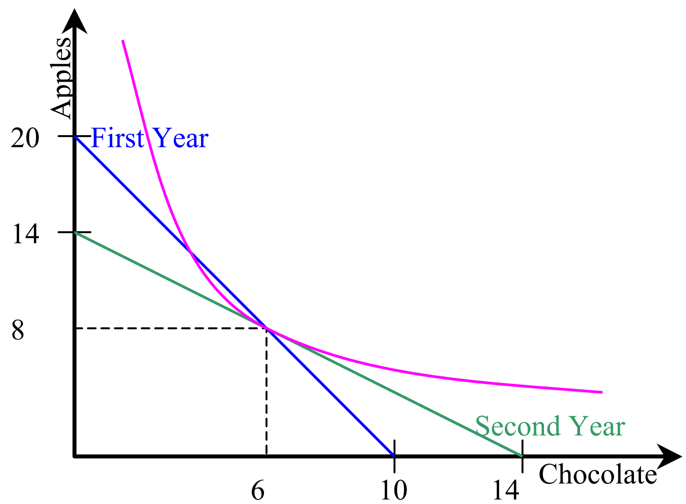
Economics 370
Microeconomic Theory
Midterm 1
Answer Key

1) *Dennis consumes two goods only: Chocolate bars and apples. One year the price of chocolate bars is \$1 per bar and the price of apples is 50¢ each. Dennis has income of \$10 per day. In the second year the price of chocolate bars is \$2 per bar, the price of apples is \$2 each, and Dennis's income has risen to \$28 per day. In the second year, Dennis consumes 6 chocolate bars and 8 apples per day. If Dennis's preferences have remained constant through time, in which year is he better off? Why?*

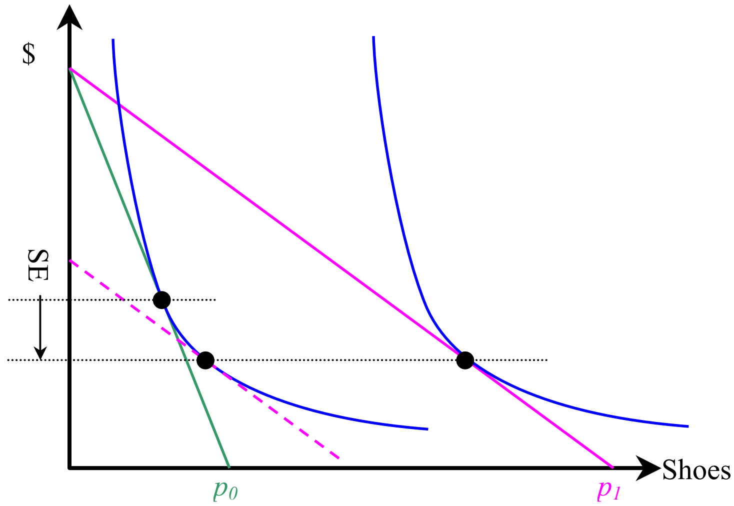


See the diagram above. In particular, observe the example preferences drawn. Since he chooses to consume (6, 8) in the second year, his indifference curve must be tangent to the second-year budget constraint.

The budget constraint for the first year cuts through the consumption bundle he chooses in the second year (as shown). Note that it also cuts **through** the second-year indifference curve. Unless preferences are kinked, this will always hold true. So he will be better off in the first year.

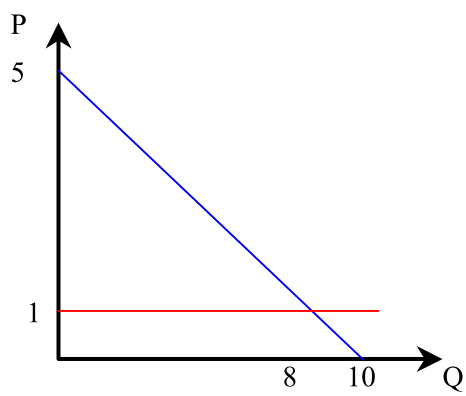
2) *Imelda buys shoes and all other goods. Her income elasticity of demand for all other goods is zero (i.e., if her income were to increase, the increase in income would be spent solely on shoes). One day, the price of shoes falls. In a diagram, show the substitution and income effects, explaining your reasons.*

The graph below shows the (Hicksian) income and substitution effects for the problem. Since the problem specifies that her income elasticity for all other goods is zero, the income effect for all other goods (\$ on the graph) must be zero. The substitution effect unambiguously reduces consumption for all other goods. So, the net effect of the price change is an increase in consumption of shoes and a decrease in consumption of all other goods.



3) Suppose that the demand curve for plums is given by Z = 10 – 2p, where Z is the number of pounds demanded, and p is price per pound. Suppose that the price is $1 per pound.

a) Find the quantity demanded, total expenditure, and consumer surplus.



Quantity Demanded: $Z = 10 - 2p = 10 - 2(1) = 8$ pounds of plums.
Total Expenditure = $Z \times p = 8 \times 1 =$ \$8.

Consumer Surplus is the area beneath the demand curve and above the price paid. If we define an "inverse demand function" $P(Z) = (10 - Z) / 2$, then Consumer Surplus will always be:

$$CS = \int_0^Z P(x)dx$$

However, in this case, we do not need to resort to integral calculus. Since consumer surplus is a triangle, we can write consumer surplus as:

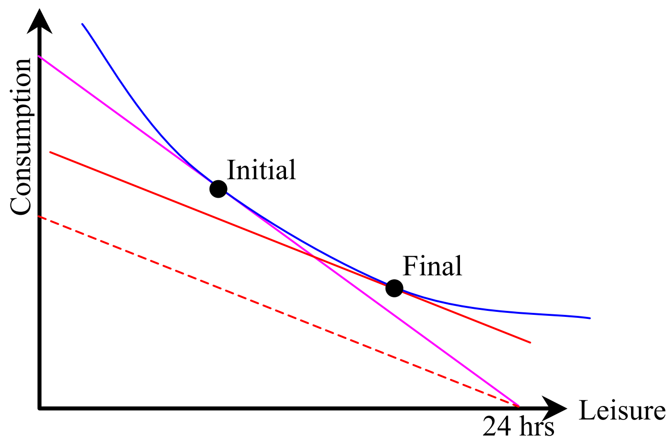
$CS = ½(5 - 1)8 =$ \$16.

b) *Now suppose that the government initiates a program to limit the supply of plums. Suppose further that as a consequence of the plan, price goes up to \$2. What is consumer surplus after the price increase? What is the maximum amount that plum consumers would be willing to bribe legislators to repeal the supply limitation program?*

Z = 10 – 2(p) = 10 – 2(2) = 6.
CS = ½(5 – 2)6 = \$9.

Before the program, consumers got \$16 worth of value from consuming plums. After the program, consumers got only \$9 in value from consuming plums. They are willing to spend up to their loss in consumer surplus to undo the program. That is, they are willing to spend up to 16 - 9 = \$7 to get back to their old state.

4) *The government levies a 30% wage tax on Cleopatra. It uses the money to finance a parade. The parade's value to Cleopatra is just sufficient to make her as well off as she was before the tax was levied. What is the effect of the government tax and expenditure package on Cleopatra's labor supply? Explain using the appropriate diagrams.*



The magenta line above represents her initial budget constraint. The dashed red line indicates what her budget constraint would be if the government levied the tax and did not give the parade. The question states that after the parade, Cleopatra is as well off as she was before implementation of the government program. In our diagram, that means that that she ends up on the same indifference curve as she started on. The solid red line represents her new budget constraint consistent with this condition. As shown, her labor supply drops as a result of the program. In particular, the program produces a pure substitution effect for her choice.

5) *A risk-averse white-collar employee is considering whether to embezzle. The probability of being caught is ρ. If caught embezzling, the employee has to pay a fine of ψ for each dollar he has stolen. Suppose ψ = \$3. What is the lowest value of ρ that will* ***guarantee*** *that the employee will not embezzle.*

By definition, a risk-averse person will never take a risk if the expected value is zero. So, if the expected value of embezzling is zero, the employee will not embezzle.

For each dollar the employee embezzles, then expected value of embezzling is:
EV = $(1 - \rho) - \rho\psi = 0$.
EV = $1 - (1 + \psi)\rho = 0$.
That implies that $\rho = 1 / (1 + \psi) = 1 / (1 + 3) = 0.25$.

So, if the probability of being caught is at least 25%, a risk-averse employee will not embezzle.

6) ***(Extra Credit)**: Kaiser Health Foundation, the largest health provider in the United States, has to build hospitals before knowing exactly what the demand for them will be. They can choose to build "small" hospitals or "large" hospitals. Large hospitals cost more to build than small hospitals, and are unprofitable if demand turns out to be weak. Small hospitals are inadequate to meet Kaiser's needs if demand is strong.*

Once built, it is very costly to expand a small hospital into a large one. However, "flexible" hospitals can be built. A flexible hospital has the same initial size as a small hospital, but can be more easily expanded. The initial cost of a flexible hospital is greater than that of a small hospital. Moreover, the total cost of a flexible hospital that has been expanded to he large size is greater than the cost of a large hospital. Assume that Kaiser is risk-neutral. Why might is still make sense for Kaiser to construct flexible hospitals?

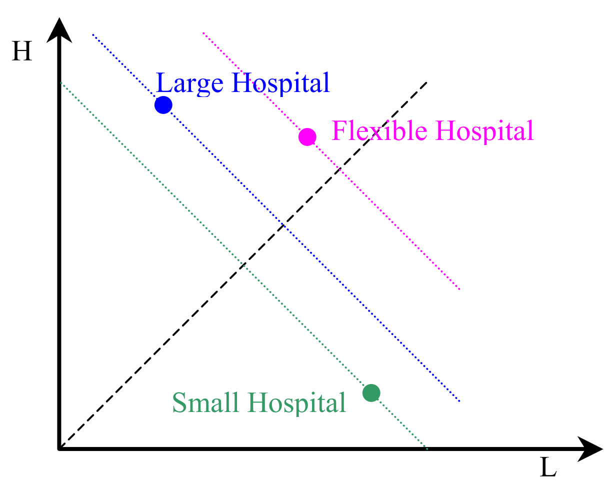
Kaiser faces two possible states of the world, High Demand (H) and Low Demand (L). We assume that Kaiser attributes a probability of π_H to the High Demand state. Since we assume there are only two possible states of the world in this case, then the probability of the Low Demand State $\pi_L = 1 - \pi_H$. For simplicity, I will assume that $\pi_H = \pi_L = 0.5$

We assume that Kaiser is only interested in profits, so the easiest way to analyze the problem is consider the amount of profits Kaiser will enjoy in each state depending on its choice. The problem states that the total cost of a flexible hospital is greater than the total cost of a large hospital in the High-Demand case and greater than the total cost of a small hospital in the Low-Demand case. Stated in terms of profits, that means that the profits for a Flexible Hospital are less than the profits for a Large hospital in the High-Demand case and are less than the profits for a small hospital in the Low-Demand case. Consider the following possible case:

	Large Hospital	Small Hospital	Flexible Hospital
High Demand	\$5,000	\$800	\$4,000
Low Demand	\$400	\$4,000	\$3,000
Expected Value	\$2,700	\$2,400	\$3,500

The numbers listed above meet those requirements.

Graphically, this would look like this:



Note again that, as drawn, the profits for a Flexible hospital are less than the profits for a large hospital in the "H" case and are less than the profits for a small hospital in the "L" case.