Directions: Answer questions 1 and 2 and any other four questions.

Part A: Answer both questions

1. Consider extending Krugman’s one-sector model of monopolistic competition to two sectors. One good, Y, is produced under perfect competition, using a constant-returns technology with labor as the only input: \( Y = L_Y \)

The other good, X, is produced under monopolistic competition. Each firm uses one unit of capital and \( x \) units of labor to produce \( x \) units of output.

There are 100 units of capital and 100 units of labor in this economy. Thus, there are 100 X-firms in equilibrium.

Normalize the number of consumers to equal one, and assume a quasi-linear utility function, \( U = Y + \alpha c_i \), where \( \alpha < 1 \), and \( c_i \) is consumption of variety \( i \). Choose \( \alpha = 1/2 \), to give a constant demand elasticity equal to 2 for each variety (measured positively)

The wage rate is normalized to equal one, and the rental rate on capital is denoted \( r \).

For (a)-(c), assume the economy is in autarky.

(a) What are the equilibrium prices of Y and each X variety in equilibrium? State the equilibrium condition that you are using.

(b) Using (a), state the first-order conditions for utility maximization, and solve for the equilibrium consumption of each variety (which equals the equilibrium output of each X-firm). Then derive the equilibrium output of Y.

(c) What is the equilibrium rental rate on capital in equilibrium? State the equilibrium condition that you are using. (Hint: What does free entry imply, noting that each entrant must buy one unit of capital?)

For (d)-(e), assume that there is free trade in goods between two identical countries; that is, identical utility functions, production technologies and factor endowments.

(d) How does trade change product prices, the rental rate on capital, the number of X-firms in each country, each X-firm’s output, each consumer’s consumption of each variety, and the number of varieties consumed by each consumer? Explain.

(e) Do consumers benefit from trade in this model? Explain if and how.
2. Let $Q_i$ be country $i$’s output vector. $Q_i$ can be used for domestic consumption $C_{ii}$ or foreign consumption $C_{ji}$ ($j \neq i$):

$$Q_i \equiv C_{ii} + \Sigma_{j \neq i} C_{ji}.$$  \hspace{1cm} (1)

Let $A_i$ be country $i$’s technology matrix and $V_i$ be country $i$’s endowment vector. Assume that full employment holds in all countries:

$$A_i Q_i = V_i \text{ for all } i.$$  \hspace{1cm} (2)

Let $X_i \equiv \Sigma_{j \neq i} C_{ji}$ be country $i$’s total exports. Define country $i$’s factor content of trade as

$$F_i \equiv A_i X_i - \Sigma_{j \neq i} A_j C_{ji}.$$  \hspace{1cm} (3)

(a) Prove that

$$F_i = V_i - s_i V_w - \left[ \Sigma_j A_j \left( C_{ji} - s_i Q_j \right) \right],$$  \hspace{1cm} (4)

where $V_w$ be the vector of world endowment and $s_i$ is the consumption share of country $i$.

(b) Explain why the existence of non-tradables can lead to deviations from the HOV equation.

(c) Assume that there exist Hicks-neutral technology differences across countries. Show in detail how equation (4) may be modified.

(d) Is there any empirical support for the existence of Hicks-neutral technology differences? Explain carefully and be clear about what paper(s) you are looking at.

Part B: Answer any four questions

3. Consider the model described in question 1

(a) This economy satisfies a version of the factor-price equalization theorem. State the theorem, and derive the factor-price equalization set for this economy, using your previous calculations from question 1. Draw this factor-price equalization set in an Edgeworth Box, and identify the slopes of its boundaries (give a number for each slope and show any calculations).

(b) Starting from the case of identical countries, suppose that we move some labor from country 1 to country 2, but we keep the endowments in the factor-price equalization set. How do the outputs of $Y$ and $X$ change in each country? Is there interindustry trade or intraindustry trade, or both? Does this example satisfy the Heckscher-Ohlin theorem? Explain, including a statement of the theorem.

(c) Suppose that the endowments of the two countries lie outside the factor-price equalization set, and country 1 is specialized in the production of $X$. It has 100 units of capital and $L$ units of labor. Use the conditions for labor market equilibrium to derive the equilibrium output of each variety as a function of $L$. For a given price of each variety, $p$, derive the equilibrium wage rate as a function of $p$ and $L$. Finally, derive the equilibrium rental rate on capital as a function of $p$ and $L$. As the labor endowment $L$ rises, how does the equilibrium rental-wage change? How does this compare with the impact of a higher $L$ on the rental-wage ratio in the case considered in question 1, where the country produces both goods?
4. Consider the welfare effects of offshoring in the Grossman and Rossi-Hansberg model of “trading tasks”. Assume a small open economy, facing fixed product prices. There are two types of labor, low-skilled (L) and high-skilled (H). Assume that low-skilled tasks are outsourced.

Two models are considered, a model in which the country produces two goods and a model in which it produces one good. The first model is an extension of the Heckscher-Ohlin model to include offshoring, and the second is based on the specific-factors model.

(a) One argument against offshoring is that it reduces the domestic demand for low-skilled labor, causing a reduction in the real wages received by low-skilled workers. For which of the two models is this argument valid? Explain, including a statement of the conditions for equilibrium in the labor market and how increased offshoring requires a fall in the low-skilled wage to restore labor-market equilibrium.

(b) For the model in (a), how does offshoring affect the wage received by high-skilled labor. Explain, using the equilibrium conditions.

(c) For the other model, explain how offshoring affects the wages received by low- and high-skilled workers. It would be best to state and use the relevant equilibrium conditions, but you should at least provide an intuitive explanation.

5. The “new” trade theory introduced imperfect competition and increasing returns to scale to complement the theory of trade based on comparative advantage. Going a step further, “new-new” trade theory adds heterogeneity to the analysis. The following questions concern these literatures.

(a) Describe at least two types of trade policies that would not be undertaken by welfare-maximizing governments according to the old trade theory, but are justified under the new trade model. Your answer should briefly describe how the new trade theory models these trade policies, including the market structure to which they are applied, and why they raise welfare.

(b) What important empirically-relevant insights emerge from models with monopolistic competition and firm heterogeneity than cannot be obtained from Krugman’s original one-sector model of monopolistic competition and trade?

6. Over the past two decades, China, India and several other emerging economies have become more integrated into the global economy.

(a) What are the impacts of this economic integration on the pattern of international trade? Is the Heckscher-Ohlin model sufficient for explaining the new pattern of international trade? Explain, including a discussion of the relevant alternative models.

(b) What are the impacts of this economic integration on the demand for labor in both developed countries and those emerging markets?
7. Amiti and Konings (AER, 2007) use the following estimating equation to examine the impact of tariff reductions on firm-level productivity:

\[ tfp^i_t = \gamma_0 + \alpha_i + \alpha_i (output tariff)^i_t + \gamma_2 (input tariff)^i_t + \gamma_3 (input tariff)^i_t FM^e_i + \gamma_4 FM^e_i + \epsilon^i_t. \]

(a) Explain the differences between output tariffs and input tariffs.

(b) What are the economic interpretations of \( \gamma_1 - \gamma_4 \)?

(c) What are the channels through which input tariff reductions may improve firm-level productivity? Why is Amiti and Konings’ explanation for these channels incomplete? How would you like to investigate this further? Describe an empirical strategy.