase in nonlabor income
d. an income tax decrease
e. an increase in the consumer's desire to buy consumer goods
Assume the figure below, for Farmer Jones, is a graphical representation of our intertemporal choice model where $C_0$ and $C_1$ = quantities of current and future period consumption respectively and the line aa represents Farmer Jones' initial budget constraint where, initially, Farmer Jones has equal income of $10,500 in periods 0 and 1 (i.e. $I_0 = I_1 = 10,500$) and the price of 1 unit of $C_0$ and $C_1$ = $1$. Assume $r = 5\%$. Use this information to answer questions #11 through #15.

11. What is the equivalent future value to Farmer Jones of his/her present period (value) income of $10,500 given $r = 5\%$ (show calculation)?

$$= 10,500 \times (1.05) = 11,025$$

12. What is the apparent maximum attainable value of $C_1$ (show calculation)?

$$= \frac{I_0 (1+r) + I_1}{p} = \frac{10,500(1.05) + 10,500}{1} = 21,525$$

13. Label as point "1" on aa in the figure above, Farmer's original point of utility maximization if it corresponds to the point where he/she is neither a net borrower nor a net saver. What is the value of $C_0$ and $C_1$ at this point? Draw and label as $U_1$, a maximum attainable indifference curve that corresponds to this situation.

$C_0 = C_1 = 10,500$
14. Assume Farmer Jones experiences a 50% reduction in current period income due to lower grain prices (i.e., $I_0 = $5,250). Draw and label as bb Farmer’s new budget constraint as a result of the current period income reduction. What is its vertical axis intercept?

\[
\text{New max } C_1 = \text{new } I_0 \cdot (1 + r) + \frac{I_1}{p} = 5250 \cdot (1.05) + 10,500 = 8525 \quad \text{or } \quad 16,012.50
\]

15. How much could Farmer Jones increase his/her current period consumption by as a result of borrowing if he/she reduces future period consumption by $1,800 and \( r = 5\% \) (i.e. note Farmer Jones will pay back $1,800 principal and interest out of future period income).

\[
PV = \frac{1800}{1.05} = 1714.29
\]

16. Assume a specific mathematical Lagrangian objective function associated with a constrained utility maximization problem is given by \( \pi = x^{1/2}y^{1/2} + \lambda(10.00 - .50x - 2.00y) \). Derive the three first-order conditions that would have to hold in order for \( \pi \) to be maximized.

\[
\begin{align*}
\text{Eq. 1) } & \quad \frac{\partial}{\partial x} = \frac{1}{2} x^{-1/2} y^{1/2} - .5 \lambda = 0 \\
\text{Eq. 2) } & \quad \frac{\partial}{\partial y} = \frac{1}{2} x^{1/2} y^{-1/2} - 2 \lambda = 0 \\
\text{Eq. 3) } & \quad \frac{\partial}{\partial \lambda} = 10 - .5x - 2y = 0
\end{align*}
\]

17. In question #16 above, how much income does the consumer have to spend on goods \( x \) and \( y \)?

\[
\Rightarrow I = 10
\]
18. Assume a utility-maximizing consumer with income = I (and therefore a budget constraint of \( I - P_x X - P_y Y = 0 \)) purchases pounds of \( X = \) oranges and pounds of \( Y = \) grapes such that \( X = 10Y \). Given this information, \( Y^* = \) 

\[
\begin{align*}
\text{a.} & \quad \frac{I}{10P_x + P_y} \\
\text{b.} & \quad \frac{I - P_x}{P_y} \\
\text{c.} & \quad \frac{I}{P_x + 10P_y} \\
\text{d.} & \quad \frac{10P_x + P_y}{I} \\
\text{e.} & \quad \frac{P_y}{I - P_x X}
\end{align*}
\]

19. If an Intermediate Microeconomic Theory textbook costs $50 today. What will college students have to pay for this book 10 years from today if the cost of the book increases at an annual rate of 9% over this time period?

\[
\begin{align*}
\text{PV} & = 50 \\
\Rightarrow \text{FV} & = 50 \left( \text{FVIF}_{0.09,10} \right) = 50 \left( 2.3673 \right) \\
& = 118.36
\end{align*}
\]

20. An "income consumption curve" shows, for a given consumer as their income changes, the different:

\[
\begin{align*}
\text{a.} & \quad \text{optimal combinations of two goods purchased} \\
\text{b.} & \quad \text{combinations of price and optimal quantity of one good purchased} \\
\text{c.} & \quad \text{changes in prices of one good that would be required to keep utility constant} \\
\text{d.} & \quad \text{points of tangency with the original indifference curve} \\
\text{e.} & \quad \text{points on the consumer's demand curve for a given good}
\end{align*}
\]

21. Which of the following products was the first to give consumers utility in this country by being sold first?

\[
\begin{align*}
\text{a.} & \quad \text{Coca Cola} \quad 1896 \\
\text{b.} & \quad \text{Perrier} \quad 1906 \\
\text{c.} & \quad \text{Budweiser} \quad 1876 \\
\text{d.} & \quad \text{Pepsi Cola} \quad 1903 \\
\text{e.} & \quad \text{Wheaties} \quad 1924
\end{align*}
\]