MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) The real wage denotes
   A) the number of units of leisure time that can be exchanged for one unit of labor time.
   B) the number of units of labor time that can be exchanged for one unit of leisure time.
   C) the number of units of labor time that can be exchanged for one unit of consumption goods.
   D) the number of units of consumption goods that can be exchanged for one unit of labor time.

2) The time constraint for the consumer is
   A) the amount of time for decision making.
   B) expressed as leisure time + time spent working = total time available.
   C) expressed as leisure time - sleep time = time spent working.
   D) expressed as leisure time - time spent working = total time available.

3) As the quantity of labor increases, the marginal product of labor
   A) increases.
   B) decreases.
   C) is constant.
   D) may either increase or decrease.

4) The marginal product of a factor of production
   A) is equal to the amount of additional output that can be produced with one additional unit of that factor input, holding constant the quantities of the other factor inputs.
   B) always exceeds the average product of that factor input, holding constant the quantities of the other factor inputs.
   C) is equal to the amount of additional output that can be produced with one additional unit of each factor input.
   D) is equal to the ratio of the amount of that factor of production to the amount of output produced.

5) Of the following, which is the least likely example of an increase in total factor productivity?
   A) the introduction of the assembly line
   B) a reduction in the relative price of energy
   C) good weather
   D) the invention of the personal computer

6) An indifference curve
   A) connects a set of consumption bundles among which the consumer is indifferent.
   B) is only useful in analyzing apathetic consumers.
   C) is only useful in microeconomics.
   D) connects a set of consumers who each have the same preferences.
7) That indifference curves are bowed in toward the origin
   A) follows from the fact that more is preferred to less.
   B) is not true.
   C) follows from the property that the consumer likes diversity in his or her consumption bundle.
   D) follows from the property that consumption and leisure are normal goods.

8) In a one-period economy
   A) consumers may increase their consumption by borrowing.
   B) consumption equals disposable income plus the value of non-market work.
   C) savings is always positive.
   D) consumption equals disposable income.

9) The marginal rate of substitution
   A) cannot be deduced from the properties of the indifference curve.
   B) can be computed by measuring the curvature of the indifference curve.
   C) can be computed by measuring the slope of the indifference curve.
   D) can only be computed if we know the prices of all goods.

10) A good is normal for a consumer if
    A) some minimal level of the good must be consumed to assure the consumer's survival.
    B) its consumption falls when income rises.
    C) it is always consumed in a consistent quantity.
    D) its consumption rises when income rises.

11) A production function describes the
    A) amount of resources available to the representative firm.
    B) technological possibilities for converting factor inputs into outputs.
    C) actual process of converting factor inputs into outputs.
    D) intellectual possibilities for converting factor inputs into outputs.

12) The representative consumer acts competitively
    A) when he or she is a price-taker.
    B) when he or she is a price-maker.
    C) when he or she can haggle for a lower price.
    D) if the consumer is large relative to the size of the market.

13) The profit-maximizing quantity of labor equates the marginal product of labor with
    A) total factor productivity.
    B) the average product of labor.
    C) the real wage.
    D) the marginal product of capital.

14) When consumption and leisure are both normal goods, and there is an increase in real dividend income minus taxation, the rational consumer
    A) increases consumption and increases leisure.
    B) reduces consumption and reduces leisure.
    C) reduces consumption and increases leisure.
    D) increases consumption and reduces leisure.
15) Two key properties of indifference curves are that an indifference curve slopes
   A) downward and is bowed out from the origin.
   B) downward and is bowed in toward the origin.
   C) upward and is bowed out from the origin.
   D) upward and is bowed in toward the origin.

16) A lump-sum tax is a tax that
   A) does not depend on the actions of the government.
   B) does not depend on the actions of the economic agent being taxed.
   C) distorts economic decisions.
   D) can be avoided by strategic behavior.

17) In the production function, \( Y = zF(K,Nd) \), total factor productivity is
   A) \( F / Y \).
   B) \( Y / Nd \).
   C) \( Y / K \).
   D) \( z \).

18) The optimal consumption bundle is the point representing a consumption-leisure pair that is
   on the
   A) lowest possible indifference curve and is on or outside the consumer's budget constraint.
   B) lowest possible indifference curve and is on or inside the consumer's budget constraint.
   C) highest possible indifference curve and is on or inside the consumer's budget constraint.
   D) highest possible indifference curve and is on or outside the consumer's budget constraint.

19) An increase in the real wage
   A) has an ambiguous effect on consumption and increases labor supply.
   B) increases consumption and has an ambiguous effect on labor supply.
   C) has an ambiguous effect on both consumption and labor supply.
   D) unambiguously increases consumption and increases labor supply.

20) The construct of a representative firm is most helpful in describing the behavior of all of the
    firms in the economy when
    A) there are increasing returns to scale.
    B) there are constant returns to scale.
    C) the marginal product of labor is increasing in the amount of labor input.
    D) there are decreasing returns to scale.

21) Leisure includes all of the following except
    A) recreational activities.
    B) market work.
    C) sleep.
    D) home yardwork.

22) A utility function
    A) is useful only in microeconomics, not macroeconomics.
    B) captures the representative firm's ability to produce goods and services.
    C) is a stand-in for a more complicated function.
    D) captures the preferences of the representative household over consumption and leisure.
23) In a one-period economy, all of the following are equivalent expressions of the budget constraint except
A) \( C = w(N^s + l) + p - T. \)  B) \( C = w(h - l) + p - T. \)
C) \( C = wN^s + p - T. \)  D) \( C + wI = wh + p - T. \)

24) With consumption on the vertical axis and leisure on the horizontal axis, the slope of the budget line is equal to
A) \(-p.\)  B) \(-w.\)  C) \(w.\)  D) \(p.\)

25) At the optimal consumption bundle the marginal rate of substitution of leisure for consumption is equal to
A) minus the real wage and the budget line is tangent to the indifference curve.
B) minus the real wage and the budget line intersects the indifference curve.
C) the real wage and the budget line intersects the indifference curve.
D) the real wage and the budget line is tangent to the indifference curve.

26) In macroeconomic analysis the representative consumer
A) denotes the consumer with the average amount of income.
B) is always a misleading fiction.
C) is the consumer who bargains with firms for all workers in the economy.
D) plays the role of a stand-in for all consumers in the economy.

27) An increase in real dividend income minus taxes represents
A) neither a pure income effect nor a pure substitution effect.
B) a pure substitution effect.
C) a pure income effect.
D) a combination of income and substitution effects.

28) A defense for the assumption that consumers maximize is that
A) consumers never make mistakes.
B) mistaken consumers may receive counseling from the government.
C) mistakes by the consumer are not likely to last for a long time.
D) it allows for many possible outcomes.

29) A good is inferior for a consumer if
A) its consumption falls when income rises.
B) some minimal level of the good must be consumed to assure the consumer's survival.
C) its consumption rises when income rises.
D) it is never included in his or her consumption bundle.

30) Constant returns to scale means that, given any constant \( x > 0, \)
A) \( xY = z^x F(K,Nd) . \)  B) \( xY = zF(xK,xNd) . \)
C) \( xY < zF(xK,xNd) . \)  D) \( xY > zF(xK,xNd) . \)
1. Why might hours worked by the representative consumer decrease when the real wage increases?

2. Using a diagram show that, if the consumer prefers more to less, then indifference curves cannot cross.

3. Suppose that the government imposes a proportional tax on the representative consumer’s wage income. That is, the consumer’s wage income is \( w(1-t)(h-l) \), where \( t \) is the tax rate. What effect does the income tax have on consumption and labour supply? Explain your results in terms of income and substitution effects and represent it in a diagram.

4. Show that the consumer is better off with a lump-sum tax rather than a proportional tax on wage income (as in question 3) given that either tax yields the same revenue for the government. You will need a diagram to show this.

5. Suppose that the government imposes a producer tax. That is, the firm pays \( t \) units of consumption goods to the government for each unit of output it produces. Determine the effect of this tax on the firm’s demand for labour.

6. Suppose that the government subsidizes employment. That is, the government pays \( s \) units of consumption goods to the firm for each unit of labour that the firm hires. Determine the effect of this subsidy on the firm’s demand for labour.
## MULTIPLE CHOICE

1) Answer: D  
2) Answer: B  
3) Answer: B  
4) Answer: A  
5) Answer: D  
6) Answer: A  
7) Answer: C  
8) Answer: D  
9) Answer: C  
10) Answer: D  
11) Answer: B  
12) Answer: A  
13) Answer: C  
14) Answer: A  
15) Answer: B  
16) Answer: B  
17) Answer: D  
18) Answer: C  
19) Answer: B  
20) Answer: B  
21) Answer: B  
22) Answer: D  
23) Answer: A  
24) Answer: B  
25) Answer: D  
26) Answer: D  
27) Answer: C  
28) Answer: C  
29) Answer: A  
30) Answer: B
PROBLEMS

1. Because the income effect might dominate the substitution effect. By substitution effect the increase in the real wage would make the consumer want to work more but by income effect the increase in the real wage (income) will lead the consumer to want more leisure since this is a normal good.

2. Consider the two hypothetical indifference curves in Figure 4.1. Point A is on both indifference curves, $I_1$ and $I_2$. By construction, the consumer is indifferent between A and B, as both points are on $I_2$. As well, the consumer is indifferent between A and C, as both points are on $I_1$. But at point C, the consumer has more consumption and more leisure than at point B. As long as the consumer prefers more to less, he or she must strictly prefer C to A. We, therefore, contradict the hypothesis that two indifference curves can cross.

![Figure 4.1]

3. When the government imposes a proportional tax on wage income, the consumer’s budget constraint is now given by:

$$C = w(1-t)(h-l) + \pi - T,$$

where $t$ is the tax rate on wage income. In Figure 4.3, the budget constraint for $t = 0$, is FGH. When $t > 0$, the budget constraint is EGH. The slope of the original budget line is $-w$, while the slope of the new budget line is $-(1-t)w$. Initially, the consumer picks the point A on the original budget line. After the tax has been imposed, the consumer picks point B. The substitution effect of the imposition of the tax is to move the consumer from point A to point D on the original indifference curve. The point D is at the tangent point of indifference curve, $I_1$, with a line segment that is parallel to EG. The pure substitution effect induces the consumer to reduce consumption and increase leisure (work less).
The tax also makes the consumer worse off, in that he or she can no longer be on indifference curve, \( I_1 \), but must move to the less preferred indifference curve, \( I_2 \). This pure income effect moves the consumer to point B, which has less consumption and less leisure than point D, because both consumption and leisure are normal goods. The net effect of the tax is to reduce consumption, but the direction of the net effect on leisure is ambiguous. Figure 4.3 shows the case in which the substitution effect on leisure dominates the income effect. In this case, leisure increases and hours worked fall. Although consumption must fall, hours worked may rise, fall, or remain the same.

![Figure 4.3](image)

4. In Figure 4.4, with a proportional tax on wage income, the consumer’s budget constraint is

\[
C = w(1 - t)(h - l) + \pi,
\]

where \( t \) is the tax rate. In Figure 4.4, the budget constraint is \( DEF \), and the consumer chooses point A, where \( C = C_1 \) and \( l = l_1 \). Now, suppose that the government taxes the consumer lump-sum, and the total tax the consumer pays with the lump-sum tax is the same as it was with the proportional tax, so that the lump-sum tax is \( T = wt(h - l_1) \). The consumer’s budget constraint is now

\[
C = w(h - l) + \pi - wt(h - l_1).
\]

Figure 4.4 shows the budget constraint (2), which is \( DGH \). Note that the new budget constraint is steeper than the old one, and that point A is on the new budget constraint, because if \( (C_1, l_1) \) satisfies (1) it must also satisfy (2). Thus, the consumer will now choose point \( B \), which must be on a higher indifference curve that \( A \), so the consumer is better off with a lump-sum tax than with a proportional tax. The proportional tax distorts economic decisions and is therefore less efficient in extracting the same revenue that a lump-sum tax can generate.
5. The firm chooses its labour input, \( N^d \), so as to maximize profits. When there is no tax, profits for the firm are given by

\[
\pi = zF(K, N^d) - wN^d.
\]

Profits are the difference between revenue and costs. In the top panel in Figure 4.7, the revenue function is \( zF(K, N^d) \) and the cost function is the straight line, \( wN^d \). The firm maximizes profits by choosing the quantity of labour where the slope of the revenue function equals the slope of the cost function:

\[
MP_N = w.
\]

The firm’s demand for labour curve is the marginal product of labour schedule in the bottom panel of Figure 4.7.

With a tax that is proportional to the firm’s output, the firm’s profits are given by:

\[
\pi = zF(K, N^d) - wN^d - tzF(K, N^d)
= (1-t)zF(K, N^d),
\]

where the term \((1-t)zF(K, N^d)\) is the after-tax revenue function, and as before, \(wN^d\) is the cost function. In the top panel of Figure 4.7, the tax acts to shift down the revenue function for the firm and reduces the slope of the revenue function. As before, the firm
will maximize profits by choosing the quantity of labour input where the slope of the revenue function is equal to the slope of the cost function, but the slope of the revenue function is \((1-t)MP_N\), so the firm chooses the quantity of labour where

\[
(1-t)MP_N = w.
\]

In the bottom panel of Figure 4.7, the labour demand curve is now \((1-t)MP_N\), and the labour demand curve has shifted down. The tax acts to reduce the after-tax marginal product of labour, and the firm will hire less labour at any given real wage.

![Revenues, Costs](image)

6. The firm chooses its labour input \(N^d\) so as to maximize profits. When there is no subsidy, profits for the firm are given by

\[
\pi = zF(K, N^d) - wN^d.
\]

Profits are the difference between revenue and costs. In the top panel in Figure 4.7, the revenue function is \(zF(K, N^d)\) and the cost function is the straight line, \(wN^d\). The firm maximizes profits by choosing the quantity of labour where the slope of the revenue function equals the slope of the cost function:
\[ MP_N = w . \]

The firm’s demand for labour curve is the marginal product of labour schedule in the bottom panel of Figure 4.8.

With an employment subsidy, the firm’s profits are given by:

\[ \pi = zF(K, N^d) - (w-s)N^d \]

where the term \( zF(K, N^d) \) is the unchanged revenue function, and \((w-s)N^d\) is the cost function. The subsidy acts to reduce the cost of each unit of labour by the amount of the subsidy, \( s \). In the left panel of Figure 4.8, the subsidy acts to shift down the cost function for the firm by reducing its slope. As before, the firm will maximize profits by choosing the quantity of labour input where the slope of the revenue function is equal to the slope of the cost function, \( (t-s) \), so the firm chooses the quantity of labour where

\[ MP_N = w - s . \]

In the right panel of Figure 4.8, the labour demand curve is now \( MP_N + s \), and the labour demand curve has shifted up. The subsidy acts to reduce the marginal cost of labour, and the firm will hire more labour at any given real wage.