G022 MSc Core Macroeconomics Sample Paper

You have THREE HOURS. Answer TWO of THREE questions in Part A, and ALL questions in Parts B and C. There are a total of 100 points on the exam.

In cases where a student answers more questions than requested by the examination rubric, the policy of the Economics Department is that the student's first set of answers up to the required number will be the ones that count (not the best answers). All remaining answers will be ignored.

TURN OVER

PART A (20 points)

Answer **two** of the following **three** questions. Be concise in your answers; Irrelevant material will be penalized. Each question has equal weight.

1. Consider a two period endowment economy in which endowments in both periods can be either low or high: $y_t \in \{\underline{y}, \bar{y}\}$. The stochastic process governing endowments is described as follows:

$$\Pr(y_1 = \underline{y}) = \Pr(y_1 = \bar{y}) = \frac{1}{2}$$

$$\Pr(y_2 = \underline{y} | y_1 = \underline{y}) = \Pr(y_2 = \bar{y} | y_1 = \bar{y}) = \rho.$$

   Consider a riskless asset that is purchased in period one and pays out 1 in period two, regardless of the realization of the period two endowment.
   Comment on the following statement as either True, False, or Uncertain:
   Since this is a riskless asset, the price paid in period one is independent of the period one endowment.

2. Consider the following description of an endowment economy. The period one endowment is $y_1 = y$ with probability one. In period two, the endowment y_2 is stochastic, with mean y and variance σ^2. The endowment is non-storable. The representative consumer has preferences over consumption in the two periods given by

$$U = ac_1 - bc_1^2 + \beta \mathrm{E}_1[ac_2 - bc_2^2], \qquad u'(c_t) > 0, \quad u''(c_t) < 0.$$

   Consider two such economies A and B, identical in all ways except that the variance of the stochastic process for the second period endowment is higher in economy A than in economy B: $\sigma_A^2 > \sigma_B^2$.
   Comment on the following statement as either True, False, or Uncertain:
   In a competitive equilibrium, economy A will have a lower interest rate than economy B.

3. Comment on the following statement as either True, False, or Uncertain:
   In the Solow-Swan growth model savings is a constant fraction of output. In the Ramsey-Cass-Koopmans model savings is a constant fraction of output. Therefore there are no differences between the implications of these two growth models.

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Part B (40 points)

B.1 (20 points)

Consider the following two-period economy. The representative household chooses consumption and labour supply in each period to maximize

$$U = u(c_1, l_1) + \beta u(c_2, l_2) \qquad 0 < \beta < 1,$$

where

$$u(c_t, l_t) = \log c_t + \gamma \log(1 - l_t), \qquad \gamma > 0.$$

There is no uncertainty and the household faces the dynamic budget constraints given by

$$\begin{aligned} c_1 + k_2 &= w_1 l_1 + (1 + r_1) k_1 \\ c_2 &= w_2 l_2 + (1 + r_2) k_2. \end{aligned}$$

Competitive firms produce goods in each period according to a Cobb-Douglas technology in each period $t \in \{1, 2\}$:

$$y_t = k_t^{\alpha} (A_t l_t)^{1-\alpha}$$

and face market wage, w_t, and a rate of interest r_t. The economy is endowed with an initial capital stock k_1. Capital depreciates fully between periods. To begin, assume $A_1 = A_2 = \bar{A}$.

1. Define a competitive equilibrium in this economy.

2. Define a Pareto Optimum in this economy.

3. Solve for a competitive equilibrium.

4. Suppose now that total factor productivity is expected to rise in period 2, so that $A_2 > \overline{A} = A_1$. How does this anticipated change affect aggregate investment, output, and consumption in each period.

5. Suppose instead that total factor productivity rises in period 1, so that $A_1 > \overline{A} = A_2$. How does this change affect aggregate investment, output, and consumption in each period (relative to the original situation)?

TURN OVER

B.2 (20 points)

Consider the following representation of the standard real business cycle model:
The representative household has preferences over stochastic sequences of consumption c_t and leisure l_t, described by

$$U = \mathrm{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{(c_t^{\gamma} l_t^{1-\gamma})^{1-\theta} - 1}{1-\theta}$$

where E_0 is the expectations operator, conditional on time zero information, and β is the discount factor, $\beta \in (0,1)$. The household has one unit of time to divide between leisure and hours of work

$$l_t + h_t \quad = \quad 1.$$

There is a representative firm with a constant returns-to-scale Cobb-Douglas production function that uses capital k_t and labour hours h_t to produce output y_t

$$y_t = f(z_t, k_t, h_t) = \exp(z_t) k_t^{\alpha} h_t^{1-\alpha}$$

where z_t is a stochastic term representing random technological progress. z_t evolves according to

$$z_{t+1} = \rho z_t + \varepsilon_{t+1}, \qquad \mathrm{E}_t[\varepsilon_{t+1}] = 0.$$

Capital evolves according to the law of motion

$$k_{t+1} = (1-\delta) k_t + i_t, \qquad k_0 \text{ is given,}$$

where δ is the depreciation rate and i_t investment. The economy must satisfy the resource constraint

$$c_t + i_t = y_t.$$

1. Why are preferences of this form typically assumed in the real business cycle literature? Why is the Cobb-Douglas production function also typically assumed.

2. Let $V(k_0, z_0)$ be the value of $\mathrm{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{(c_t^{\gamma} l_t^{1-\gamma})^{1-\theta} - 1}{1-\theta}$ for the representative consumer who begins time 0 with capital stock k_0 and observes productivity shock z_0. Write down Bellman's equation in $V(k_t, z_t)$.

3. How well does this model do in accounting for the business cycle facts associated with consumption, investment, employment, and the real wage? [You do not need to solve the model.] How could the model be modified to match the facts better?

CONTINUED

PART C: (40 points)

This section will consist of questions similar to those posed here:

`http://www.homepages.ucl.ac.uk/~uctpgl0/mockexam.pdf`

END OF EXAM