QUEEN'S UNIVERSITY FINAL EXAMINATION
FACULTY OF ARTS AND SCIENCE
DEPARTMENT OF ECONOMICS

ECON 222 001-002 – Professors: Bill Dorval and Mohsen Bakhshi-Moghaddam
December 11, 2023

INSTRUCTIONS TO STUDENTS:

This examination is 3 HOURS in length.

There are 2 sections to this examination. Section A consists of multiple-choice questions. You should answer all 20 of them. Each question is worth 1 mark for a total of 20 marks. Section B consists of 4 long questions. Each question is worth 20 marks for a total of 80 marks. You should answer all the long questions. Marks will be awarded on the basis of the logical arguments given to support your answers.

Please record multiple choice answers on the provided scantron, and long answers in the distributed answer booklets.

The following aids are allowed:
Casio FX-991 calculator

Put your student number on all pages of all answer booklets, including the front.
GOOD LUCK!

PLEASE NOTE:
Proctors are unable to respond to queries about the interpretation of exam questions.
Do your best to answer exam questions as written.

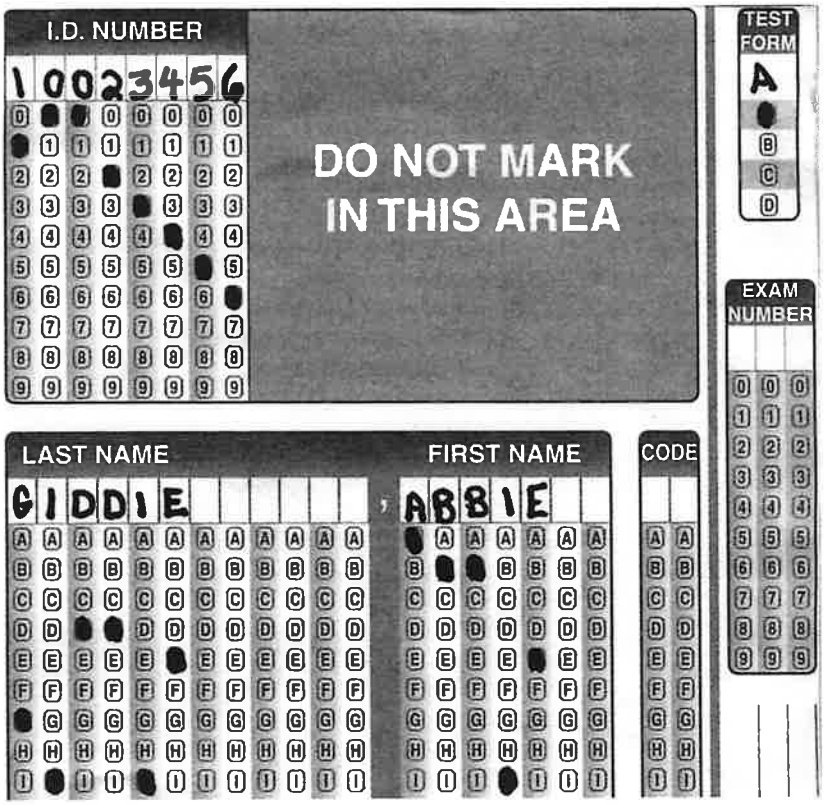
Multiple-Choice Instructions. Multiple-choice answers on the answer sheet are marked by an optical scanner. It reads only what is in the rectangle. Fill it in completely and stay within its limits. **You must use a soft lead (e.g. "HB") pencil to fill in the Answer Sheet.** Remember, if you need to change your answer, COMPLETELY ERASE IT, and correct it. For all questions, there is only one best (correct) answer; if two or more choices are marked, the item will be graded incorrect.

Before You Begin the Exam:

1. Write your Student # under "**I.D. Number**" on the Answer Sheet and fill in the appropriate rectangle below each number. **See example below.**

2. Print your **Last Name** followed by first name in the appropriate space, and fill in the appropriate rectangle under each letter. (If your name is too long to fit in the spaces provided, please enter as many letters as you can.) **See example below.**

3. Under "**Test Form**", fill in "**A**". **See example below.**



Part A (MULTIPLE CHOICE): Answer ALL the following questions. Choose the one alternative that best completes the statement or answers the question.

1) The A company collects bushels of wild berries, which it sells for $2 million to the B company to be made into jam. The B company's wild berry jam is sold for a total of $6 million. What is the total contribution to the country's GDP from companies A and B?

A) $2 million
B) $4 million
C) $6 million
D) $8 million

2) The principle of diminishing marginal productivity implies that

A) if we increase labour and capital, the output will eventually decrease.
B) if we decrease labour and capital, the output will decrease.
C) if we increase one input while keeping other inputs constant, the productivity of variable input will decrease.
D) if we increase one input while keeping other inputs constant, the output will decrease.

3) An adverse supply shock would

A) shift the production function up and decrease marginal products at every level of employment.
B) shift the production function down and decrease marginal products at every level of employment.
C) shift the production function down and increase marginal products at every level of employment.
D) shift the production function up and increase marginal products at every level of employment.

4) Your boss wants to know if you should lay off any workers. You answer that you should lay off workers if the

A) marginal revenue product of labour is greater than the nominal wage rate.
B) marginal product of labour is greater than or equal to the real wage rate.
C) marginal revenue product of labour is equal to the nominal wage rate.
D) marginal product of labour is less than the real wage rate.

5) The tendency to reduce current consumption and increase future consumption as the real interest rate increases is called

A) the substitution effect of the real interest rate on saving.
B) the income effect of the real interest rate on saving.
C) the net effect of the real interest rate on saving.
D) the substitution effect of the real interest rate on investment.

6) An economy in which output exceeds absorption

A) will send goods abroad and have a current account surplus.
B) is a net importer with a current account deficit.
C) is a net borrower in the international market.
D) will have a capital account deficit.

7) The Ricardian equivalence proposition says that

A) a budget deficit caused entirely by a current tax cut has no effect on the economy.
B) a budget deficit resulting solely from higher government purchases has no impact on the economy.
C) any budget deficit generated by the government has no effect on the economy.
D) an increase in government spending accompanied by an equivalent increase in taxes has no effect on the economy.

8) The main difference between the small open economy and the large open economy is that

A) the former faces a fixed international real interest rate, but the latter can influence it.
B) the former can influence the international real interest rate, but the latter cannot.
C) the former cannot maintain a large current account deficit, but the latter can.
D) the former can maintain a large current account deficit, but the latter cannot.

9) Which of the following is *true* when the expected future marginal product of capital increases?

A) The investment and the current account rise.
B) The investment rises, but the current account declines.
C) The investment and the current account declines.
D) The investment declines, but the current account rises.

10) Over the past year, output grew 6%, capital grew 2%, and labour grew 4%. If the elasticities of output with respect to capital and labour are 0.3 and 0.7, respectively, how much did productivity grow?

A) 2.0%
B) 2.6%
C) 3.0%
D) 3.3%

11) In the neoclassical growth model, if productivity does NOT grow,

A) output per worker will be constant.
B) output will grow at the same rate as the population growth.
C) consumption will be constant.
D) both A and B are correct.

12) According to the endogenous growth theory,

A) the primary source of growth is population growth.
B) the primary source of growth is capital growth.
C) the marginal productivity of capital does not need to decrease as capital stock increases.
D) the marginal productivity of capital decreases as capital stock increases.

13) If the interest elasticity of money demand is -1/4, by what percent does money demand rise if the nominal interest rate rises from 4% to 5%?

A) 6.25%
B) 0.25%
C) -0.25%
D) -6.25%

14) For any real interest rate, an increase in the expected inflation

A) increases the nominal interest rate and reduces the demand for money.
B) increases the nominal interest rate and increases the demand for money.
C) decreases the nominal interest rate and reduces the demand for money.
D) decreases the nominal interest rate and increases the demand for money.

15) The *FE* line is vertical because the level of output at full employment does not depend on the

A) real wage rate.
B) level of employment.
C) marginal product of labour.
D) real interest rate.

16) A tax cut on capital will

A) shift the *IS* curve down and to the left.
B) shift the *LM* curve up and to the right.
C) shift the *IS* curve up and to the right.
D) shift the *LM* curve down and to the left.

17) A rise in the price of a bond causes the yield of the bond to

A) rise.
B) fall.
C) remain unchanged.
D) rise if it is a short-term bond and fall if it is a long-term bond.

18) The real exchange rate is

A) the price of one currency in terms of another.
B) the price of domestic goods relative to foreign goods.
C) the quantity of gold that can be purchased by one unit of currency.
D) the difference in interest rates between the two countries.

19) Purchasing power parity does NOT hold in the short to medium run because

A) exports do not equal imports.
B) exchange rates fluctuate too much.
C) most business cycles are caused by shocks to aggregate demand.
D) countries produce different goods.

20) Which of the following statements describes the interest parity condition?

A) In the equilibrium, all the prices must be the same in the international market.
B) In the equilibrium, the inflation rates must be the same in the international market.
C) In the long run, the exchange rates must be the same in the international market.
D) In the equilibrium, the rates of return on assets of comparable risk and liquidity must be the same in the international market.

Part B (Long Questions):

B1. Long Run Economic Growth in the Solow model (20 marks)

Consider an economy with the following aggregate production function:

$$Y_t = A_t K_t^{\alpha} N_t^{1-\alpha}$$

where Y_t is aggregate output, A_t represents total factor productivity, K_t is the aggregate capital stock, and N_t is the number of workers in the economy. The labour force grows at rate n, capital depreciates at rate d, and the households save a constant fraction, s, of their income.

a) Let $y_t = \frac{Y_t}{N_t}$ and $k_t = \frac{K_t}{N_t}$. Derive the intensive form of the production function in per worker terms. Show your steps.

b) Derive an algebraic expression for the level of investment per worker and saving per worker in a steady-state equilibrium. Also, find the expression for the capital-labour ratio in the steady state. With the aid of the diagram, show that this equilibrium point is stable. Briefly explain your reasoning.

c) Now, suppose there are two economies (A and B) that are described by the intensive form of the production function found in part a). The two economies are identical in all respects except that A has a higher savings rate than B: $s_A > s_B$. Explain using a diagram what this implies for the relative steady-state levels of capital and output per worker in each country.

d) Suppose that, in addition to having a higher savings rate, economy A also has a higher population growth rate than economy B: $s_A > s_B$ and $n_A > n_B$. Is it possible that both economies have the same steady-state output per worker? Explain with the aid of a diagram.

B2. Asset market equilibrium (20 marks)

Suppose that the real money demand function is given by

$$\frac{M^d}{P} = L(Y, r + \pi^e) = 700 + 0.1\,Y - 5000\,(r + \pi^e)$$

where M^d is the nominal money balances demanded, P is the price level, Y is total output, r is the real interest rate, and π^e is the expected inflation rate.

a) Assuming that the asset market is currently in equilibrium at $r = 0.05$. Calculate the nominal money supply, M^s, if $Y = 2000$, $P = 2$ and $\pi^e = 0.05$. What is the velocity of money in this economy? What is the value of k in the quantity theory of money?

b) Assume that the quantity theory of money holds and that velocity is constant at the level you found in part a). In this same economy, the central bank fixes the nominal money supply (M^s) at 500. With output fixed at its full-employment level ($Y = 2000$) and assuming that prices are flexible, what will be the new price level? What happens to the price level if the nominal money supply rises to 600?

c) Now, suppose the central bank follows a money supply rule. In particular, it sets the money supply according to:

$$M^s = 1000 + 0.1Y - 4000\pi.$$

If expected inflation equals actual inflation $\pi = \pi^e = 0.03, Y = 1000$, and $r = 0.02$, calculate the price level in equilibrium using the real money demand function in part a).

d) Now, suppose that the new real money demand function is given by:

$$\frac{M^d}{P} = \frac{Y^\sigma}{(r + \pi^e)^\varphi}.$$

What are the elasticities of real money demand with respect to real income and the nominal interest rate, respectively? Briefly explain what they mean.

B3. The closed economy IS-LM-FE model (20 marks)

A closed economy is described by the following equations:

$$C^d = 450 + 0.5(Y - T) - 500r$$

$$I^d = 300 - 500r$$

$$\frac{M^d}{P} = 50 + 0.5Y - 1000(r + \pi^e)$$

where Y is real output, P is the price level, r is the real interest rate, π^e, is inflation expectations, T is a lump-sum tax, C^d, is desired consumption, I^d is desired investment, and M is the nominal supply of money which is set by the central bank.

a) Derive an algebraic expression for the IS and LM curves with the real interest rate, r, on the left-hand side of the equation. Find also the AD curve, with real output, Y, on the left-hand side.

b) Assume the expected inflation rate, π^e, is 5%, the real money supply, M/P, is 500, the price level, P, is 1, government spending, G, is 200, and the government has a budget deficit of 100. Using your results from part a), find the full employment level of output, $\bar{Y}$, and the real interest rate, r.

c) Now assume there is a temporary negative productivity shock and the new full employment level of output, $\bar{Y}_2$, is now 1300. Find the price level, P, as well as the real interest rate, r, in the long run. Show graphically and explain the transition between the old and the new long-run equilibria.

d) One of the goals of the Bank of Canada is to keep inflation low and stable. Calculate the new level of nominal money supply, M, required to avoid the change in the price level, P, found in part c). In other words, the Bank of Canada wants to keep the price level at 1 in the long run.

B4. The open economy IS-LM-FE model (20 marks)

A small open economy is described by the following equations:

$$C^d = 900 + 0.5(Y - T) - 1000r$$

$$I^d = 600 - 1000r$$

$$NX = 900 - 0.25Y - 400e$$

$$\frac{M^d}{P} = 0.5Y - 2000(r + \pi^e)$$

where Y is real output, P is the price level, r is the real interest rate, e, is the real exchange rate, π^e, is inflation expectations, T is a lump-sum tax, C^d, is desired consumption, I^d is desired investment, NX is net export, and M is the nominal supply of money which is set by the central bank.

a) Derive an algebraic expression for the IS and LM curves with the real interest rate, r, on the left-hand side of the equation. Find also the AD curve, with real output, Y, on the left-hand side.

b) Assume the expected inflation rate, π^e, is 5%, the real money supply, M/P, is 1000, the domestic and foreign price level, P and P_{for}, are 1, the nominal exchange rate, e_{nom}, is 2, government spending, G, is 450, and the government budget is balanced. Using your results from part a), find the full employment level of output, $\bar{Y}$, and the world interest rate, r^w.

c) Assume this economy has a flexible exchange rate regime. The central bank has decided to increase the nominal money supply to 1080. Find real output, Y_{SR}, and the real exchange rate, e_{SR}, in the Keynesian short-run equilibrium. Also, show graphically and explain the initial equilibrium, the short-run equilibrium, and the return to the long-run equilibrium.

d) "*Consumer sentiment (confidence) falls.*" Using the open economy IS-LM-FE framework, show graphically and explain how the change in consumer expectations, highlighted in this headline, would impact the economy if the economy had:

i. A flexible exchange rate regime.
ii. A fixed exchange rate regime.

Make sure to show the initial equilibrium (assume the economy is initially in general equilibrium), the short-run equilibrium, and the return to the long-run equilibrium. *[Note: No calculations needed].*