國立中山大學114學年度
碩士班考試入學招生考試試題

科目名稱：統計學【經濟所碩士班】

—作答注意事項—

考試時間：100分鐘

- **考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。**請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- **答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示**，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，請衡酌作答。
- 答案卡請以2B鉛筆劃記，不可使用修正液（帶）塗改，未使用2B鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，後果由考生自負。
- 答案卷（卡）應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 可否使用計算機請依試題資訊內標註為準，如「可以」使用，廠牌、功能不拘，唯不得攜帶書籍、紙張（應考證不得做計算紙書寫）、具有通訊、記憶、傳輸或收發等功能之相關電子產品或其他有礙試場安寧、考試公平之各類器材入場。
- **試題及答案卷（卡）請務必繳回，未繳回者該科成績以零分計算。**
- **試題採雙面列印，考生應注意試題頁數確實作答。**
- **違規者依本校招生考試試場規則及違規處理辦法處理。**

國立中山大學114學年度碩士班考試入學招生考試試題

科目名稱：統計學【經濟所碩士班】　　題號：403003

※本科目依簡章規定「不可以」使用計算機(問答申論題)　　

本試卷所有題目均為計算題(第4題除外)，請詳述計算過程，否則不予給分

1. (15%) Let X be a random variable with the moment generating function

   $M(t) = (a + be^t)^c \; with \; E(X) = 4, Var(X) = 2.$

   Find a, b, c.

2. (24%) Let X and Y have the following joint probability density function:

   $f_{XY}(x, y) = 2(x + 2y)/3$ with support $0 < x < 1, and \; 0 < y < 1.$

   (a) (8%) Find the marginal probability density function $f_X(x)$ and $f_y(y)$.

   (b) (8%) Find $f_{X|Y}(X = x|Y = y)$.

   (c) (8%) Find $Cov(3X, 4Y)$.

3. (23%) Consider the following hypothesis test, assuming the sample X_i are i.i.d. normal $N(\mu, \sigma^2)$:

   $$H_0: \mu \geq 8$$
   $$H_a: \mu < 8$$

   The sample size is 100, and the population standard deviation is 4. The significance level is $\alpha = 0.05$. To answer the following two questions, you may need to use data provided by Table 1 in Page 3.

   (a) (8%) If the actual population mean is 7.2, what is the probability of Type II error?

   (b) (15%) Suppose the researcher wants to reduce the probability of Type II error to 0.05 when the actual population mean is 7.2. What is the recommended sample size?

4. (12%) Consider the estimation of relationship between CEO salary and firm sales.

   (a) (3%) Interpret the regression coefficient on sales if the regression function is $salary = 4.82 + 0.3sales + u.$

   (b) (3%) Interpret the regression coefficient on sales if the regression function is $log(salary) = 4.82 + 0.3sales + u.$

   (c) (3%) Interpret the regression coefficient on sales if the regression function is $salary = 4.82 + 0.3log(sales) + u.$

   (d) (3%) Interpret the regression coefficient on sales if the regression function is $log(salary) = 4.82 + 0.3log(sales) + u.$

5. (15%) Consider the following regression model:

$$y = \beta_0 + \beta_1 x^* + u$$

We are concerned that x^* is measured with error empirically with finite variance $\sigma^2_{x^*}$. Let x represent the data observed by researchers with the measurement error $x = x^* + e$, where e denotes the measurement error with its variance σ^2_e. Assume that the classical errors-in-variables (CEV) assumption holds such that the measurement error is uncorrelated with the unobserved explanatory variable x^*, i.e., $Cov(x^*, e) = 0$.

Specifically, we now regress y on x. Is OLS a consistent estimate for the parameter β_1? Provide a detailed reasoning by carefully deriving the OLS estimator $\hat{\beta}_1$.

6. (11%) Please fill in the blanks of the following ANOVA table from a regression model: (write down your answer on the answer sheets)

$$Y = \beta_0 + \beta_1 X + \epsilon.$$

Source	SS	df	MS	F ratio	F critical value ($\alpha = 0.05$)	P value of F
Model	139,449,474	(1)	(4)	(6)	(7)	(8)
Residual	(3)	(2)	(5)			
Total	635,065,396	73				

Y	Coefficient	Standard error	t-statistics	P-value	95% Confidence Interval
Intercept	11,253.06	1,170.813	9.61	$<10^{-12}$	(8,919.088, 13,587.03)
X	-238.8943	53.07669	(9)	$<10^{-4}$	(-344.7008, -133.0879)

Additionally, answer the following questions.

(10) How many observations in the problem?
(11) What is the coefficient of determination R^2?

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