

# 國立中山大學 108 學年度 碩士暨碩士專班招生考試試題

科目名稱：商用統計學【企管系企管甲班碩士班甲組選考、乙組選考、  
丙組選考】

## —作答注意事項—

考試時間：100 分鐘

考試開始響前不得翻閱試題，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，不得另攜帶紙張，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，其後果由考生自行負擔。

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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，唯不得攜帶具有通訊、記憶或收發等功能或其他有礙試場安寧、考試公平之各類器材、物品（如鬧鈴、行動電話、電子字典等）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。

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## 一、觀念解釋題（共 2 題，每題 5 分，合計 10 分）

1. 在假設檢定中，決策者可能犯的錯誤有兩種：型 I 錯誤和型 II 錯誤。為什麼我們選擇控制型 I 錯誤的機率  $\alpha$ ，而不是控制型 II 錯誤的機率  $\beta$ ？難道型 I 錯誤比型 II 錯誤嚴重嗎？還是別的原因？以你的理解，請說明。
2. ANOVA 分析中，有哪三個基本假設？以你的理解，請說明為什麼要使用這三個假設？

## 二、單選題（共 40 題，每題 2 分，答錯不倒扣，合計 80 分）

1. A researcher has collected the following sample data.

5    12    6    8    5  
6    7    5    12    4

The 75th percentile is

- A. 7
  - B. 7.5
  - C. 8
  - D. 9
2. The table below shows the population growth rate of a city for the years 2008 through 2012.

Year	Population Growth Factor
2008	0.8923
2009	1.0587
2010	1.1934
2011	1.2345
2012	1.0995

What has been the average growth rate of the city form year 2008 to 2012?

- A. 8.88%
  - B. 13.54.%
  - C. 12,34%
  - D. 1.088%
3. The random variable  $X$  is the number of occurrences of an event over an interval of ten minutes. It can be assumed that the probability of an occurrence is the same in any two time periods of an equal length. It is known that the mean number of occurrences in ten minutes is 4. The probability that there are 3 occurrences in five minutes is
    - A. 0.1804
    - B. 0.1721
    - C. 0.1126
    - D. 0.9107
  4. (Continued with problem 3) What is the standard deviation of  $X$ ?
    - A. 2.
    - B. 5
    - C. 3
    - D. 16
  5. The following table shows part of the probability distribution for the number of boats sold daily at Boats

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Unlimited. It is known that the average number of boats sold daily is 1.57.

X	f(x)
0	0.20
1	0.30
2	0.32
3	???
4	0.05
5	0.02

Which of the following is the correct variance?

- A. variance = 1.5092
  - B. variance = 1.8903
  - C. variance = 1.4051
  - D. variance = 1.6881
6. The average life expectancy of dishwashers produced by a company is 6 years with a standard deviation of 8 months. Assume that the lives of dishwashers are normally distributed. If 155 of this year's dishwasher production fail operating in less than 4 years and 4 months, then how many dishwashers were produced this year? ( $Z_{2.49}=0.0064$ ,  $Z_{2.39}=0.0084$ ,  $Z_{2.59}=0.0048$ )
- A. 24200
  - B. 34000
  - C. 29000
  - D. 40400
7. From a population that is not normally distributed and whose standard deviation is not known, a sample of 6 items is selected to develop an interval estimate for the mean of the population ( $\mu$ ). Then, which of the following is correct?
- A. The normal distribution can be used.
  - B. The t distribution with 5 degrees of freedom must be used.
  - C. The t distribution with 6 degrees of freedom must be used.
  - D. The sample size must be increased.
8. A machine that produces a major part for an airplane engine is monitored closely. In the past, 10% of the parts produced would be defective. With a .95 probability, the sample size that needs to be taken if the desired margin of error is .04 or less is ( $Z_{0.025}=1.96$ )
- A. 110
  - B. 111
  - C. 216
  - D. 217
9. Two thousand numbers are selected randomly; 960 are even numbers. At the .10 level of significance using the p-value approach, test the hypotheses  $H_0: p = 0.5$ . vs.  $H_1: p \neq 0.5$ . What is the range of p-value? ( $Z_{0.05}=1.645$ ,  $Z_{0.025}=1.96$ )
- A. p-value > 0.10
  - B.  $0.025 < \text{p-value} < 0.05$
  - C.  $.001 < \text{p-value} < 0.025$
  - D.  $0.05 < \text{p-value} < 0.1$
10.  $H_0: \mu = 120$  vs.  $H_1: \mu \neq 120$  are used to test whether a bath soap production process is meeting the standard output of 120 bars per batch. Use a 0.05 level of significance for the test and a planning value of 5 for the standard deviation. If the mean output drops to 117 bars per batch, the firm wants to have a 98% chance of concluding that the standard production output is not being met. How large a

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sample should be selected? ( $Z_{0.02}=2.05$ )

- A. 44
- B. 45
- C. 46
- D. 47

11. In national public opinion polls for interval estimation conducted by large professional organizations, what is the margin of error most commonly adopted?

- A. 0.01 ~ 0.02
- B. 0.02 ~ 0.03
- C. 0.03 ~ 0.04
- D. 0.04 ~ 0.05

12. The table below gives beverage preferences for random samples of teens and adults.

	Teens	Adults	Total
Coffee	10	40	50
Soft Drinks	30	20	50
	40	60	100

We are asked to test for independence between age (i.e., adult and teen) and drink preferences. What is the value for the test statistic?

- A. 5.991
- B. 7.815
- C. 14.067
- D. 16.67

13. Consider the following information.

$$SSTR = 6750$$

$$SSE = 8000$$

$$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$$

$H_a$ : At least one mean is different

$n=5$  is selected from each population and the null hypothesis is to be tested at the 5% level of significance (table value  $F_{3,16; 0.05} = 3.24$ ). The null hypothesis

- A. should be rejected
- B. should not be rejected
- C. was designed incorrectly
- D. cannot be tested

14. Regression analysis was applied between sales data ( $y$  in \$1000s) and advertising data ( $x$  in \$100s) and the following information was obtained.

$$\hat{y} = 12 + 1.8x$$

$$n = 17 \quad SSR = 225 \quad SSE = 75 \quad S_{b_1} = .2683$$

The F test statistic computed from the above data is

- A. 43
- B. 45
- C. 48
- D. 50

15. Given the data for two variables, X and Y.

$x_i$	6	11	15	18	20
$Y_i$	6	8	12	20	30

Which of the following is correct?

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- A.  $b_1=1.5873$
- B.  $E(y) = -6.045 + 1.32x$
- C.  $b_0 = -6.022$
- D. none is correct

16. The following information regarding a dependent variable ( $y$ ) and an independent variable ( $x$ ) is provided as follow.

<u>Y</u>	<u>X</u>
4	2
3	1
4	4
6	3
8	5

It is known that  $SSE = 6$   $SST = 16$ . Then, the least squares estimate of the  $y$ -intercept is

- A. 1
  - B. 2
  - C. 3
  - D. 4
17. (Continued with problem 16) What is the value of the F test statistic?
- A. 2
  - B. 3
  - C. 4
  - D. 5
18. In a regression analysis, the regression equation is given by  $y = 12 - 6x$ . If  $SSE = 510$  and  $SST = 1000$ , then the coefficient of correlation is
- A. -0.7
  - B. +0.7
  - C. 0.49
  - D. -0.49
19. Regression analysis was applied between sales data ( $y$  in \$1000s) and advertising data ( $x$  in \$100s) and the following information was obtained.
- $\hat{y} = 12 + 1.8x$   
 $n = 17$   
 $SSR = 225$   
 $SSE = 75$   
 $sb_1 = .2683$
- Then, the  $t$  statistic for testing the significance of the slope is
- A. 1.80
  - B. 1.96
  - C. 6.71
  - D. 0.56
20. A measure of identifying the effect of an unusual  $x$  value on the regression results is called
- A. Cook's D
  - B. leverage
  - C. odd ratio
  - D. unusual regression

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21. In order to test for the significance of a regression model involving 3 independent variables and 47 observations, the numerator and denominator degrees of freedom (respectively) for the critical value of  $F$  are
- A. 47 and 3
  - B. 3 and 47
  - C. 2 and 43
  - D. 3 and 43

22. The following estimated regression equation was developed relating yearly income ( $y$  in \$1000s) of 30 individuals with their age ( $x_1$ ) and their gender ( $x_2$ ) (0 if male and 1 if female).  
 $\hat{y} = 30 + .7x_1 + 3x_2$  Also provided are  $SST = 1200$  and  $SSE = 384$ . At the 5% level the  $F$  table value is  $F_{2,27;0.05}=3.35$ ; then, the model
- A. is significant
  - B. is not significant
  - C. would be significant if the sample size was larger than 30
  - D. has significant individual parameters.

23. Use the computer output shown below to choose the correct answer, at a .05 level of significance.

**ANOVA**

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	2	118.8474	59.4237	40.9216	0.0000
Residual	9	13.0692	1.4521		
Total	11	131.9167			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	118.5059	33.5753	3.5296	0.0064
( $x_1$ )	-0.0163	0.0315	-0.5171	0.6176
( $x_2$ )	-1.5726	0.3590	-4.3807	0.0018

- A. the model is not significant
  - B.  $x_1$  is significant and no evidence that  $x_2$  is significant
  - C. no evidence that  $x_1$  is significant while  $x_2$  is significant
  - D.  $n=11$
24. (Continued with problem 23) What is the value of the coefficient of determination?
- A. 0.8
  - B. 0.7
  - C. 0.1
  - D. 0.9

25. In a regression analysis involving 20 observations and five independent variables, the following information in the ANOVA table was obtained. Which of the following answers is correct?

**ANOVA**

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>
Regression	_____?	_____?	_____?	_____?
Error (Residual)	_____?	_____?	30	
Total		990		

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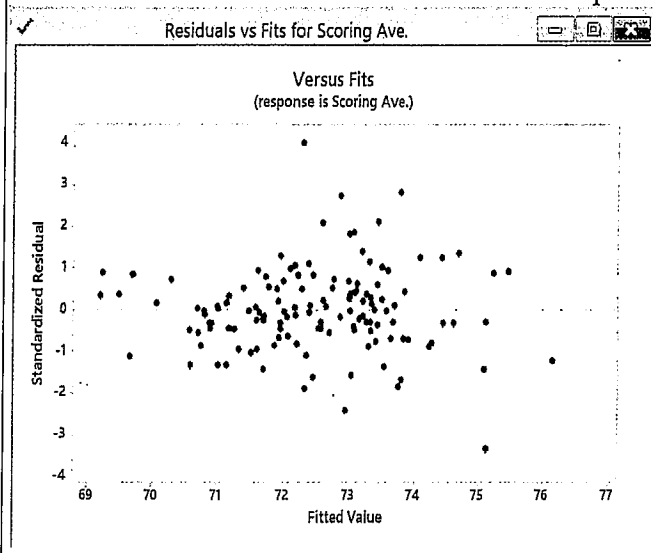
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- A.  $F = 3.6$
- B.  $F = 3.8$
- C.  $SSR = 420$
- D.  $MSE = 114$

26. Provided with the standardized residuals plot as follow, please choose the correct answer.



- A. the standardized residual plot supports all the four assumptions about  $\varepsilon$
- B. the plot does not seem to indicate existence of outliers
- C. the variance of the residuals appear to increase for larger fitted values
- D. the plot seems to violate the assumption that  $E(\varepsilon) = 0$

27. In Durbin-Watson test the null hypothesis  $H_0$  is

- A.  $H_0: \rho \geq 0$
- B.  $H_0: \rho \leq 0$
- C.  $H_0: \rho = 1$
- D.  $H_0: \rho = 0$

28. In the test of autocorrelation which of the following is correct?

- A. the error terms are modelled as  $\varepsilon_t = \rho \varepsilon_{t-1}$
- B. autocorrelation means successive error terms are automatically correlated
- C. the error terms are modelled as  $\varepsilon_t = \rho \varepsilon_{t-1} + z_t$
- D. none of the above is correct

29. A variable such as  $z$ , whose value is  $z = x_1x_2$ , is added to a general linear model in order to account for potential effects of two variables  $x_1$  and  $x_2$  acting together. This type of effect is

- A. called multiplicative effect
- B. called interaction effect
- C. called dual choice effect
- D. called binary choice effects

30. When dealing with the problem of non-constant variance, the reciprocal transformation means using

- A.  $1/x$  as the independent variable instead of  $x$
- B.  $1/x^2$  as the independent variable instead of  $x$
- C.  $1/y^2$  as the dependent variable instead of  $y$
- D.  $1/y$  as the dependent variable instead of  $y$

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31. A data set consisting of 7 observations of a dependent variable  $y$  and two independent variables  $x_1$  and  $x_2$  was used in a regression analysis. Using  $x_1$  as the only independent variable, the following function is provided.
- $$\hat{y} = .408 + 1.338x_1$$
- The SSE for the above model is 39.535.  
Using both  $x_1$  and  $x_2$  as independent variables yields the following function.
- $$\hat{y} = .805 + .498x_1 - .477x_2$$
- The SSE for this function is 1.015.  
Then, the F test statistic equals
32. Given an actual demand of 61, its forecast of 58, and an  $\alpha$  of 0.3, what would be the forecast for the next period using exponential smoothing?
33. Which of the following smoothing constants would make an exponential smoothing forecast equivalent to a naive forecast?
34. In stepwise regression procedure, how would you decide which variable to enter or leave the model?
35. If the estimate of the trend component is 158.2, the estimate of the seasonal component is 94%, the estimate of the cyclical component is 105%, and the estimate of the irregular component is 98%, then the multiplicative model will produce a forecast of
36. Below you are given the first five values of a quarterly time series. The multiplicative model is appropriate and a four-quarter moving average will be used.

Year	Quarter	Time Series Value $Y_t$
1	1	36
1	2	24
1	3	16
1	4	20
2	1	44



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An estimate of the seasonal-irregular component for Quarter 3 of Year 1 is

- A. 0.64
- B. 1.5625
- C. 5.333
- D. 0.3

37. The quality control manager requested a producer's risk of 0.1 when  $p_0$  was 0.03 and a consumer's risk of 0.2 when  $p_1$  was 0.15. Consider the acceptance sampling plan based on a sample size of 20 and an acceptance number of 1. Let  $X$  be the number of defective items selected in the sample, then which of the following answers is correct?

- A. the producer's risk =  $P(X \geq 2 \mid n=20, p=0.03)$
- B. the producer's risk =  $P(X \leq 1 \mid n=20, p=0.15)$
- C. the producer's risk =  $P(X \geq 2 \mid n=20, p=0.15)$
- D. the producer's risk =  $P(X \leq 1 \mid n=20, p=0.03)$

38. (Continued with problem 37) Which of the following is correct?

- A. the consumer's risk =  $P(X \geq 2 \mid n=20, p=0.15)$
- B. the consumer's risk =  $P(X \geq 2 \mid n=20, p=0.03)$
- C. the consumer's risk =  $P(X \leq 1 \mid n=20, p=0.15)$
- D. the consumer's risk =  $P(X \leq 1 \mid n=20, p=0.03)$

39. A nonparametric version of the parametric analysis of variance test is the

- A. Kruskal-Wallis test
- B. Mann-Whitney-Wilcoxon test
- C. sign test
- D. Wilcoxon signed-rank test

40. Fifteen people were given two types of cereal, Brand X and Brand Y. Two people preferred Brand X and thirteen people preferred Brand Y. We want to determine whether or not customers prefer one brand over the other. The  $p$ -value for this test is (Hint:  $0.5^{15}=0.000030517$ )

- A. 0.0005
- B. 0.001
- C. 0.0037
- D. 0.0074

### 三、計算題 (合計 10 分)

1. Consider the following time series data. Please answer the following questions.

Week	1	2	3	4	5	6	7
Value	24	13	20	12	19	23	15

- (a) Develop the 3-week moving average forecasts for this time series. Compute MSE and a forecast for week 8.
- (b) Use  $\alpha=0.2$  to compute the exponential smoothing forecasts for the time series. Compute MSE and a forecast for week 8.
- (c) Compare the 3-week moving average approach with the exponential smoothing approach using  $\alpha=0.2$ . Which appears to provide more accurate forecasts based on MSE?

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## —作答注意事項—

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- 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 108 學年度碩士暨碩士專班招生考試試題

科目名稱：微積分【企管系企管甲班碩士班甲組選考、乙組選考、丙組選考】 題號：441003

※本科目依簡章規定「不可以」使用計算機(問答申論題)

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請按題號順序作答，並請寫出推導過程，違者扣分。

1. Find  $dy/dx$  for the following (15%)

a.  $y = \frac{w}{w+1}$  and  $w = \frac{x}{x+1}$

b.  $x^{3/4} + y^{3/4} = 2$  by implicit differentiation

c.  $y = \ln(x + e^{-3x})$

2. Sketch the graph of  $f(x) = 8x^5 - 5x^4 - 20x^3$ , indicating local extrema, inflection points, concave structure, and asymptotes, if applicable. (15%)

3. Evaluate the integrals (30%)

a.  $\int_0^{\pi/3} \sin 3t dt$

b.  $\int_{-\infty}^0 \frac{dx}{\sqrt{4-x}}$

c.  $\int \frac{dx}{x^2 - x - 6}$

d.  $\int x\sqrt{x+1} dx$

e.  $\int \frac{dx}{\sqrt{x}(2+\sqrt{x})^2}$

f.  $\int \frac{e^{3x}}{1+e^{3x}} dx$

4. Find the limits of the following (15%)

a.  $\{a_n\}_{n=0}^{\infty}$  where  $a_n = \frac{3^n + 5}{e^n}$

b.  $\sum_{n=1}^{\infty} nx^n$ , indicating the interval of convergence.

c.  $\lim_{x \rightarrow 0} \frac{\ln(3+x)}{x}$

5. Approximate  $\ln(1.11)$  by Taylor's expansion accurate to 3 decimal places. (10%)

6. 某一城市一年內需要維修的街道數目假設是隨機變數，其機率密度函數(probability density function)為  $f(x) = 12x^2(1-x)$ ,  $0 \leq x \leq 1$ , 求今年該區最多到一半的道路需要維修的機率。(15%)