

國立高雄大學九十六學年度研究所碩士班招生考試試題

科目：統計學
考試時間：100 分鐘

系所：應用經濟學系
本科原始成績：100 分

是否使用計算機：是

Note: You may not be able to find the exact probabilities for some problems. Try to explain your steps as clear as possible.

1. (20 points) For a simple regression model,

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i, i=1\dots n$$

,where Y_i and X_i are variables randomly drawn from a population; ε_i is a error term and is not correlated with X_i .

(a) (10 points) Assume that X_i is nonstochastic and ε_i is i.i.d. $N(0, \sigma^2)$. If $\hat{\beta}_1$ is the least squared estimators of β_1 . Please find the exact distribution of $\hat{\beta}_1$.

(b) (10 points) Show that $\hat{\beta}_1$ are unbiased and it is the most efficient estimator among unbiased and linear estimators.

2. (15 points) Consider the linear probability model, $Y_i = \beta_0 + \beta_1 X_i + u_i$, where Y_i is a binary variable equal to 1 if success and 0 if fail and $\Pr(Y_i = 1 | X_i) = \beta_0 + \beta_1 X_i$.

(a) (7 points) Please show that u_i is heteroskedastic and how to fix heteroskedastic problem. What else weakness does the linear probability model have?

(b) (8 points) Instead of modeling this problem by using linear probability, we suppose that $\Pr(Y_i = 1 | X_i) = \phi(\beta_0 + \beta_1 X_i)$, where $\phi(\cdot)$ is a logistic c.d.f. function. In order to estimate β_0, β_1 , the method of least square is no longer valid and Why? So, the method of Maximum Likelihood is usually applied here. Please write down the log of the likelihood function and briefly explain how to find the Maximum Likelihood Estimators of β_0, β_1 .

3. (20 points) Let X_1 and X_2 have independent gamma distributions with parameters α, θ and β, θ , respectively. Let $W = X_1 / (X_1 + X_2)$. Find the p.d.f. of W . What is the distribution of W ?

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4. (15 points) Earnings functions attempt to predict the log of earnings (Y_i) from a set of explanatory variables, both binary and continuous. You have allowed for an interaction between two continuous variables: years of education and tenure with the current employer. Your estimated regression is of the following type:

$$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 \text{Femme}_i + \hat{\beta}_2 \text{Educ}_i + \hat{\beta}_3 \text{Tenure}_i + \hat{\beta}_4 \text{Educ}_i \cdot \text{Tenure}_i$$

, where Femme is a binary variable taking on the value of one for females and is zero otherwise, Educ is the number of years of education, and Tenure is continuous years of work with the current employer.

- (a) (5 points) What is the effect of an additional year of education on earnings (“returns to education”) for men? For women?
- (b) (5 points) If you allowed for the returns to education to differ for males and females, how would you respecify the above regression?
- (c) (5 points) What is the effect of an additional year of tenure with a current employer on earnings?
5. (10 pts) Bags of a chemical produced by a company have impurity weights that can be represent by a normal distribution with mean 12.2 grams and standard deviation 2.8 grams. A random sample of 400 of these bags is taken. What is the probability that at least 100 of them contain less than 10 grams of impurities?
6. Consider a fishing company on the coast of New England. It operates a search plane to find schools of salmon that are randomly located in the North Atlantic. On average, 1 school of salmon appears per 100,000 square miles of sea. On a given day, the plane can fly 1,000 miles, effectively searching a lateral distance of 5 miles on either side of its path.
- (a) (10 pts) What is the probability of finding at least one school of salmon during 3 days of searching?
- (b) (10 pts) How many days of search are needed before the probability of finding at least 1 school of salmon reaches 0.95?

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一、簡答 (50%)

- (一) Explain and show how a firm that follows the law of diminishing marginal returns can adjust its production scale in the long run.
- (二) Explain and show why a monopolistic firm produces an output at which demand is inelastic in the long run.
- (三) 如市場獨占者進行逃漏稅行爲時，利潤稅仍具有「中立性(neutrality)」嗎？
- (四) 優勢策略均衡是否爲 Nash 均衡？而 Nash 均衡是否一定是優勢策略均衡？
- (五) 公平與效率兩者可兼得嗎？請舉例說明。

二、申論題與計算題

- (一) 請就訊息的傳訊(signaling)與篩選(screening)概念說明勞動市場中「大學文憑」的角色扮演與均衡的型態，並進而說明目前在台灣的大學文憑之價值與價格。(15%)
- (二) Suppose there are two markets, A and B. (15%)
 - (1) Suppose the total demand for a good is given as $P = 80 - Q$ and the total supply is given as $P = 2Q$. What is the price elasticity of demand, when the market is clearing?
 - (2) Suppose the demand for the good in market A is given as $P = 80 - 4Q$. The good is provided by a monopolist that has two identical factories, α and β , in markets A and B respectively. What are the market prices and quantities provided by each factory, when two markets are perfectly isolated? What are the market prices and quantities provided by each factory, when freight is costless?
- (三) 給定市場反需求函數爲 $P(Q)=50-2Q$ ，其中 $Q=q_1+q_2$ ， q_1 與 q_2 爲企業 1 與企業 2 之產量；產業中兩家企業的成本函數爲 $C(q_i)=2q_i$ ， $i=1, 2$ 。(20%)
 - (1) 當兩個企業爲 Cournot 競爭者時，首先推導出各個企業的反應函數；繼之計算每個企業的產出與利潤，並求出市場結清時的價格。
 - (2) 當企業 1 爲領導者時，計算 Stackelberg 均衡下之市場價格、市場總產出、各企業產量與其利潤。
 - (3) 列表就 Cournot 均衡與 Stackelberg 均衡作比較。

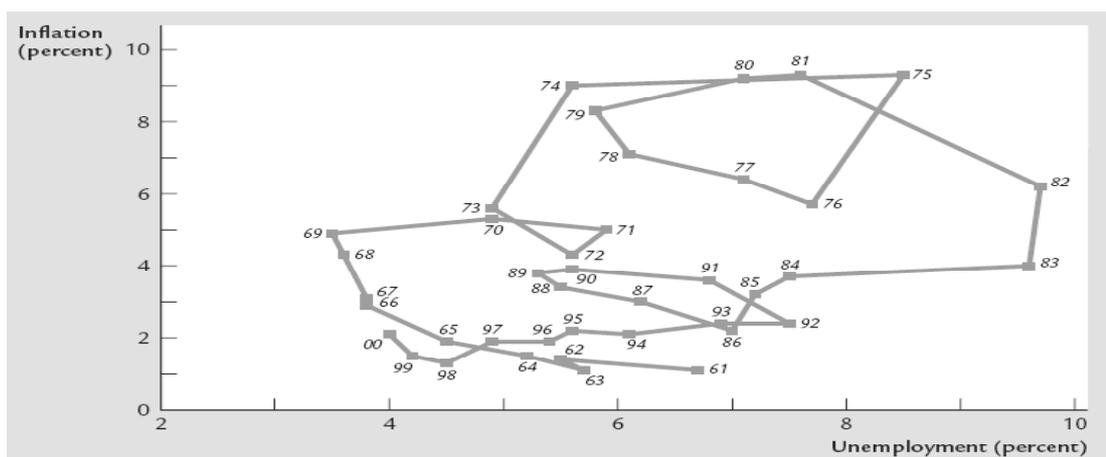
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1. (25%)
 - (a) What is “sterilization” policy of the central bank? (5%)
 - (b) Is it possible for a nation’s central bank to implement a full sterilization operation while its capital market is perfectly mobile? Why? (5%)
 - (c) For a country of large degree of capital control with fixed exchange rate regime, use Fleming (1962) framework of full sterilization to compare the effect of expansionary monetary policy on output for small and large elasticities of domestic investment. (15%)
2. (25%) The figure below shows the inflation and unemployment in the US since 1961.
 - (a) What is “Phillips curve”? (5%)
 - (b) Is there any evidence showing the existence of Phillips curve in the US since 1961? Please write down the Phillips curve equation and conclude your findings. (20%)



3. (25%) Please use Solow’s neoclassical growth model to answer the following questions.
 - (a) What is “steady state”? (5%)
 - (b) What is “gold rule” allocation? (5%)
 - (c) Use this framework to analyze the short- and long-run effects on consumption, saving and output of a shock, like Rebar group (力霸集團) scandal, causing the capital stock dropped suddenly from its original level at steady state. (15%)
4. (25%)
 - (a) What is “Ricardian equivalence”? (5%)
 - (b) Please state the main differences between Keynes’ and Friedman’s consumption function. (10%)
 - (c) Compare the effect on current consumption and saving of a temporarily dropped (starting from next year and lasting for 6 months) in income tax. (10%)