Instructions: This is a 75 minute examination worth 100 total points. Question 1 is worth 40 points, all other questions are worth 30 points. ANSWER QUESTION 1 then choose TWO of following THREE questions. DO NOT ANSWER ALL OF THE QUESTIONS. If you do, your grade will be based on the LOWEST of the questions.

In order to get full credit, you must give a clear, concise, and correct answer, including all necessary calculations. Notes and books will not be permitted. Explain your answers clearly and use graphs when helpful.
ANSWER THIS QUESTION (40 points)

1. Suppose you run across the following argument in the newspaper. “The GDP of Neverland has been growing at a rate more than double that of the US. In ten years, Neverland will likely be much richer (in per capita GDP terms) than the US.”

   (a) What facts would you want to collect to address the validity of this claim?

   (b) Suppose that the population growth rates in the US and Neverland were the same, but Neverland had a much higher savings rate than the US. (Suppose that both of these savings rates are constant.) How would this affect your conclusions? Use the Solow model to guide your answer.

   (c) Suppose you find out that the population growth rate in Neverland is much higher than in the US, and these rates won’t change over time. In addition, suppose the claim was that the size of the overall economy (levels of GDP, not per-capita) of Neverland would surpass the US. How would this affect your conclusions? Use the Solow model to guide your answer.

ANSWER TWO OF THE FOLLOWING THREE QUESTIONS (30 points each)

2. Consider the optimal growth model with inelastic labor supply, and for simplicity assume that there is no population or productivity growth. Household preferences are:

   \[ \sum_{t=0}^{\infty} \beta^t u(C_t) \]

   The capital evolution equation is:

   \[ K_{t+1} = (1 - \delta) K_t + F(K_t) - C_t. \]

   Suppose the economy is initially in the steady state and then there is an unexpected and permanent increase in household patience, so \( \beta \) increases (or \( \theta = 1/\beta - 1 \) falls).

   (a) What are the long-run effects of this change on consumption?

   (b) What are the long-run effects of this change on capital?
3. Consider a two period problem where a consumer has preferences over consumption in the two periods given by:
\[ \log c + \beta \log c'. \]
She has no initial assets and has income \( y \) in the first period \( y' \) in the second, pays taxes (net of benefits) \( T \) in the first and \( T' \) in the second, and can borrow and lend at interest rate \( r \), thus giving the present value budget constraint:
\[ c + \frac{c'}{1 + r} = y - T + \frac{y' - T'}{1 + r}. \]
The government finances spending through taxes and borrowing:
\[ G = T + B, \quad G' + (1 + r^G)B = T', \]
where the government borrows at a lower rate than households: \( r^G < r \).

(a) Solve for the agent’s optimal consumption choices \( c \) and \( c' \).

(b) Now suppose that the government cuts taxes in the current period, so \( T \) falls by some amount \( \Delta \), but government spending is unchanged. Thus future taxes must rise to pay back the principal and interest on the deficit this policy creates. How does this affect the consumer’s optimal choices?

4. Consider the two-period dynamic general equilibrium model, which we can depict graphically as in class with equilibrium in the labor market (labor supply and demand) and the goods market (output supply and demand). Suppose the economy is initially in equilibrium, and then a new government program is announced. This program will make public infrastructure investments in the current period that will be funded by lump sum tax revenue and will increase future productivity. That is, the program combines an increase in \( G \) today (only, not \( G' \) as well) with an increase in \( z' \) in the future. As in class, assume that the response of labor supply to interest rates is small.

(a) What effect will the program have on consumption and investment demand, and thus on output demand?

(b) What effect will this program have on labor supply and labor demand? How will the program affect the output supply curve?

(c) What will be the net equilibrium effects on output, interest rates, employment, and wages?