

PRACTICE EXAM 2
Solutions will be provided in class on November 9 at 1pm.

Instructions: Please read carefully.

- You have 75 minutes to complete this exam. There are 5 questions totaling 105 points. Before you begin, please make sure that you have all the 4 pages of this exam stapled together.
- This is a closed book/notes exam. You may not use a calculator.
- Partial credit will be awarded if part of your work is correct. To receive partial credit, you must show your work in the space provided after each question.
- Write legibly and only in the space provided. Mentioning extra things that are wrong can hurt your score. Part of the challenge here is to provide a short, precise answer. Good luck!

QUESTION 1 [20 points]

Describe the final goods producing sector in the Romer (1990) model. Is there perfect or imperfect competition? Write down the production function and the profit maximization problem of the firm (or firms) in this sector. Derive the first order optimality condition.

QUESTION 2 [20 points]

State three of the shortcomings of the AK model proposed by Romer (1986) as discussed in class. For each shortcoming, give a 2-3 sentence explanation.

QUESTION 3 [20 points]

Consider the production function: $Y = AK^\alpha L^{1-\alpha}$.

- a) [10 points] Does this function exhibit increasing, constant, or decreasing returns to scale? Is the question asked here well posed or not? If it is then you should answer it as is. If not, clarify the different interpretations and answer the well posed question after your clarification.

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- b) [12 points] How does Romer get around the potential problem caused by this production function you discussed in part (a)?

QUESTION 4 [25 points]

Consider the following simple version of the Romer model. Here are the specifics (the notation below is exactly the same we have used all along):

- i. The production function is $Y = K^\alpha (AL_Y)^{1-\alpha}$,
- ii. Capital accumulation is $\dot{K} = s_K Y - dK$,
- iii. Population growth: $\dot{L} / L = n$,
- iv. Creation of new ideas: $\dot{A} = \delta A^\phi L_A^\lambda$,
- v. Proportion of labor in research: $L_A / L = s_R$,

Suppose also that $\lambda < 1$ and $\phi > 0$. Answer the following questions given this information.

a) [15 points] Solve for the growth rate of TFP (or ideas, A) in this model. Show the steps of your work.

b) [10 points] According to the equation you derived in part (a), what does the model imply for the relationship between population growth and TFP growth?

QUESTION 5 [20 points]

Describe the simple microfoundation Romer (1986) provided for the AK model. Describe the key idea, write down the equations and show how it can give rise to an AK model. Discuss two of the shortcomings of this model. Finally, describe Lucas (1988)'s variation on the Romer (1986) model.