True/false and explain

State whether the following statements are true or false and explain why you say so. I will only grade what is written in the space provided (10 points total).

1. (6 points) Using a Solow model it is possible to show that the saving rate that achieves the maximal long-run GDP level also achieves the highest long-run consumption level.

**FALSE, HOLDING OTHER FACTORS CONSTANT, THE SAVING RATE THAT GENERATES THE HIGHEST SOLOW CURVE IS S=1.** THUS, THE SAVING RATE THAT GENERATES THE HIGHEST LONG RUN CAPITAL, AND THE HIGHEST GDP IS S=1. HOWEVER, AT S=1 CONSUMPTION IS ZERO.

2. (4 points) Consider an economy where the labor market is always in equilibrium (and goes back to equilibrium immediately after any possible shock). If the central bank of such an economy performs an open market purchase whenever there is a recession then GDP will necessarily increase, which results in a milder recession. It is thus clear that central banks should always play an active role in smoothing the business cycle.

**FALSE. IF THE LABOR MARKET IS ALWAYS IN EQUILIBRIUM THEN AGGREGATE SUPPLY IS PERFECTLY VERTICAL. CHANGES IN THE INTEREST RATE (WHICH RESULT FROM OPEN MARKET OPERATIONS) WOULD HAVE NO IMPACT ON GDP, ONLY ON PRICES.**

Multiple choice section

Circle what you consider is the best answer to each of the following questions (50 points total, equally weighted).

Use the following data to answer questions 3-5

<table>
<thead>
<tr>
<th>Consumption in Snowville</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Price</strong></td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td><strong>2002</strong></td>
</tr>
<tr>
<td>Rutabaga $0.50</td>
</tr>
<tr>
<td>Parka $50.00</td>
</tr>
<tr>
<td>Book $40.00</td>
</tr>
</tbody>
</table>

In 2002, consumers in Snowville consumed only rutabagas, parkas, and books. The prices and quantities for 2002 and 2003 are listed in the above table. The base year for Snowville’s CPI is 2002

3. The CPI for Snowville in 2002 equaled
   (a) 1.1
   (b) 1
   **B, BY DEFINITION OF CPI**

4. The CPI for Snowville in 2003 equaled
   (a) 1.1
5. The 2003 real GDP of Snowville equaled (assume the base year is also 2002)

(a) 452
(b) 505
(c) 400

Useful information: The price index of year $t$ when the base year is year $t'$ equals the cost of the base year basket at period $t'$ prices divided by the cost of the base year basket at period $t$ (the base) prices.

$\text{REALGDP}_{2003}(\text{BASE}2002) = \frac{200 \times 0.7 + 2 \times 75 + 5 \times 30 + 140 + 150 + 150}{200 \times 0.5 + 2 \times 50 + 5 \times 40} = \frac{440}{400} = 1.1$

6. Gross domestic product (GDP) equals the ______ of final ______ produced within a country during a given period of time

(a) market value; goods
(b) market value; services
(c) market value; goods and services
(d) quantity; goods
(e) quantity; goods and services

Answer: C

7. You face two job offers. The first is in London and pays £50,000 per year. The second is in the United States and pays $84,440 U.S. dollars per year. Assume that the exchange rate between British pounds and American dollars is £1 = $1.8 U.S. In PPP terms £1 = $1.2 U.S. PPP. The offer that provides you with the highest purchasing power is

(a) The first
(b) The second

Answer: B. THE OFFER IN LONDON, IN PURCHASING POWER, IS EQUIVALENT TO 1.2*50000=70,000<84,440.

8. Which of the following transactions would be included in the GDP of the United States?

(a) Coca Cola produces soft drinks in England.
(b) Honda produces cars in Ohio.
(c) McDonalds produces and sells hamburgers in Russia.
(d) Ford Motors produces cars in Mexico.
(e) None of the above.

Answer: B.

9. During 1970, total compensation of employees (i.e. the sum of wage income + all other benefits) per worker in the United States equaled $6,085. Total compensation of employees per worker in 2005 equaled $50,107 dollars. The price level during 1970 was 27 and it equaled 112 during 2005. Using these numbers you can conclude...
(a) That the purchasing power of the average worker in the United States roughly doubled from 1970 to 2005.

(b) That the purchasing power of the average worker in the United States increased by a factor of 8 in one generation.

(c) That workers are clearly exploited and have obtained no benefit from economic growth.

Answer: A.

\[
\text{Real wage}_{1970} = \frac{6085}{27} = 225;\quad \text{Real wage}_{2005} = \frac{50107}{112} = 447.447
\]

\[
\frac{447}{225} = 1.98
\]

10. Growth in Total factor productivity is often calculated as the

(a) difference between potential and actual economic growth.

(b) growth in output per unit of labor.

(c) growth in labor productivity not explained by the growth in capital per hour of labor (after adjusting by the 1/3 rule).

(d) growth of capital utilization.

Answer: c.

11. Recent increases in real estate prices have resulted in higher property tax revenues for the IRS. The US government is evaluating two possible uses for this money. Option 1 consists of investing in research and development and is expected to increase total factor productivity by 2%. Option 2 is as costly as option 1. Option 2 consists of providing subsidies to investments in physical capital. These subsidies are expected to result in a 3% increase in the capital stock of the US economy. The “one-third” rule applies for the US economy. If the government wants to generate the maximum increase in GDP from its policy it should

(a) Follow option 1

(b) Follow option 2

Answer: a. Option 1 increases GDP by 2%. Option one increases GDP by \(\frac{3\%}{3} = 1\%\).

12. The following table provides you with data about the behavior of productive inputs in Japan during two different periods.

<table>
<thead>
<tr>
<th>Period</th>
<th>Growth in GDP per worker</th>
<th>Growth in capital per worker</th>
<th>Growth in hours worked</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960-1973</td>
<td>7.2%</td>
<td>6%</td>
<td>0%</td>
</tr>
<tr>
<td>1991-2000</td>
<td>0.5%</td>
<td>0.6%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Clearly, and relative to the 1960-73 period, the economy of Japan slowed-down substantially during the last decade. If the one third-rule holds for Japan then most of the slowdown in GDP growth can be attributed to a slowdown in

(a) the growth rate of capital per worker

(b) the growth rate of hours worked

(c) the growth rate of total factor productivity

Answer: c (explained during the review session)

13. One implication of the Information Technology Revolution is that computers, semiconductors, etc. constitute now a large proportion of the total capital stock of the United States. Information Technologies have a very high rate of depreciation. Thus, the Information Technology revolution resulted in a sudden increase in the depreciation rate of physical capital in the United States. According to the Solow model, this increase in capital depreciation (on its own)

(a) should translate into a lower long-run capital stock, and thus lower long-run GDP
(b) should translate into a higher long-run capital stock, and thus higher long-run GDP

Answer: a. Higher depreciation results in a lower Solow curve, and thus a lower long run capital and GDP.

14. The U.S. economy experienced one of its strongest economic expansions during the 1990-2000 period. Some people attribute this economic expansion to the massive introduction of Information Technologies. Based on your answer to the previous question, and using a Solow diagram, it is possible to say

(a) that the increase in TFP associated to the use of information technologies more than compensated for the negative impact of higher depreciation, which can help explain why the economy ended up with a higher GDP

(b) that the increase in GDP attributed to the higher depreciation of capital was further expanded by the increase in TFP associated to the use of information technologies

Answer: a. Higher TFP results in a higher Solow curve, and thus higher long run capital and GDP. Given the answer to 11, option b does not make sense. Option a has to be true. For GDP to grow the positive impact of TFP must have more than compensated the negative impact of higher depreciation.

15. According to the Solow growth model (normalizing population to 1 and assuming no population growth), capital evolves through time following the law of motion

\[ K_{t+1} = sAK_t^{\frac{1}{3}} + (1 - \delta)K_t. \]

Suppose the saving rate of Weird country is equal to 15%, that the level of total factor productivity (A) is equal to 40, and that capital depreciates at a 6% annual rate. Let \( K_{2007} = 1000 \) (Note: \( 1000^{\frac{1}{3}} = 10 \)). According to the Solow model, the stock of capital for year 2008 will be

(a) 900
(b) 1540
(c) 460
(d) 1000
(e) none of the above

\[ K_{2008} = 0.15 \times 40 \times 10 + (1 - 0.06) \times 1000 = 1000 \]

16. Based on your previous answer, the long-run capital stock of the economy is

(a) impossible to determine with the information provided
(b) less than 1000
(c) larger than 1000 but lower than 1540
(d) 1000
(e) more than 1540

Answer: d (explained during the review session)

17. If a firm has capital stock valued at $4,500 at the beginning of the year, invested (in physical capital) $1,500 during the year, and ended up with a capital stock valued at $5,000 at the end of the year then we know that

(a) depreciation equaled $500.
(b) gross investment equaled $1,500 and depreciation equaled $1,000.
(c) net investment equaled $1,500.
18. A firm is considering a one-year project that is expected to deliver a 7% nominal profit rate. The current real interest rate is 5% and inflation is expected to equal 3%. Then,

(a) The firm should invest in the project
(b) The firm should not invest in the project

**Answer:** b. The real profit rate is profit rate - inflation = 4% which is less than what the firm can obtain in the bank (in a deposit that pays the real interest rate, 5%).

19. In Figure 1 above, if the government increases the taxes on corporate profits then the real interest rate ____ and the equilibrium quantity of investment and saving ____.

(a) rises; increases
(b) rises; decreases
(c) falls; increases
(d) falls; decreases

**Answer:** d, higher taxes shift the investment demand left. As a result, the interest rate falls, and investment and saving fall.

20. In Figure 1 above, if future personal income is suddenly expected to be much higher than current personal income, the real interest rate ____ and the equilibrium quantity of investment ____.

(a) rises; increases
(b) rises; decreases
(c) falls; increases
(d) falls; decreases

**Answer:** b, higher future income lowers saving, ss shifts left so that a new equilibrium with higher interest and lower investment and saving appears.
21. In the labor market described by Figure 2 above, if the real wage temporarily dropped to $10 dollars per hour firms would like to hire _______ hours and workers would like to work _______ hours. The latter situation implies there is an ____________.

(a) Approximately 100 billion hours per year; approximately 200 billion hours per year; excess supply of workers that would eventually translate into higher wages
(b) Approximately 200 billion hours per year; approximately 100 billion hours per year; excess demand for workers that would eventually translate into higher wages

Answer: b

22. Suppose that the government imposes a minimum wage of $20 dollars per hour to the labor market described in the previous question. As a result,

(a) All workers are better off
(b) All workers are worse off
(c) Employment equals 100 bn hours and the wage rate equals $20 dollars per hour. Relative to equilibrium the imposition of a minimum wage generates unemployment equivalent to 100 bn hours
(d) Employment equals 100 bn hours and the wage rate equals $20 dollars per hour. Relative to equilibrium the imposition of a minimum wage generates excess demand for workers and pressures for wages to go up even further.

Answer: c.

23. Consider an economy where the labor market goes back to equilibrium immediately after any change in the labor market. The FED considers that the GDP of the economy is lower than it should be and lowers the interest rate. As a result

(a) Aggregate demand shifts to the right, GDP and the price level go up (i.e., there is inflation).
(b) Aggregate demand shifts to the right, GDP is unchanged and the price level goes up (i.e., there is inflation).

Answer: b.
24. Consider an economy where the labor market goes back to equilibrium *slowly* (it takes more than a quarter) after any change in the labor market. The FED considers that the GDP of the economy is lower than it should be and lowers the interest rate. As a result

(a) Aggregate demand shifts to the right, GDP and the price level goes up (i.e., there is inflation).
(b) Aggregate demand shifts to the right, GDP is unchanged and the price level goes up (i.e., there is inflation).

*Answer: a*

25. An increase in the reserve requirement ratio

(a) lowers the amount of money commercial banks create through loans and deposits.
(b) increases the amount of money commercial banks create through loans and deposits.
(c) has nothing to do with the amount of money commercial banks create.

*Answer: a.*

26. To increase commercial bank lending the Fed can

(a) lower the discount rate, or sell government securities.
(b) raise the discount rate, or sell government securities.
(c) lower the discount rate, or buy govt. securities.
(d) raise the discount rate, or buy government securities.

*Answer: c*

Use the following data to answer question 27

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>$800</td>
<td>$600</td>
<td>$600</td>
</tr>
<tr>
<td>110</td>
<td>700</td>
<td>700</td>
<td>600</td>
</tr>
<tr>
<td>120</td>
<td>600</td>
<td>800</td>
<td>600</td>
</tr>
<tr>
<td>130</td>
<td>500</td>
<td>900</td>
<td>600</td>
</tr>
</tbody>
</table>

27. In the short-run equilibrium of this economy the labor market is

(a) at a full-employment equilibrium and wages will not change.
(b) above full-employment equilibrium and wages will rise.
(c) above full-employment equilibrium and wages will fall.
(d) below full-employment equilibrium and wages will fall.

*Answer: b.*

28. According to the theory of real business cycles a typical economic recession occurs when

(a) The consumer confidence index falls so that people spend less driving equilibrium GDP down.
(b) The FED increases the interest rate so that people spend less driving equilibrium GDP down.
(c) The growth rate of total factor productivity slowsdown.
(d) The economy of any of the major trading partners of the US slows down.  
Answer: c.

29. According to Edward C. Prescott in his paper "Theory ahead business cycle measurement," economic policy in relation to business cycles should focus on

(a) Leaving the economy alone.
(b) Changing the interest rate to smooth the business cycle (i.e. lower it during recessions, and increasing it during expansions so that inflation is contained).
(c) Understanding the factors that determine the rate at which technology advances.  
Answer: c.

Short answer problems

Answer four out of the five following questions as concisely as possible.

30. (10 points total) The following questions are based on our discussion of the paper "Theory ahead business cycle measurement," by Edward C. Prescott

(a) (5 points) What is the business cycle phenomena?
(b) (5 points) What are, according the E.C. Prescott, the main forces accounting for business cycle fluctuations?

31. (10 points total) The following questions are based on our discussion of the papers "On the mechanics of economic development," by Robert E. Lucas Jr., and "Needed: A theory of total factor productivity," by Edward C. Prescott

(a) (3 points) How does Lucas define the problem of economic development?
(b) (3 points) Explain the orders of magnitude of the difference between poor and rich countries in terms of their levels of per-capita GDP? (i.e. the GDP per capita of the richest countries is how many times that of the poorest ones?)
(c) (4 points) According to Prescott, what are the main factors accounting for the observed cross-country disparity in per capita GDP?

32. (10 points) The following table provides data for the output and capital per worker for Chile during the years 1980 and 2000.

<table>
<thead>
<tr>
<th>Year</th>
<th>Output per worker</th>
<th>Capital per worker</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>$19,451.79</td>
<td>$36,659.13</td>
</tr>
<tr>
<td>2000</td>
<td>$32,064.61</td>
<td>$71,894.77</td>
</tr>
</tbody>
</table>

\[
\ln(32064) - \ln(19451) = 0.50 \\
\frac{0.3 \times (\ln(71894) - \ln(36659))}{\ln(32064)} = 0.20
\]

Using either one of the following two formulas below, answer each one of the following two questions

(a) How much of the increase in GDP can be accounted for by changes in capital per worker? How much by changes in TFP?

CHANGE IN GDP ACCOUNTED FOR BY CHANGES IN CAPITAL: 20% (SEE LOG FORMULAS BELOW THE TABLE)
CHANGE IN GDP ACCOUNTED FOR BY CHANGES IN TFP: 30% (SINCE CHANGES IN CAPITAL AND CHANGES IN TFP MUST ADD UP TO CHANGES IN GDP)
(b) what has been the most important factor behind the observed growth in output per worker for Chile?

**CHANGES IN TFP ARE THE MOST IMPORTANT FACTOR (30%>20%)**

33. (10 points) Deviations from trend in total factor productivity are positively correlated with deviations from trend in GDP. This observation motivated the development of the Real Business Cycle Theory. However it is also true that the magnitude of the deviations from trend in GDP are larger than the deviations from trend in TFP. Discuss in detail the mechanisms through which a 1% deviation from trend in TFP can generate a larger than 1% deviation from trend in GDP.

SEE SLIDES ON REAL BUSINESS CYCLE THEORY.