This Midterm Exam includes covers content from chapters 1, 2, and 3 in addition to the material covered in class prior to the exam. You are allowed the use of a calculator as well as writing utensils. No additional materials may be used beyond that. You have 50 minutes to complete the exam. The exam is worth 100 points.

Name: _____

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1 Multiple Choice Questions

1. (2 points) **Using the rule of 72, how fast would a country have to be growing to double its output in 12 years?**
   (a) 4 percent growth
   (b) 5 percent growth
   (c) 6 percent growth
   (d) 7 percent growth

2. (2 points) **Which of the following is not a proximate cause for changes in GDP?**
   (a) Capital accumulation
   (b) Immigration flows from year-to-year
   (c) Natural resource shock
   (d) Government policy on property rights

3. (2 points) **What is the statistical problem with omitted variable bias?**
   (a) Omitted variable bias stems from not accounting for a variable which is correlated with the explanatory variable but not the dependent variable.
   (b) Omitted variable bias stems from not accounting for a variable which is correlated with the dependent variable but not the explanatory variable.
   (c) Omitted variable bias stems from not accounting for a variable which is correlated with both the explanatory variable and the dependent variable.
   (d) None of the above.

4. (2 points) **What is the statistical problem with reverse causation?**
   (a) Reverse causation means that the direction of causality goes in the direction opposite of that which is being considered.
   (b) Reverse causation means that the direction of causality cannot be considered because there is only correlation between the variables.
   (c) Reverse causation means that you should consider a third variable that directly effects the dependent variable but not the explanatory variable.
   (d) None of the above.

5. (2 points) **Why is milk not physical capital?**
   (a) It is not produced.
   (b) It is not rival in use.
   (c) It does not depreciate in value.
   (d) It is not productive.

6. (2 points) **Which of the following is not an example of physical capital?**
   (a) A military aircraft.
   (b) A robot on a manufacturing line.
   (c) An oil tanker.
   (d) A telephone pole.

7. (2 points) **A country is described by the Solow model, with a production function of $y = k^{\frac{1}{2}}$. Suppose that k is equal to 400. The fraction of output invested is 42%. The depreciation rate is 6%.**
   (a) The country is at its steady-state level of output per worker.
   (b) The country is above its steady-state level of output per worker.
   (c) The country is below its steady-state level of output per worker.
   (d) The country does not have a steady-state as this scenario is not theoretically possible.

8. (2 points) **Suppose you have a dataset with the variable population. Population describes (in millions) the number of people living in each country. You want to know the number of countries with a population over 100 million. What command would you use in Stata?**
   (a) count > 100 if population
   (b) count population if > 100
   (c) count if population > 100
   (d) if population count > 100

9. (2 points) **Suppose you have a dataset with a continuous variable, *twenty* for the 20th percentile of income earners and a categorical variable, *region* for the region of the world in which the country sits. You want to display the continuous variable as a boxplot by region. What command should you use in Stata?**
   (a) graph box twenty by(region)
   (b) graph box twenty, over(region)
   (c) box graph twenty, by(region)
   (d) box twenty by(region)

10. (2 points) **Suppose you have a dataset with a variable for the net overseas development assistance received by a country, *net_oda* and a variable for year, *year*. You want to graph net overseas development aid as a scatter plot and also as a line. What command would you use in Stata.**
    (a) twoway scatter net_oda year lfit net_oda year

(b) twoway (scatter net_oda year) (lfit net_oda year)

(c) graph twoway scatter net_oda year lfit net_oda year

(d) graph twoway (scatter net_oda year) (lfit net_oda year)

2 Short-Answer Questions

1. (5 points) **Country Growth Differences** Country A and Country B have the same investment rate but potentially varying depreciation and production functions. Country A is twice as rich as Country B. How would you expect their short-run growth rates to compare based on data? How would you expect their short-run growth rates to compare based on the Solow model?

2. (10 points) **Income Mobility** Given the discussion above about growth rates, what should the income mobility table look like? To think about this, complete the table based on what you know about the distribution of growth rates by income-level. Additionally, complete the table assuming there is no mobility. Finally, complete the table assuming perfect mobility. Note: at the end of this question, you should have created three separate tables.

	20th	40th	60th	80th	100th
20th	P(X=20|20)	P(X=40|20)	P(X=60|20)	P(X=80|20)	P(X=100|20)
40th	P(X=20|40)	P(X=40|40)	P(X=60|40)	P(X=80|40)	P(X=100|40)
60th	P(X=20|60)	P(X=40|60)	P(X=60|60)	P(X=80|60)	P(X=100|60)
80th	P(X=20|80)	P(X=40|80)	P(X=60|80)	P(X=80|80)	P(X=100|80)
100th	P(X=20|100)	P(X=40|100)	P(X=60|100)	P(X=80|100)	P(X=100|100)

3. (5 points) A study finds that there is a strong correlation between being overweight and suffering a heart attack. Does this prove that being overweight causes heart attacks? Tell a story in which the correlation is the result of reverse causation. Tell a story in which the correlation is the result of an omitted variable (note: the stories should be about the correlation between being overweight and having a heart attack).

3 Numerical Questions

Equations for Solow

1. Capital Accumulation: $\Delta k_{t+1} = \gamma * y(k_t) - (\delta + n) * k_t$

2. Cobb-Douglas Production: $f(k_t) = A * k_t^{\alpha}$

Equation for Exponential Growth

1. Annualized Growth: $A_t = A_0(1 + g)^t$

1. (30 points) Consider the Solow model with a Cobb-Douglas production function, where A is a fixed technological parameter.
   (a) Explicitly solve for the steady-state value of the per capita capital stock and the per capita income.
   (b) How do these values change in response to a rise in (a) the technology parameter A, (b) the rate of saving γ, (c) α, (d) δ, the depreciation rate, and (e) the population growth rate n?
   (c) Show that in a Solow model, the savings rate and depreciation rate has only a level effect and not a growth effect on both per capita income and total income. Note that a growth effect can be seen as the growth in per capita and total income over time (say from time t to time $t+1$).

2. (30 points) In 1900 GDP per capita in Japan (measured in year 2005 dollars) was \$1,617. In 2000 it was \$29,639.
   (a) Calculate the annualized growth rate of income per capita in Japan over this period.
   (b) Now suppose that Japan grows at the same rate for the half-century following 2000. What will Japanese GDP per capita be in the year 2050?
   (c) Suppose that between 2000 and 2050, Japanese population growth was zero percent. If, instead, Japanese population growth had been one percentage point higher, how much poorer in GDP per capita terms would the country be in 2050 (assuming GDP per capita grew at the constant rate in part a)?

4 Extra Credit

1. (10 points) **Kuznets Curve** Simon Kuznets was a nobel-prize winning economist who made many contributions to the understanding of growth. He pointed out something called the Kuznets Curve, which suggests that within-country inequality changes with level of income per-capita. He also developed the Kuznets ratio, which looked at the ratio of the share of national income held by the richest 20% of a population and the share of national income held by the poorest 40% of the population.
   (a) Use the table to construct a *Kuznets ratio* (named after the economist and historian Simon Kuznets): the ratio of incomes earned by the richest 20% of the population to those earned by the poorest 40% of the population.
   (b) If incomes were distributed almost equally, what value would you expect this ratio to assume? What values do you see?
   (c) In the sample represented by the table, do you see a trend as we move from low-income to high-income countries?
   (d) Create two different plots by hand. First, plot the share of the poorest 40% and the share of the richest 20% on the y-axis with income on the x-axis. Second, create a plot of the Kuznets ratio on the y-axis and income on the x-axis. What do you see?

country	Per Capita Income (1993 PPP)	Share of Poorest 40%	Share of Richest 20%	Kuznets Ratio
0 - 3,000 PPP				
Tanzania	580	18	45	
Uganda	900	17	48	
India	1,220	21	41	
Bangladesh	1,290	19	46	
Senegal	1,650	11	59	
Nicaragua	1,900	12	55	
Pakistan	2,170	21	40	
El Salvador	2,350	12	53	
Sri Lanka	2,990	22	39	
3,000 - 9,000 PPP				
Peru	3,220	14	50	
Guatemala	3,350	8	63	
Brazil	5,370	7	65	
Colombia	5,490	12	54	
Costa Rica	5,520	13	50	
Panama	5,840	8	60	
Thailand	6,260	11	59	
Mexico	6,810	10	60	
Malaysia	7,930	13	54	
Venezuela	8,130	11	59	
9,000+ PPP				
Portugal	10,710	18	40	
Mauritius	12,420	18	43	
Spain	13,510	23	35	
United Kingdom	17,210	20	41	
France	19,000	19	42	
Japan	20,850	18	42	
United States	24,740	15	44	