HOWARD UNIVERSITY

DEPARTMENT OF ECONOMICS

CODE NUMBER _____ TOTAL NUMBER OF PAGES _____

January 17, 2018

COMPREHENSIVE EXAMINATION:

MACROECONOMIC THEORY/ M.A.

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.

QUESTIONS	PAGE NUMBERS
1.	
2.	
3.	
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8.	

M.A. MACROECONOMIC THEORY
COMPREHENSIVE EXAMINATION SPRING 2018

PART A. ANSWER ALL THREE (3) QUESTIONS 1-3.

1. **Write short definitions for (a)-(g). Use diagrams and/or equations where appropriate.**

   (a) Centralized Economy
   (b) Steady state Equilibrium
   (c) Closed Economy
   (d) Human capital
   (e) Conditional Convergence
   (f) Balanced growth
   (g) Permanent technology shock

2. **For the centrally planned model**

$$Y_t = C_t + I_t,$$

$$\Delta K_{t+1} = I_t - \delta K_t, \text{ and}$$

$$Y_t = F(K_t, N_t),$$

   where Y_t is output, C_t is consumption, I_t is investment, K_t is the capital stock, and N_t is the level of labor, and the objective is to maximize

$$V_t = \sum_{s=0}^{\infty} \beta^s U(C_{t+s}).$$

   Answer questions (a)-(c).

   (a) Use the national income identity, capital accumulation equation, and production function to define the economies resource constraint.
   (b) Define the Lagrangian for the centralized economy.
   (c) Determine the first order conditions for (b).

3. **Be sure to use diagrams as well as a written explanation when a answering this question. According to the IS-LM model and Aggregate Demand and Supply model, what happens to the interest rate, income, consumption, investment, prices, and unemployment rate in the short run and long run under the following scenarios:**

Answer questions (a)-(c).

(a) Congress decides to dramatically reduce taxes.
(b) Congress decides to cut social programs (degreasing government expenditure).
(c) The Fed decides to increase the money supply through increasing open market purchases.

PART B. ANSWER ANY TWO (2) QUESTIONS FROM QUESTIONS 4-8.

4. Suppose that the following equations describe the economy of Arlingtonia, whose currency is in dollars:

$C(Y - T) = 2000 + 0.5(Y - T)$	**Consumption Function**
$I(r) = 600 - 100r$	**Investment Function**
$T = 200$	**Taxes**
$G = 200$	**Government Spending**
$L(r, Y) = .5Y - 100r$	**Demand for Real Money Balances**
$M = 3,200$	**Money Supply**
$P = 4$	**Price Level**

Answer questions (a)-(c).

(a) Given the information above, drive an equation for the IS curve for Arlingtonia. Express the IS curve as $r(Y)$.
(b) Given the above equations, drive an equation for the LM curve for Arlingtonia. Express the LM curve as $r(Y)$.
(c) Solve for the equilibrium interest rate and output using the IS curve derived in (a) and the LM curve derived in (b).

5. Suppose the production function

$$Y_t = F(K_t, N_t) = K_t^{\alpha}(E_t N_t)^{1-\alpha},$$

where E_t denotes the efficiency of labor at time t and α represents the capital share of income. The country has a constant savings rate and capital accumulation equation given by

$$\Delta k_{t+1} = s y_t - (\delta + n + g)k_t,$$

where $y_t = \frac{Y_t}{E_t N_t}$ is output per effective worker, $k_t = \frac{K_t}{E_t N_t}$ is capital per effective worker, δ is the rate of capital depreciation, n is the rate of population growth, and g is the growth rate for labor efficiency. The parameters $\alpha, s, \delta, n,$ and g are assumed to be nonnegative.

Answer questions (a)-(d).

(a) Write the production function in terms of per effective worker.
(b) Determine the marginal product of capital for the production function.
(c) Use the capital accumulation equation and the production function, in terms of per effective worker, to determine the steady state level of capital and output, both in terms of per effective worker.
(d) At the steady state, what is the growth rate for output, output per capita, and output per effective worker?
(e) Suppose the growth rate of labor efficiency is lower in the country what will happen to the steady state?

6. Consider the following centrally-planned model with labor:

$$y_t = c_t + i_t$$

$$\Delta k_{t+1} = i_t - \delta k_t$$

$$y_t = \left[\alpha k_t^{\psi} + (1-\alpha) n_t^{\psi}\right]^{1/\psi}$$

and the objective is to maximize

$$V_t = \sum_{s=0}^{\infty} \beta^s \left[c_{t+s}^{\varphi} l_{t+s}^{1-\varphi}\right] \text{ and } \beta = \frac{1}{1+\theta}$$

where y_t is output, c_t is consumption, i_t is investment, k_t is the capital stock, n_t is employment, and l_t is leisure, $n_t + l_t = 1$. The parameters $\alpha, \psi, \delta, \varphi,$ and θ are assumed to be nonnegative.

Answer questions (a)-(d).

(a) Define the Lagrangian for the centralized economy.
(b) Determine the first order conditions for (a).
(c) Obtain the long-run, steady state, solution.
(d) What are the implied long-run real interest rate and wage rate?

7. **Suppose we allow for installation costs, the utility function and production function are given by**

$$U(c_t) = \ln c_t \text{ and } y_t = Ak_t^{\alpha}$$

In addition, the resource constraint and capital accumulation are given by

$$y_t = c_t + \left(1 + \frac{\phi}{2}\frac{i_t}{k_t}\right) i_t \text{ and } \Delta k_{t+1} = i_t - \delta k_t$$

where $\phi \geq 0$.

(a) Write the First Order Conditions for consumption, capital, investment, and Lagrange multipliers for the optimal solution.
(b) Derive the equation for Tobin's q. [*hint: ratio of the Lagrange multipliers*]
(c) Using (a) and (b), derive the Euler equation in terms of Tobin's q, capital, and consumption.
(d) Determine the steady state level for Tobin's q, capital, investment, and consumption.
(e) Determine the effects of a permanent productivity increase (i.e. $\Delta A > 0$).

8. **Suppose we allow for technological progress, the utility and production function are given by**

$$U(C_t) = \ln C_t \text{ and } Y_t = K_t^{\alpha}[(1+\mu)^{t/(1-\alpha)}N_t]^{1-\alpha}.$$

In addition, capital accumulation and labor are given by

$$\Delta K_{t+1} = I_t - \delta K_t$$

$$N_t = (1+n)^t N_0$$

The parameters μ, α, δ and n and initial level of for labor, N_0, are assumed to be nonnegative.

Answer questions (a)-(d).

(a) Write the utility function, production function, and capital accumulation equation in terms of per effective labor input.
(b) Using (a) define the Lagrangian for the centralized closed economy.
(c) Determine the first order conditions for (a).
(d) Using (c), determine the Euler equation.