

**HOWARD UNIVERSITY  
DEPARTMENT OF ECONOMICS**

**CODE NUMBER-----**

**TOTAL NUMBER OF PAGES-----**

**January 16, 2019**

**COMPREHENSIVE EXAMINATION:  
MACROECONOMIC THEORY/ Ph.D.**

**EXAMINERS:**

- 1. Dr. Mika Kato, Chairperson**
- 2. Dr. Gerald Daniels**
- 3. Dr. Gaminie Meepagala**

- 1. The examination is scheduled between the hours: 9:30 a.m-1.00 pm**

**ALL STUDENTS ARE TO BE SEATED BY 9:15 a.m.**

- 2. YOU ARE REQUIRED TO ANSWER ONLY FIVE (5) QUESTIONS.**

**Any additional questions answered over the required number from each category will NOT receive credit.**

- 3. Correct answers to questions NOT asked will receive NO credit.**

- 4. Be sure to write the Code Number assigned to you in the TOP LEFT HAND CORNER OF THIS SHEET AND ON EACH ANSWER SHEET. DO NOT WRITE YOUR NAME ON ANY SHEET OF THE EXAMINATION.**

- 5. Begin each question on a new page. Number each page used in sequence. Write only on one side of the paper.**

- 6. Write clearly and illustrate your answers with graphs whenever and wherever possible.**
- 7. USE ONLY BLACK INK PENS.**
- 8. At the end of the examination, please indicate the total number of pages being submitted in the space provided in the TOP RIGHT HAND CORNER of this sheet.**

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- 1. Bring your pens, pencils, calculators and rulers.**
- 2. No briefcases, book bags or sacks, no handbags larger than 10 x 6 of any form are to be brought into the examination room.**
- 3. No books, notes or other study material are to be brought into the examination room.**
- 4. During the Examination there is to be no communication between or amongst students for any purpose. All questions must be directed to and channeled through the faculty member conducting the examination.**
- 5. Only the scrap paper provided by the proctor is to be used for the examination. Scrap paper should bear the code number assigned to each student, and be handed over to the proctor along with the examination.**
- 6. Students are not expected to leave the examination room before completing their examination and turning it in to the proctor.**
- 7. NO FOOD OR SMOKING is permitted in the examination room.**
- 8. It is the student's responsibility to remove any coffee or water containers taken into the examination room.**
- 9. NO CELL PHONES ARE ALLOWED.**
- 10. EXAMINATION RESULTS WILL ONLY BE GIVEN TO STUDENTS WHO ARE REGISTERED.**

**Revised 09/07/2004**

**CODE NUMBER**\_\_\_\_\_

**STUDENTS: PLEASE CIRCLE ONLY THE QUESTIONS  
ANSWERED AND PROVIDE THE PAGE NUMBERS.**

<b>QUESTIONS</b>	<b>PAGE NUMBERS</b>
<b>1.</b>	
<b>2.</b>	
<b>3.</b>	
<b>4.</b>	
<b>5.</b>	
<b>6.</b>	
<b>7.</b>	
<b>8.</b>	

**PH.D. MACROECONOMIC THEORY  
COMPREHENSIVE EXAMINATION SPRING 2019**

**PART A. ANSWER ANY TWO (2) QUESTIONS FROM QUESTIONS 1-3.**

**1. Explain (a)-(f). You may use a simple model and/or a graph if appropriate.**

- (a) Dynamic inconsistency problem.
- (b) Expectation-augmented Phillips curve.
- (c) Voluntary and involuntary unemployment.
- (d) Vertical innovation.
- (e) Neutrality of money.
- (f) Arrow (1962)'s learning by doing.

**2. Answer questions (a)-(c).**

- (a) The Solow-Swan model predicts the so-called conditional convergence. Explain.
- (b) How can we give an empirical test of conditional convergence? Write down your idea and an econometric model.
- (c) Quah (1996, 1997) has shown that the world distribution of per-capita income is becoming more and more "twin peaked". Can conditional convergence explain this fact? Explain.

**3. Answer questions (a)-(c).**

- (a) What is the engine of growth in Romer (1990)'s product variety growth theory and in the Schumpeterian growth theory?
- (b) Compare it to the element driving endogenous growth in the neoclassical theory. What does this comparison imply in terms of pro-growth policy design in both settings?
- (c) Both the product-variety and the Schumpeterian models predict scale effects, namely, that a larger population (a larger population of researchers) would predict faster growth. Is this prediction problematic? How would you empirically test this prediction?

**PART B. ANSWER ANY THREE (3) QUESTIONS FROM QUESTIONS 4-8.**

4. Suppose that there is a large number of competitive firms. The representative firm seeks to maximize profits:

$$\pi = Y - wL,$$

where the output technology is described by

$$Y = F(eL),$$

where effort  $e$  depends on the wage the firm pays:

$$e = e(w).$$

Answer questions (a)-(c).

- (a) Write out the problem of the representative firm.
- (b) Derive the first-order necessary conditions for profit maximization.
- (c) Compute the efficiency wage when the effort function is given as:

$$e(w) = 0.001w + 0.1w^2 - 0.05w^3.$$

5. Suppose that the economy's production function is

$$Y = K^{0.5}(LA)^{0.5}$$

where  $K$  is capital,  $L$  is labor, and  $A$  is the state of technology.

Suppose that the saving rate ( $s$ ) is equal to 12%, the rate of depreciation of capital ( $\delta$ ) is equal to 2.2%, the number of workers grow at 0.7% per year and the rate of technological progress is 3.1%.

Answer questions (a) and (b).

- (a) Find the steady state values of:

- i. capital stock per effective worker
- ii. output per effective worker
- iii. growth rate of output per effective worker
- iv. growth rate of output per worker
- v. growth rate of output

- (b) Suppose that the growth rate of workers decreases. Study its short-run and the long-run effect on the *growth rate* of output per worker.

6. Given the following production function:

$$Q = F(K, L) = BK^\alpha L^{1-\alpha},$$

where  $B > 0$  and  $0 < \alpha < 1$  and with output  $Q$  divided between consumption and investment. The fraction of income devoted to investment is  $s$ , a constant, capital depreciates at the rate  $\delta$ , and labor grow at a constant rate  $n$ . Answer questions (a)-(d).

- (a) Write  $Q$  in an intensive (per capita) form,  $q$ .
- (b) Find the equation that describes the evolution of the capital stock per unit of labor,  $k$ .
- (c) Find the steady-state levels,  $k^*$  and  $q^*$ . Draw a diagram showing  $q$ , depreciation, and savings.
- (d) If the population growth rate increases show what happens to the equilibrium consumption. You may use a diagram.

7. Suppose that the economy can be described by the following three equations:

$$\begin{aligned} u_t - u_{t-1} &= -0.4(g_{yt} - 3\%) && \text{Okun's law} \\ \pi_t - \pi_{t-1} &= -(u_t - 5\%) && \text{Phillips curve} \\ g_{yt} &= g_{mt} - \pi_t && \text{Aggregate demand} \end{aligned}$$

where  $u_t$  is unemployment,  $\pi_t$  is inflation,  $g_{yt}$  is income growth, and  $g_{mt}$  is money growth in year  $t$ . Assume initially that  $u_t = u_{t-1} = 5\%$ ,  $g_{mt} = 13\%$  and  $\pi_t = 10\%$ . Now suppose that this year's money growth is permanently reduced from 13% to 0%. Answer questions (a) and (b).

- (a) Compute the impact on unemployment and inflation this year and next year.
- (b) Compute the values of unemployment and inflation in the medium run.

8. Consider a Ramsey-Cass-Koopmans model where a representative agent consumes and engages in production for  $t \in [0, \infty)$ . The agent's utility depends on its current consumption  $u(c_t)$  and its production technology is  $y_t = f(k_t)$ . Both functions have usual properties.

Answer questions (a)-(d).

- (a) Write down the representative agent's problem to find the optimal consumption to maximize the present-value of utility when its subjective discount rate is  $\rho$  and the depreciation rate of capital is  $\delta$ .
- (b) Show the first-order necessary conditions for maximization.
- (c) Using a phase diagram, show that there is a unique steady state and that the steady state is stable.
- (d) Show that the golden rule capital stock is not guaranteed in the steady state.