國立中山大學115學年度
碩士班考試入學招生考試試題

科目名稱：總體經濟學【經濟所碩士班】

—作答注意事項—

考試時間：100分鐘

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科目名稱：總體經濟學【經濟所碩士班】　　題號：403001

※本科目依簡章規定「不可以」使用計算機(混合題)　　

I. 選擇題 (所有題目皆為單選題，每題5分；共50分)

1. 假設台幣/美元採固定匯率，中央銀行該如何使外匯市場繼續維持在此固定匯率上？
   (A) 若市場利率上升則令新台幣貶值
   (B) 若市場利率上升則令新台幣升值
   (C) 若市場對美元有超額供給，買入美元
   (D) 不必干預市場，讓其自動達成均衡
   (E) 若市場對美元有超額需求，買入美元

2. 政府開放外國人投資台灣的股市，將每家上市公司的外國人投資上限由25%提高到50%，此舉造成外資大量湧入台灣股市；中央銀行未干預，且在其它條件不變下，
   (A) 外匯存底減少　(B) 形成股市泡沫
   (C) 造成房地產大跌價　(D) 外匯存底增加
   (E) 新台幣將因此升值

3. 格萊欣法則又被稱為：
   (A) 成本效益法則　(B) 邊際成本遞增法則
   (C) 劣幣驅逐良幣法則　(D) 供需法則
   (E) 邊際報酬遞減法則

4. 下列何者為中間投入？
   (A) 折舊費用
   (B) 消費者為了清潔自家所購買的掃把
   (C) 政府建造的新鐵路
   (D) 量販店業者為了興建停車場所購置的土地
   (E) 汽車製造商為了生產新車配件所購買的輪胎

5. 若中央銀行宣佈提高存款準備率，則我們可以預期：
   (A) 債券價格下跌，但利率上升　(B) 利率下跌，但債券價格上升
   (C) 利率與債券價格同步下跌　(D) 利率與債券價格同步上升
   (E) 對利率與債券價格毫無影響

6. 2024年物價指數為110，2025年為100，若知物價指數由2025年至2026年上漲10%，請問2026年物價指數為多少？
   (A) 121　(B) 100　(C) 99　(D) 110　(E) 120

7. 下列各學派對於短期景氣波動的說明，何者正確？
   (A) 新興古典學派認為可預料的貨幣供給變動會影響產出
   (B) 凱因斯學派認為在資訊不完全下，景氣才有短期波動
   (C) 古典學派認為，即使處於充分就業狀態，仍可能存在非循環性失業
   (D) 理性預期學派認為勞動市場不健全，引起失業及景氣波動
   (E) 貨幣學派認為法則性政策是景氣波動的來源

8. 下列何者無法解釋短期總合供給線呈現正斜率的原因？
   (A) 工資僵固性　(B) 民間資訊不完整
   (C) 有未預料的貨幣供給變動　(D) 勞動生產力改變
   (E) 市場價格機能不健全

9. Suppose that the central bank is required to follow a monetary policy rule to stabilize prices. If the economy starts at long-run equilibrium and then aggregate supply shifts right the central bank would have to
   (A) increase the money supply, which causes output to move closer to its long-run equilibrium.
   (B) increase the money supply, which causes output to move farther from long-run equilibrium.
   (C) decrease the money supply, which causes output to move closer to its long-run equilibrium.
   (D) decrease the money supply, which causes output to move farther from long-run equilibrium.
   (E) keep money supply unchanged, since the price level does not deviate from its target.

10. A reduction in U.S. net exports would shift U.S. aggregate demand
   (A) rightward. To stabilize the economy, the government could raise taxes.
   (B) rightward. To stabilize the economy, the government could cut taxes.
   (C) leftward. To stabilize the economy, the government could raise taxes.
   (D) leftward. To stabilize the economy, the government could cut taxes.
   (E) leftward. The government needs no further action.

II. 計算與問答題(共 50 分) Note: Answer all the questions on separate sheets. Please label question numbers clearly. Credit is only granted based on the correct final solution.

1. Consider a neoclassical growth model with exhaustible natural resources:

$$Y = K^{\alpha} L^{\beta} E^{\gamma} (AN)^{1-\alpha-\beta-\gamma};\ 0<\alpha<1,\ 0<\beta<1,\ 0<\gamma<1, \text{ and } \alpha+\beta+\gamma<1,$$

$$\dot{K} = sY - \delta K;\ 0<s<1 \text{ and } 0<\delta<1.$$

   Here Y, A, N, E, K, and L denote output, labor productivity, labor (population), the flow of natural resources, the capital stock, and the land stock, respectively. The parameters α, β, and γ are the shares of capital, land, and natural resources; s is the saving rate; and δ is the capital depreciation rate. Assume that land is fixed: $\dot{L}/L = 0$, and that the flow of natural resources declines at a constant rate: $\dot{E}/E = -\rho < 0$. In addition, assume that labor productivity and labor grow at constant rates: $\dot{A}/A = g > 0$ and $\dot{N}/N = n > 0$, respectively. Solve for the growth rate of output per capita $y = Y/N$ on the balanced growth path. (10pt.)

2. Consider an economy with the aggregate expenditure function:

$$AE(Y) = \frac{1}{2\alpha} Y^2 + \frac{\beta}{2};\ \alpha > 0 \text{ and } 0<\beta<\alpha,$$

   where Y denotes the level of income. In a Keynesian income-expenditure (Keynesian cross) model, equilibrium income satisfies $Y = AE$. Derive the two equilibrium levels of income and show that one equilibrium is unstable while the other is stable. (20pt.)

3. Consider a household with the following two-period utility maximization problem:

$$\max\ U = \ln c_1 + \beta \ln c_2;\ 0 < \beta < 1,$$

$$s.t.\ c_1 + k + \frac{c_2}{1+r} = y_1 + \frac{f(k)}{1+r};\ y_1 > 0,$$

where β denotes the discount factor. Here y_1 is an endowment income in period 1, $f(k)$ is output produced in period 2, and r is the interest rate. The household allocates its income and output between investment in capital k and consumption in periods 1 and 2, namely c_1 and c_2. Assume that the production function is $f(k) = k^{\alpha}$ where $0 < \alpha < 1$ denotes the capital share. In equilibrium, the goods market clearing condition is $f(k) = c_2$.

(1) Derive the Euler equation. (10pt.)

(2) Solve for the equilibrium capital stock k^*. (10pt.)

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※本科目依簡章規定「不可以」使用計算機(問答申論題)　　

Question 1: A consumer has an amount of income m. He/she wants to spend the income on two goods, good 1 and good 2. Let x_1 and x_2 be the amount of good 1 and good 2 that he/she purchases, respectively. His/her utility function is the following.

$$u(x_1, x_2) = x_1 + 2\ln x_2$$

The prices of good 1 and good 2 are p_1 and p_2, respectively.

(i) Suppose $p_1 = 2$, $p_2 = 4$ and $m = 10$. What is his/her optimal consumption of good 1 and good 2? (10 points)

(ii) Suppose $p_1 = 6$, $p_2 = 4$ and $m = 10$. What is his/her optimal consumption of good 1 and good 2? (10 points)

Question 2: Two players, player 1 and player 2, are playing a simultaneous-move game. Player 1 can use strategies U, M, and D, and player 2 can use strategies L, C and R. Their payoffs are described by the payoff matrix in Figure 1.

		Player 2		
		L	C	R
Player 1	U	2, 6	5, 8	6, 5
	M	7, 3	3, 2	2, 1
	D	1, 1	2, 6	3, 3

Figure 1: The payoff matrix in Question 2

(i) Write down the strictly dominated strategy for player 1. (5 points)

(ii) Write down the strictly dominated strategy for player 2. (5 points)

(iii) Write down all the pure-strategy Nash equilibria. (10 points)

(iv) Write down one mixed-strategy Nash equilibrium in which each player plays at least two strategies with a positive probability. (10 points)

Question 3: Two farmers, farmer 1 and farmer 2, use the same water source to grow crops. The total amount of water is 96. Each farmer gains a positive payoff for selling the crops. On the other hand, each farmer also enjoys the clean water that is left in the water source. Each farmer needs to decide the amount of water he/she uses for the crops. Let the amount of water that farmer 1 uses for the crops be x_1, where $0 \le x_1 \le 96$. Let the amount of water that farmer 2 uses for the crops be x_2, where $0 \le x_2 \le 96$. The payoff function of farmer 1 is the following.

$$u_1(x_1, x_2) = \sqrt{x_1} + 2\sqrt{96 - x_1 - x_2}$$

The payoff function of farmer 2 is the following.

$$u_2(x_1, x_2) = \sqrt{x_2} + 2\sqrt{96 - x_1 - x_2}$$

(i) Given that farmer 2 uses x_2 amount of water where $0 \leq x_2 \leq 96$, what is the best response for farmer 1? (5 points)
(ii) What is the pure-strategy Nash equilibrium? (10 points)
(iii) What is the Pareto efficient outcome? (Specify x_1 and x_2 in your answer.) (10 points)

Question 4: There are three firms that produce identical products. Let these three firms be firm 1, firm 2 and firm 3. Each of the firms needs to decide the quantity to produce. Let the quantity produced by firm i be q_i where $i = 1,2,3$. For firm i to produce q_i, the cost is $c_i(q_i) = 2q_i$. The (inverse) demand function in the market is $p = 300 - q_1 - q_2 - q_3$. Consider the following two settings.

(i) In this setting, all three firms simultaneously decide the quantities to produce.
(i-1) Given that firm 2 produces q_2 and firm 3 produces q_3, what is the best response for firm 1? (5 points)
(i-2) What is the pure-strategy Nash equilibrium? (10 points)
(ii) In this setting, firm 1 first decides to produce q_1. After that, both firm 2 and firm 3 observe q_1. Then, firm 2 and firm 3 simultaneously decide the quantities to produce. What is the pure-strategy subgame-perfect Nash equilibrium? (10 points)

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1. (10%) For a non-negative random variable, prove that

$$E(X) = \int_0^\infty P(X \geq t)dt = \int_0^\infty (1 - F(t))dt$$

2. (15%) Consider $Y = max\{0, X - 5\}$, where X is uniformly distributed on $[-5, 15]$, compute the moment generating function $M_Y(t)$ for the random variable Y.

3. (10%) Consider a random sample $\{(X_i, Y_i): i = 1,2, \ldots, n\}$, where X_i, Y_i are two positive random variables satisfying $E(Y_i \mid X_i) = \theta X_i^2$ for all i. Answer the following questions.

   (a) (4%) State the minimal assumption(s) such that the estimator

$$W = n^{-1}(\sum_{i=1}^{n} \frac{Y_i}{X_i^2})$$

   is unbiased for θ.

   (b) (6%) Now consider the estimator

$$Z = \frac{\bar{Y}}{\bar{X^2}} = \frac{n^{-1}\sum_{i=1}^n Y_i}{n^{-1}\sum_{i=1}^n X_i^2}$$

   State the minimal assumption(s) such that Z is unbiased for θ?

4. (20%) An insurance company, *Forimoto,* currently offers an automobile insurance policy. Assume the following:

   I. The number of accidents N that each policyholder experiences in a year follows a Poisson distribution with mean 0.5.
   II. The loss amount from each accident, X_i, is independent and follows an exponential distribution with a mean of 20,000.
   III. The number of accidents N is independent of the loss amounts X_i, and all accidents and loss amounts are mutually independent.

   (a) (8%) Let $S = \sum_{i=1}^{N} X_i$ denote the total claim amount for a single policyholder during one year. Compute the expected value $E(S)$ of the total annual claim amount.

   (b) (12%) Suppose the insurer imposes a deductible of 5,000 per accident, meaning it only compensates the portion of each loss that exceeds 5,000. Given a per-accident deductible of 5,000, what is the expected total annual payment by the insurer?

5. (15%) A well-known luxury brand recently claimed that its confidential brand-preference survey found that as many as 70% of consumers liked its products. The survey quickly became a topic of public discussion. A magazine specializing in brand rankings thus invited a data scientist to reassess the company's claim and conducted a new random sample of 1,000 consumers from the target population. The new results show that 675 respondents reported that they "liked'' the brand.

   Please compute the probability of observing 675 or fewer "likes" in a random sample of 1,000 consumers if the true population preference rate is 70%. (You may use Table 1 in the Appendix to approximate this probability.)

6. (15%) Let $X_1, \dots, X_6 \sim iid\ Bernoulli(p)$. Suppose $\sum_i^6 X_i = 1$. Construct an exact test of level-5% one-sided for

$$H_0: p \geq 0.5\ vs.\ H_1: p < 0.5.$$

   Compute the p-value, and state the rejection region and the conclusion.

7. (15%) City Z introduced a policy that charges \$1 per plastic bag starting on Jan. 1, 2022. You collect store-level weekly data from 2020 and 2024 for the city Z and a neighboring city K.

   As a data analyst for city Z to evaluate the effectiveness of this policy, you consider the following regression model:

$$\log(Y_{it}) = \beta_0 + \beta_1 Post_t + \beta_2 Treat_i + \delta Post_t Treat_i + \gamma X_{it} + \epsilon_{it},$$

   where Y_{it} is the number of plastic bags used per 100 transactions in store i during week t; $Post_t$ is an indicator equal to one for the post-policy period; $Treat_i$ is an indicator equal to one for stores located in City Z; X_{it} is a vector of time-varying store characteristics.

   (a) (5%) Explain the interpretation of the coefficient δ in terms of conditional expectations of $\log(Y_{it})$.

   (b) (5%) Provide an economic interpretation of the estimated coefficient $\hat{\delta}$. Suppose $\hat{\delta} = 0.06$ and the p-value is 0.002.

   (c) (5%) Give one scenario in which $\hat{\delta}$ fails to consistently estimate the policy's Average Treatment Effect on the Treated (ATT).

Table 1 Cumulative Probabilities for the Standard Normal Distribution

Each entry provides the cumulative probability for a given z-value, where the cumulative probability is the area to the left of that z-value under the standard normal curve.

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.0	0.00135	0.00131	0.00126	0.00122	0.00118	0.00114	0.00111	0.00107	0.00104	0.00100
-2.9	0.00187	0.00181	0.00175	0.00169	0.00164	0.00159	0.00154	0.00149	0.00144	0.00139
-2.8	0.00256	0.00248	0.00240	0.00233	0.00226	0.00219	0.00212	0.00205	0.00199	0.00193
-2.7	0.00347	0.00336	0.00326	0.00317	0.00307	0.00298	0.00289	0.00280	0.00272	0.00264
-2.6	0.00466	0.00453	0.00440	0.00427	0.00415	0.00402	0.00391	0.00379	0.00368	0.00357
-2.5	0.00621	0.00604	0.00587	0.00570	0.00554	0.00539	0.00523	0.00508	0.00494	0.00480
-2.4	0.00820	0.00798	0.00776	0.00755	0.00734	0.00714	0.00695	0.00676	0.00657	0.00639
-2.3	0.01072	0.01044	0.01017	0.00990	0.00964	0.00939	0.00914	0.00889	0.00866	0.00842
-2.2	0.01390	0.01355	0.01321	0.01287	0.01255	0.01222	0.01191	0.01160	0.01130	0.01101
-2.1	0.01786	0.01743	0.01700	0.01659	0.01618	0.01578	0.01539	0.01500	0.01463	0.01426
-2.0	0.02275	0.02222	0.02169	0.02118	0.02068	0.02018	0.01970	0.01923	0.01876	0.01831
-1.9	0.02872	0.02807	0.02743	0.02680	0.02619	0.02559	0.02500	0.02442	0.02385	0.02330
-1.8	0.03593	0.03515	0.03438	0.03362	0.03288	0.03216	0.03144	0.03074	0.03005	0.02938
-1.7	0.04457	0.04363	0.04272	0.04182	0.04093	0.04006	0.03920	0.03836	0.03754	0.03673
-1.6	0.05480	0.05370	0.05262	0.05155	0.05050	0.04947	0.04846	0.04746	0.04648	0.04551
-1.5	0.06681	0.06552	0.06426	0.06301	0.06178	0.06057	0.05938	0.05821	0.05705	0.05592
-1.4	0.08076	0.07927	0.07780	0.07636	0.07493	0.07353	0.07215	0.07078	0.06944	0.06811
-1.3	0.09680	0.09510	0.09342	0.09176	0.09012	0.08851	0.08691	0.08534	0.08379	0.08226
-1.2	0.11507	0.11314	0.11123	0.10935	0.10749	0.10565	0.10383	0.10204	0.10027	0.09853
-1.1	0.13567	0.13350	0.13136	0.12924	0.12714	0.12507	0.12302	0.12100	0.11900	0.11702
-1.0	0.15866	0.15625	0.15386	0.15151	0.14917	0.14686	0.14457	0.14231	0.14007	0.13786
-0.9	0.18406	0.18141	0.17879	0.17619	0.17361	0.17106	0.16853	0.16602	0.16354	0.16109
-0.8	0.21186	0.20897	0.20611	0.20327	0.20045	0.19766	0.19489	0.19215	0.18943	0.18673
-0.7	0.24196	0.23885	0.23576	0.23270	0.22965	0.22663	0.22363	0.22065	0.21770	0.21476
-0.6	0.27425	0.27093	0.26763	0.26435	0.26109	0.25785	0.25463	0.25143	0.24825	0.24510
-0.5	0.30854	0.30503	0.30153	0.29806	0.29460	0.29116	0.28774	0.28434	0.28096	0.27760
-0.4	0.34458	0.34090	0.33724	0.33360	0.32997	0.32636	0.32276	0.31918	0.31561	0.31207
-0.3	0.38209	0.37828	0.37448	0.37070	0.36693	0.36317	0.35942	0.35569	0.35197	0.34827
-0.2	0.42074	0.41683	0.41294	0.40905	0.40517	0.40131	0.39745	0.39361	0.38978	0.38596
-0.1	0.46021	0.45624	0.45228	0.44834	0.44441	0.44049	0.43658	0.43267	0.42877	0.42488
-0.0	0.50021	0.49619	0.49217	0.48817	0.48417	0.48019	0.47621	0.47224	0.46828	0.46433