國立雲林科技大學
96學年度博士班招生入學考試試題

系所別：財務金融系
科　目：經濟學

There are four questions included in this test. The weight of each question is equally 25 points. Each question may include a couple of sub-questions. Their weights are shown in points.

1. A factor of production i is called an inferior if the conditional demand for that factor decreases as output increases; that is, $\partial x_i(\mathbf{w}, y)/\partial y < 0$, where w is vector of factor
   (a) Draw a diagram indicating that inferior factors are possible. (7 points)
   (b) Show that if the technology is constant returns to scale, then no factors can be inferior. (9 points)
   (c) Show that if marginal cost decreases as the price of some factor increases, then the factor must be inferior. (9 points)

2. Suppose marginal costs are constant at c>0 and that the demand function is given by

$$D(p) = \begin{cases} 10/p & \text{if } p \le 20 \\ 0 & \text{if } p > 20 \end{cases}$$

   What is the profit-maximizing price? (25 points)

3. Consider the multiplier-accelerator model of income determination:
   (1)Consumption depends on the previous period's income: $C_t = a + bY_{t-1}$.
   (2)The desired capital stock is proportional to the previous period's output:
   $K_t^* = cY_{t-1}$.
   (3)Investment equals the difference between the desired capital stock and the stock inherited the previous period: $I_t = K_t^* - K_{t-1} = K_t^* - cY_{t-2}$.
   (4)Government purchases are constant: $G_t = \overline{G}$.
   (5)$Y_t = C_t + I_t + G_t$.

   (a) Express Y_t in terms of Y_{t-1}, Y_{t-2} and the parameters of the model. (10 points)
   (b) Suppose b=0.9 and c=0.5. Suppose there is a one-time disturbance to government purchases; specifically, suppose that G is equal to $\overline{G}+1$ in period t and is equal to $\overline{G}$ in all other periods. How does this shock affect output in future different 5 periods? (15 points)

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4. Assume that an economy has a production function specified as

$Y = F(K, AL)$,

where Y = output,

K = physical capital,

A = knowledge, and

L = labor.

The changes in factors per year are respectively as follows.

$$\dot{K} = sY(t) - \delta K(t),$$

$$\dot{L} = nL(t),$$

$$\dot{A} = gA(t),$$

Where s, δ, n, g are all constant.

Suppose that both labor and physical capital are paid by their marginal products.

Let $w = \dfrac{\partial F(K, AL)}{\partial L}$ and $r = \dfrac{\partial F(K, AL)}{\partial K} - \delta$, where w = wage and r =interest rate.

(a) If the production function can be written in another way as $y = f(k)$, where $y = \dfrac{Y}{AL}$ and $k = \dfrac{K}{AL}$. Show $w = A[f(k) - kf'(k)]$. (6 points)

(b) Since constant returns to scale imply that the total amount paid to the factors of production equals total net output, show that under constant returns to scale, $wL + rK = F(K, AL) - \delta K$. (7 points)

(c) Derive what the growth rates of w and r on a balanced growth path are. (12 points)

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Answer the following questions carefully

1. Find Taylor's series for $f(x)=\sin x$ at $x=\frac{\pi}{4}$. (10 points)

2. Use Maclaurin series to approximate numerical value for $\int_0^{0.1} e^{-x^2}dx$. (10 points)

3. Let $f(x)=ax^2+bx+c \quad a>0$. Prove that
   $f(x)\geq 0 \quad \forall x \quad \Leftrightarrow \quad b^2-4ac\leq 0$. (15 points)

4. Evaluate $\lim_{x\to(\frac{\pi}{2})^-}(\sec x-\tan x)$. (10 points)

5. Prove that $\lim_{x\to 0} x\sin\frac{1}{x}=0$. (15 points)

6. Find the derivative of the function $f(x)=\frac{x}{e^x+1}$ (10 points)

7. The plan $x+y+z=12$ intersects the paraboloid $z=x^2+y^2$ in an ellipse. Find the highest and lowest points on this ellipse (10 points).

8. Use the law of logarithms to solve the equation $e^{x/3}=4$ (10 points)

9. Evaluate the improper integral $\int_0^{\infty}(x-2)e^{-x^2+4x+3}dx$ if it is convergent (10 points)