國立中興大學 107 學年度碩士班招生考試試題

科目：統計學　　系所：企業管理學系乙組

本科目可以使用計算機　　本科目試題共 4 頁

1. (5%) Assume that 40% of all highway accidents involve excessive speed on the part of at least one of the drivers (Event E) and that 30% involve alcohol use by at least one driver (Event A). If alcohol is involved there is a 60% chance that excessive speed is also involved; otherwise, this probability is only 10%. An accident involves speeding. What is the probability that alcohol is involved?

2. (10%) A miner is trapped in a mine containing three doors. The first door leads to a tunnel that takes him to safety after two hours of travel. The second door leads to a tunnel that returns him to the mine after three hours of travel. The third door leads to a tunnel that returns him to his mine after five hours. Assuming that the miner is at all times equally likely to choose any one of the doors, what is the expected length of time until the miner reaches safety?

3. (15%) In an electronic assembly, let random variables X_1 and X_2 denote the lifetime of two components in hours. Suppose that the joint probability density function of these variables is

$$f_{X_1,X_2}(x_1,x_2) = 2\times 10^{-6}\times e^{-0.001x_1-0.002x_2}, \quad x_1 \geq 0, x_2 \geq 0.$$

   A. (5%) What is the marginal probability density function of X_1?
   B. (5%) Show that X_1 and X_2 are independent.
   C. (5%) What is the probability that the device operates for more than 1000 hours without any failures?

4. (10%) Let X and Y be independent random variable with E[X]=3, E[X^2]=25, E[Y]=10, E[Y^2]=164.
   A. (5%) Find Var[X] and Var[Y].
   B. (5%) Find E[$3X+Y-8$] and Var[$3X+Y-8$].

5. (10%) A market research study is to be conducted among users of a particular type of customer behavior. How many users should be sampled to estimate the percentage of users who plane to buy the given product to within 3 percentage points with 95% confidence?
   [$Z_{0.015}$=2.17, $Z_{0.025}$=1.96, $Z_{0.03}$=1.88, $Z_{0.05}$=1.645]

6. (2%)True or False: The analysis of variance (ANOVA) tests hypotheses about the population variance.

7. (2%)True or False: When the F test is used for ANOVA, the rejection region is always in the right tail.

8. (2%)True or False: If you are comparing the mean sales among 3 different brands, you are dealing with a three-way ANOVA design.

9. (2%)In testing a hypothesis using the χ^2 test, the theoretical frequencies are based on the
   A. null hypothesis.
   B. alternative hypothesis.
   C. normal distribution.
   D. None of the above.

10. (2%)The least squares method minimizes which of the following?
   A. *SSR*
   B. *SSE*
   C. *SST*
   D. All of the above.

　背面有題，請繼續作答。

TABLE A1

A campus researcher wanted to investigate the factors that affect visitor travel time in a complex, multilevel building on campus. Specifically, he wanted to determine whether different building signs (building maps versus wall signage) affect the total amount of time visitors require to reach their destination and whether that time depends on whether the starting location is inside or outside the building. Three subjects were assigned to each of the combinations of signs and starting locations, and travel time in seconds from beginning to destination was recorded. An Excel output of the appropriate analysis is given below:

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Signs	14008.33		14008.33		0.11267	5.317645
Starting Location	12288			2.784395	0.13374	5.317645
Interaction	48		48		0.919506	5.317645
Within	35305.33		4413.167			
Total	61649.67	11				

11. (4%)Referring to Table A1, the *F* test statistic for testing the main effect of types of signs is
    A. 0.0109.
    B. 2.7844.
    C. 3.1742.
    D. 5.3176.

12. (4%)Referring to Table A1, the *F* test statistic for testing the interaction effect between the types of signs and the starting location is
    A. 0.0109.
    B. 2.7844.
    C. 3.1742.
    D. 5.3176.

13. (4%)Referring to Table A1, at 10% level of significance,
    A. there is sufficient evidence to conclude that the difference between the mean traveling time for the different starting locations depends on the types of signs.
    B. there is insufficient evidence to conclude that the difference between the mean traveling time for the different types of signs depends on the starting locations.
    C. there is sufficient evidence to conclude that the difference between the mean traveling time for the different starting locations does not depend on the types of signs.
    D. None of the above.

TABLE A2

Given below are results from the regression analysis where the dependent variable is the number of weeks a worker is unemployed due to a layoff (Unemploy) and the independent variables are the age of the worker (Age) and a dummy variable for management position (Manager: 1 = yes, 0 = no).

The results of the regression analysis are given below:

Regression Statistics	
Multiple R	0.6391
R Square	0.4085
Adjusted R Square	0.3765
Standard Error	18.8929
Observations	40

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	9119.0897	4559.5448	12.7740	0.0000
Residual	37	13206.8103	356.9408		
Total	39	22325.9			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-0.2143	11.5796	-0.0185	0.9853
Age	1.4448	0.3160	4.5717	0.0000
Manager	-22.5761	11.3488	-1.9893	0.0541

14. (4%)Referring to Table A2, which of the following is a correct statement?
    A. On average, a worker who is a year older is estimated to stay jobless shorter by approximately 0.2143 weeks while holding constant the effects of the manager dummy variable.
    B. On average, a worker who is a year older is estimated to stay jobless longer by approximately 0.2143 weeks while holding constant the effects of the manager dummy variable.
    C. On average, a worker who is a year older is estimated to stay jobless shorter by approximately 1.4448 weeks while holding constant the effects of the manager dummy variable.
    D. On average, a worker who is a year older is estimated to stay jobless longer by approximately 1.4448 weeks while holding constant the effects of the manager dummy variable.

15. (4%)Referring to Table A2, which of the following is a correct statement?
    A. 37.65% of the total variation in the number of weeks a worker is unemployed due to a layoff can be explained by the age of the worker and whether the worker is a manager.
    B. 37.65% of the total variation in the number of weeks a worker is unemployed due to a layoff can be explained by the age of the worker and whether the worker is a manager after adjusting for the number of predictors and sample size.
    C. 37.65% of the total variation in the number of weeks a worker is unemployed due to a layoff can be explained by the age of the worker and whether the worker is a manager after adjusting for the level of significance.
    D. 37.65% of the total variation in the number of weeks a worker is unemployed due to a layoff can be explained by the age of the worker and whether the worker is a manager holding constant the effect of all the independent variables.

16. (4%)Referring to Table A2, what is the standard error of estimate?

17. (4%)Referring to Table A2, which of the following is the correct null hypothesis to determine whether there is a significant relationship between the number of weeks a worker is unemployed due to a layoff and the entire set of explanatory variables?
    A. $H_0 : \beta_0 = \beta_1 = \beta_2 = 0$
    B. $H_0 : \beta_1 = \beta_2 = 0$
    C. $H_0 : \beta_0 = \beta_1 = \beta_2$
    D. $H_0 : \beta_1 = \beta_2$

18. (4%)Referring to Table A2, which of the following is the correct alternative hypothesis to determine whether there is a significant relationship between percentage of students passing the proficiency test and the entire set of explanatory variables?
    A. H_1 : All $\beta_j \neq 0$ for $j = 0, 1, 2$
    B. H_1 : All $\beta_j \neq 0$ for $j = 1, 2$
    C. H_1 : At least one of $\beta_j \neq 0$ for $j = 0, 1, 2$
    D. H_1 : At least one of $\beta_j \neq 0$ for $j = 1, 2$

19. (4%)True or False: Referring to Table A2, the null hypothesis $H_0 : \beta_1 = \beta_2 = 0$ implies that the number of weeks a worker is unemployed due to a layoff is not related to any of the explanatory variables.

20. (4%)True or False: Referring to Table A2, the alternative hypothesis H_1 : At least one of $\beta_j \neq 0$ for $j = 1, 2$ implies that the number of weeks a worker is unemployed due to a layoff is related to at least one of the explanatory variables.