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

ECON 222 001-002 – Professors Bill Dorval & Mike Kennedy
April 26, 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. 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.

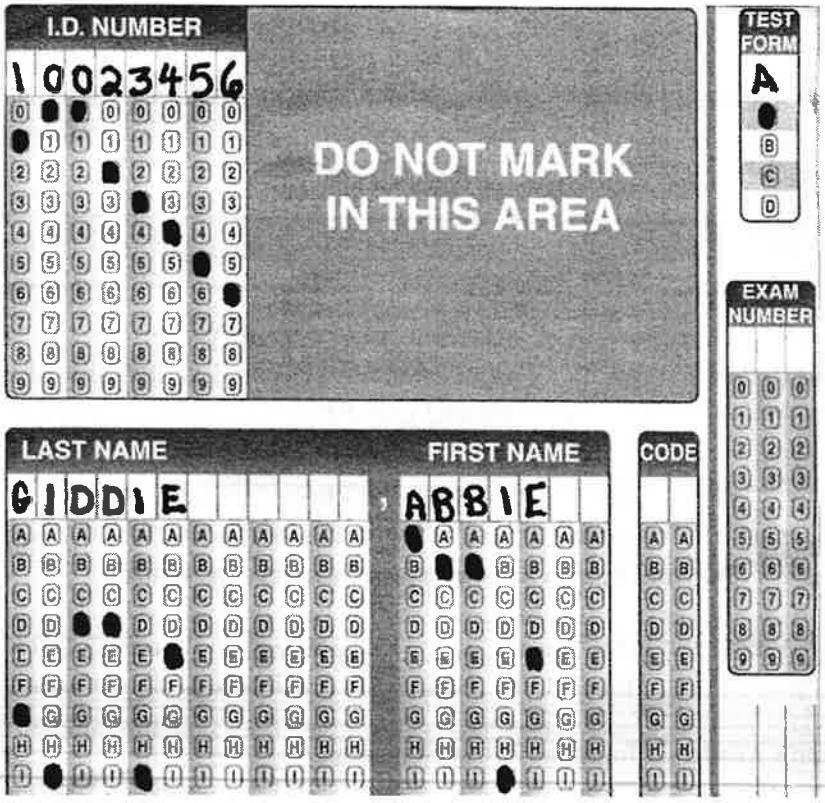
Multiple-Choice Instructions. Multiple-choice answers on the answer sheet are marked by an optical scanner. It reads only what is in the rectangle. Fill it in completely and stay within its limits. **You must use a soft lead (e.g. "HB") pencil to fill in the Answer Sheet.** Remember, if you need to change 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 country of Old Jersey produces milk and butter, and it has published the following macroeconomic data, where quantities are in gallons and prices are dollars per gallon:

	2000		2001	
Good	Quantity	Price	Quantity	Price
Milk	500	$2	900	$3
Butter	2000	$1	3000	$2

What is the growth rate of real GDP between 2000 and 2001?
A) 37.5%
B) 60%
C) 83%
D) 190%

2) You are trying to figure out how much capacity to add to your factory. You will increase capacity as long as
A) the expected marginal product of capital is positive.
B) the expected marginal product of capital is greater than or equal to the marginal product of capital.
C) the expected marginal product of capital is greater than or equal to the expected marginal product of labour.
D) the expected marginal product of capital is greater than or equal to the user cost of capital.

3) If the government cuts taxes today, issuing debt today and repaying the debt plus interest next year, a rational taxpayer will
A) spend the full amount of the tax cut today and reduce consumption next year.
B) increase consumption today, before taxes go up next year.
C) increase saving today, leaving consumption unchanged.
D) leave a smaller gross bequest to her or his heirs.

4) The uses-of-saving identity shows that if the government budget deficit rises, then which of the following must happen?
A) Private saving must rise, investment must fall, and/or the current account must fall.
B) Private saving must rise, investment must fall, and/or the current account must rise.
C) Private saving must rise, investment must rise, and/or the current account must fall.
D) Private saving must rise, investment must rise, and/or the current account must rise.

5) 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%

6) The full-employment (*FE*) line shifts left if
A) labour supply declines.
B) productivity decreases.
C) there is an adverse supply shock.
D) all of the above.

7) Which of the following statements is *true*?
A) GDP calculated by income approach is greater than GDP calculated by expenditure approach.
B) GDP calculated by product approach is greater than GDP calculated by expenditure approach.
C) GDP calculated by expenditure approach is greater than GDP calculated by product approach.
D) All three approaches for calculating GDP will result in the same value for GDP.

8) Sweetland economy's GDP is $2000 billion, desired consumption spending is $1200 billion, desired investment spending is $500 billion, and government purchases $400 billion. The Sweetland economy's absorption is
A) $2000 billion.
B) $1200 billion.
C) $2100 billion.
D) -$100 billion.

9) Under a system of fixed exchange rates, what happens if a country's currency is undervalued?
A) The Central Bank loses official reserve assets.
B) The Central Bank gains official reserve assets.
C) The currency depreciates.
D) The exchange rate falls.

10) A favourable 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.

11) The endogenous growth model implies that
A) marginal productivity of capital is diminishing.
B) human capital increases with the accumulation of physical capital.
C) the standard of living in all countries will converge in the long-run.
D) the marginal productivity of capital is increasing.

12) The principle of diminishing marginal productivity of labour implies that
A) output diminishes as labour increases.
B) output will decrease first, but it will increase as labour increases.
C) output increases at a diminishing rate as labour increases.
D) output will increase first, but it will decrease as labour increases.

13) Which of the following best describes the classical and the Keynesian views on the monetary neutrality?
A) Classical economists believe that money is neutral, but Keynesians do not.
B) Both classical and Keynesian economists believe in monetary neutrality, but they differ in the speed of price adjustment.
C) Classical economists believe in slow adjustment of prices, but Keynesians argue that price adjustment does not take long.
D) Keynesians believe that money affects employment and output in short run and long run, but classical economists argue that money is neutral only in the long run.

14) A small open economy increases its investment demand. This causes the world real interest rate to _____ and the country's current account balance to _____.
A) rise; fall
B) remain unchanged; rise
C) rise; rise
D) remain unchanged; fall

15) An increase in the real wage will cause an individual to increase his or her supply of labour if
A) the substitution effect is greater than the income effect.
B) the income effect is greater than the substitution effect.
C) the substitution effect is equal to the income effect.
D) the substitution effect is negative and the income effect is positive.

16) 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.

17) Which of the following changes would lead to a higher living standard?
A) a higher saving rate, higher population rate, and higher productivity
B) a lower saving rate, higher population rate, and higher productivity
C) a lower saving rate, lower population rate, and higher productivity
D) a higher saving rate, lower population rate, and higher productivity

18) In an open economy, an increase in net exports because of increased demand for domestic products by foreigners should cause the domestic real interest rate to _____ and should cause desired saving minus desired investment to _____.
A) rise; rise
B) rise; fall
C) fall; rise
D) fall; fall

19) When there are two large open economies, if desired international lending by the domestic country exceeds desired international borrowing by the foreign country, then
A) domestic saving must rise.
B) domestic saving must fall.
C) the world real interest rate must fall.
D) the world real interest rate must rise.

20) If all countries produce the same good (or the same set of goods) and goods are freely traded among countries, so that the real exchange rate equals one, then the relationship between domestic and foreign prices and the nominal exchange rate is
A) $P = P_{For} / e_{nom}$.
B) $P = e_{nom} \times P_{For}$.
C) $e_{nom} = P \times P_{For}$.
D) $P = P_{For}$.

Part B (Long Questions):

B1. The Neoclassical growth model (20 marks)

Consider an economy with the following aggregate production function:

$$Y_t = AK_t^{\alpha} E^{\beta} N_t^{1-\alpha-\beta}$$

where Y_t is aggregate output, A represents total factor productivity, K_t is the aggregate capital stock, N_t is the number of workers in the economy, and E is the quantity of energy. Total factor productivity, A, and energy, E, are fixed (constant). 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 $y_t = \frac{Y_t}{N_t}$, $k_t = \frac{K_t}{N_t}$, and $e_t = \frac{E}{N_t}$. Derive the intensive form of the production function in per worker terms. Show your steps.

b) Suppose the steady state investment for this economy is: $I = (n + d)K$. Find an expression for the capital-labour ratio in the steady state.

c) Derive an algebraic expression for the Golden Rule level of capital per worker, k_G. For what saving rate (s) will the steady-state level of capital per worker equal the Golden Rule level of capital per worker?

d) Now assume there is a massive storm and 25% of the energy grid becomes unusable. In other words, this 25% is no longer available for production. Find the new steady-state capital-labour ratio. Show on a graph and explain the transition between the old and the new equilibrium.

B.2 Equilibrium in Labour Market (20 marks)

Suppose we have an economy with the following aggregate production function: $Y = K^{\alpha}(AN)^{\beta} + E^{\gamma}$

Y stands for output, K for the capital stock, N for the number of people employed in production, E for the quantity of energy used in production, and A for a measure of labour efficiency. The coefficients α, β and γ are parameters whose values are between 0 and 1. Suppose $\alpha = \beta = \gamma = 0.5$.

a) Based on the production function, derive an algebraic expression for the demand for labour, assuming that w is the real wage. Be sure to sub in the values for α and β as this will simplify your final relationship.

b) Now suppose that the supply curve is upward-sloping and has the following form:

$$N^{S} = w^{2}$$

i. Find an algebraic equation for the equilibrium real wage, $\bar{w}$, and equilibrium employment, $\bar{N}$.

ii. Now suppose, A = 4; K = 16; and E = 1. Compute the values for the equilibrium real wage, $\bar{w}$, equilibrium employment, $\bar{N}$, and the level of full employment output, $\bar{Y}$. Use 2 decimals if needed.

c) Suppose there is a negative supply shock and A decreases to 3. Find the new values for the equilibrium real wage, $\bar{w}$, equilibrium employment, $\bar{N}$, and the level of full employment output, $\bar{Y}$. Use 2 decimals if needed. Also, show this shock using 2 graphs: one for the labour market and another for the production function.

d) Instead of the supply shock of part c), let's suppose the country invest heavily in energy infrastructure and the quantity of energy quadruple, $E = 4$. Find the new values for the equilibrium real wage, $\bar{w}$, equilibrium employment, $\bar{N}$, and the level of full employment output, $\bar{Y}$. Use 2 decimals if needed.

B.3 Closed economy IS-LM-FE model (20 marks)

The following represents the key equations of a closed economy

$C^d = 20 + 0.5(Y - T) - 100r$	Desired consumption
$I^d = 25 - 100r$	Desired investment
$Y = C^d + I^d + G$	Equilibrium
$M^d/P = 5 + 0.5Y - 200(r + \pi^e)$	Real money demand

In the above, Y is real output, T is total taxes, G is government spending, r is the real interest rate, π^e is expected inflation and P is the price level. Note that $r + \pi^e$ is the nominal rate of interest and that the central bank controls the money supply (M). As well, note that the sum of the interest rate coefficients on desired consumption and investment is equal to that of money demand, a feature that will simplify your calculations.

a) Derive both the *IS* and *LM* curves for this economy, with r on the left-hand side as well as the *AD* curve with Y on the left-hand side. Be sure to include inflation expectations (π^e).

b) You are given the following information: the nominal money supply is 41; the price level is 1; the level of taxation is 30; the budget is balanced; and expected inflation is 2%, which in turn is the central bank's inflation target. Based on this, find the level of full-employment output and then the real rate of interest.

c) Recently, Canada along with other economies has been experiencing inflation problems. Using the model here, suppose that π^e rises to 4%, due to news about impending temporary supply disruptions. Note the *FE* curve is not affected. Assuming that the central bank keeps the nominal money supply unchanged, calculate what happens to output and the real interest rate in the short run. [Hint: Use the *IS* curve to find the new real rate of interest.]

d) In the face of the increase in expected inflation, the Bank of Canada decides to keep the money supply unchanged and let the economy adjust back to equilibrium. Rewrite your *AD* curve with the price level on the left-hand side and then calculate what happens to the price level as the economy moves back to the equilibrium level of output that you found in **b)**. Briefly describe the mechanism driving the economy back to equilibrium. As well, suppose that it takes three years for the economy to adjust back to equilibrium. What is the annual inflation rate? Is the rate above the Bank's target 2% target?

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

The economy in question is small and takes the world rate of interest (r^w) as given. It can be described by the following equations:

$C^d = 18 + 0.6(Y - T) - 100r^w$	Desired consumption
$I^d = 19 - 100r^w$	Desired investment
$NX^d = 10 - 0.1Y - 3e$	Desire net exports
$Y = C^d + I^d + G + NX^d$	Equilibrium
$M^d/P = 7.5 + 0.5Y - 200\,r^w$	Real money demand
$e = e_{nom}P/P_{For}$	Real exchange rate

As above, you will notice that the sum of the interest rate coefficients on desired consumption and investment is equal to that of money demand, a feature that will simplify your calculations.

a) Your first task is to derive expressions for the *IS* and *LM* curves, with r^w on the left-hand sides of your equations. Now use those two relationships to derive the aggregate demand curve, first with Y on the left-hand side and then with P on the left-hand side. You will be working with these two equations plus those for net export and real exchange rate above.

b) You are given the following information: government spending (G) is 30; the government has a deficit of 5; the real exchange rate (e) is 1.5; and the real money supply (M/P) is 45. Find first the level of output, which you are to assume is the economy's long-run equilibrium level, as well as the world real rate of interest (r^w). Next assume that the nominal money supply (M) is 54, use your price level equation to calculate the price level. If the foreign price level (P_{For}) is 1, what is the level of the nominal exchange rate (e_{nom})? Find as well, the level of net exports.

c) Assume that this economy has adopted a ***fixed exchange*** rate system and that the nominal exchange rate, e_{nom}, is pegged at the level you found in **b)**. Use your model to find the short-run effect on output of a rise in government spending from 30 to 32. Note that the government deficit also rises as taxes remain constant at the level found in **b)**. Use your model to calculate what has happened to the money supply in the short run and explain why. In the long, the economy must return to equilibrium. Describe what has to happen to net exports in equilibrium given the increase in government spending. Based on this, use the net export equation to find the new level of the real exchange rate and the new level of the domestic price level.

d) Now assume that this economy has adopted a ***flexible exchange*** rate system; that is, the nominal exchange rate, e_{nom}, will now do the adjusting. Based on the class discussion, use the IS-LM-FE diagrams to describe what would happen in the short and long run when the government raises spending from 30 to 32. As well, calculate what would happen to the nominal exchange rate to restore equilibrium.