MIDTERM 1

No calculators permitted. A total of 100 points are possible.

Last Name: _____________________________ First Name: _____________________________

Your Student ID Number: __ __ __ - __ __ - __ __ __ __

Part A: Multiple Choice Questions
(20 questions, each of which is worth 4 points)

Instructions: Answer these multiple choice questions on your Scantron. Write on the Scantron your name (last name first), student ID number, and exam version number in the “name,” “subject,” “test no.” boxes respectively. For example,

<table>
<thead>
<tr>
<th>NAME</th>
<th>McComb, Maximilian</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUBJECT</td>
<td>530-66-6271</td>
</tr>
<tr>
<td>TEST NO.</td>
<td>1</td>
</tr>
<tr>
<td>DATE</td>
<td>HOUR</td>
</tr>
</tbody>
</table>

**Warning**

If you first fill in an answer and then erase it to fill in a different one, and the first answer is not fully erased, the Scantron reader may detect two answers and not accept either one. Do not fill in an answer till you are sure this is the one you want to give, or you may not receive credit for the question.
1. Suppose a pre-industrial society switches from unregulated fertility to fertility limitation. The birth rate drops from 60 per thousand to 40 per thousand. Suppose that before the switch the average women had two children that survived to adulthood. In the long run how many children per woman will now survive to adulthood?

A. 1.5  
B. 1.33  
C. 1.25  
D. 1  
E. 2

2. What happens to the real wage in the long run as a result of this decline in fertility from 60 per thousand to 40 per thousand?

A. Stays the same  
B. Decreases.  
C. Increases if the death rate stays the same.  
D. Decreases if the death rate stays the same.  
E. Increases.

3. Suppose life expectancy at birth in Tahiti in 1760 was 50 years. What was the birth rate (in birth per thousand of population)?

A. 40  
B. 30  
C. **20**  
D. 10  
E. 50

4. Suppose life expectancy at birth in Europe in 1300 averaged 30 years. The Black Death increased death rates across Europe at a given real wage rate from 1349 to about 1700. Assuming it had no effect on fertility levels, life expectancy at birth in 1400 would be

A. More than 30 years  
B. Less than 30 years  
C. Answer depends on how much real wages change  
D. Answer depends on how much population changes.  
E. **30 years**
5. We know real wages in England from 1200 on. Around which of the following dates were they highest.

A. 1300  
B. 1800  
C. 1650  
D. 1250  
E. 1450

6. The Ache who lived in the forest in Paraguay until the 1970s had to move from day to day in search of food, so that those too sick to walk were abandoned or killed. About 60% of them died from animal attacks or human violence. They lived in a climate rich with biting insects (in one period of detailed observation they were observed to be suffering nearly a mosquito bite each minute). In London in 1800 there were theatres, books, newspapers, indoor plumbing, physicians, coal for heating. Life expectancy at birth in London was 40 years. If you were to guess what it was for the Ache the best guess would be:

A. 35 years  
B. 40 years  
C. 45 years  
D. 70 years  
E. 10 years

7. Europe in the 17th century had lower temperatures than usual, and this period is sometimes referred to as the “little ice age.” Given that Europe was still a Malthusian economy what was the expected long run effect on wages of this temperature change, assuming that the only effect was to reduce agricultural output?

A. Stays the same  
B. Decrease.  
C. Increase if the birth rate goes up.  
D. Decrease if the birth rate goes down.  
E. Increase.

8. In a Malthusian economy there is a one-time improvement in technology. The effect of this in the long run is:

A. Wages, birth rates and death rates all stay the same.  
B. Wages go down, the birth rate stays the same, and the death rate falls.  
C. Wages go up, the birth rate and death rate both fall.  
D. Wages go up, the birth rate stays the same, and the death rate falls.  
E. Wages fall, birth rates and death rates stay the same.
9. The economy in China in 1600-1700 we believe was still a **Malthusian** economy. This was because:

A. The technology of the society was improving only slowly.
B. Marriage in China was nearly universal.
C. Birth rates were above 30 per thousand.
D. Internal wars caused great population losses.
E. Agriculture was still the major occupation.

10. Captain Cook is sailing in the Pacific in 1780. He finds a man adrift on a raft. He indicates his island is to the west. Cook only wants to go there if it is prosperous. Which of the following facts would be the **best** indicator that this is a prosperous island relative to England in 1780.

A. The man is 70” tall.
B. The man indicates that the average person on this island has only two children.
C. The man indicates that there are 1000 people per square mile of the island.
D. The man knows how to use a knife and fork.
E. The man has some iron implements.

11. Edward Jenner (1749-1823), a country doctor in England, introduced vaccination (called this because the vaccine was derived from cowpox) against smallpox in England in 1796. Smallpox was one of the principle causes of death in England at that time, particularly for infants. Suppose the Industrial Revolution had not occurred. The long run effect of Jenner’s discovery would have been.

A. Life expectancy same, wages fall, population grows.
B. Life expectancy same, wages fall, population the same
C. Life expectancy increases, wages fall, population grows.
D. Life expectancy increases, wages fall, population the same
E. Life expectancy same, wages same, population grows.

12. Which of the following books was written before Malthus’s **Essay on a Principle of Population**?

A. Frederick Engels, The Condition of the Working Classes in England in 1842
B. Karl Marx, Capital
C. Charles Darwin, Origin of the Species
D. Charles Dickens, Oliver Twist
E. Adam Smith, Wealth of Nations
13. “Engel’s Law” relating income and expenditures has which of the following implications for pre-industrial societies.

A. In a Malthusian economy most people live in the countryside.
B. The share of the population living in cities is an indicator of real incomes.
C. As income increases food expenditure declines.
D. Food expenditure increases proportionately with income.
E. Workers in pre-industrial Europe got low wages because they lacked unions.

14. Which of the following would NOT be a good indicator of average material living standards in a Malthusian Economy.

A. The amount of food the average person consumed per day.
B. The percentage of the population employed in agriculture.
C. The fraction of people living in urban areas.
D. The average literacy rate.
E. The percentage of income spent on food.

15. Since the Industrial Revolution the PROXIMATE CAUSE of growing output per person has been:

A. 2/3 efficiency advance, 1/3 capital accumulation
B. ½ efficiency advance, ½ capital accumulation
C. 1/3 efficiency advance, 2/3 capital accumulation
D. All capital accumulation
E. All efficiency advance

16. Suppose that in an economy output per person is growing at 3%. Supposing the share of labor in national income is 2/3, and total output is growing at 6%. What is the growth rate of the labor supply?

A. 2%
B. 3%
C. 4%
D. 9%
E. 1.5%
17. In modern economies capital per worker typically grows:

A. Slightly slower than output per worker
B. At the same rate as output per worker
C. **Slightly faster than output per worker**
D. At twice the rate of output per worker
E. At half the rate of output per worker

18. Suppose in an economy the inputs are all growing at 4%, but efficiency is declining by 2% per year. What is the rate of growth of output?

A. To answer this we would need to know the share of capital and land in national income
B. **2%**
C. 4%
D. 6%
E. To answer this we would need to know the share of capital in national income

19. Why is the calculated rate of growth of efficiency in an economy also known as the “residual.”

A. **Because it is the part of the growth of output that is left unexplained in growth accounting**
B. Because most residuals come from efficiency growth
C. Because 1% growth in the residual is the same as 1% efficiency growth
D. Because capital is the other major source of growth.
E. Because it comes at the end of the equation.

20. Suppose that **efficiency** is the fundamental source of economic growth, and that capital accumulation is induced just by the income increases brought about through efficiency advances. Suppose also that \( g_{Q/L} = g_{K/L} \). Then the rate of growth of output per person is given by,

A. \( g_{Q/L} = -\gamma(1-\alpha)g_L + g_A/(1-\alpha) \)
B. \( g_{Q/L} = g_A \)
C. \( g_{Q/L} = (1-\alpha)g_A \)
D. \( g_{Q/L} = -\gamma g_L + (1-\alpha)g_A \)
E. \( g_{Q/L} = -\gamma g_L + g_A \)
Part B: LONG ANSWER (20 points)

(a) What assumptions do we need to make to derive the basic growth accounting formulas for growth?

1. Competitive Markets
2. No externalities

(b) Show how to calculate the growth of rate of efficiency in an economy from the growth rates of inputs and outputs, starting with the expression $Q = AF(K, L, T)$.

Any change in $Q$ must come from either a change in one of the inputs or a change in efficiency, where the marginal product weights each input,

$$
\Delta Q = mpk \Delta K + mpl \Delta L + mpT \Delta T + A \Delta F(L, K, T)
$$

In a competitive economy, the marginal products equal the payments to each factor,

$$
\Delta Q = r \Delta K + w \Delta L + s \Delta T + A \Delta F(L, K, T)
$$

Now, to derive the growth rates and the share of each input, divide by $Q$ and then multiply by $\frac{1}{A}$,

$$
\frac{\Delta Q}{Q} = \frac{rK}{Q} \Delta K + \frac{wL}{Q} \Delta L + \frac{sT}{Q} \Delta T + \frac{A}{Q} \frac{\Delta F(L, K, T)}{Q} \Delta A
$$

Rewrite the shares in output as,

$$
\frac{rK}{Q} = \alpha, \frac{wL}{Q} = \beta, \frac{sT}{Q} = \gamma
$$

And, $\frac{\Delta Q}{Q} = g_Q, \frac{\Delta K}{K} = g_K$, etc. and notice that $Q = A F(L, K, T)$ will cancel the first part of the last term, leaving just $\frac{\Delta A}{A}$. Now, write the growth in output as a function of the shares and the growth rates of the inputs and efficiency,

$$
g_Q = \alpha g_K + \beta g_L + \gamma g_T + g_A
$$

Finally, to show the growth rate of efficiency, simply rewrite the above expression as,

$$
g_A = g_Q - \alpha g_K - \beta g_L - \gamma g_T.
$$
(c) What is the efficiency growth rate when the growth rate of output is 4%, the growth rate of capital is 6%, the growth rate of labor is 4%, the growth rate of land is 2%, and the share of capital, labor and land are \( \frac{1}{4}, \frac{1}{2}, \frac{1}{4} \).

Use the expression above to solve this problem; the answers for each version are as follows:

- Madeline = 1%
- Midnight = 1%
- Maximilian = 0%
- Maricella = \( \frac{1}{2} \)%