

本試題是否可以使用計算機:  可使用,  不可使用 (請命題老師勾選)

## 1 Multiple Choice $4\% \times 12 = 48\%$

1. Which of the following statements is true?
  - A. Gamma distribution is left-skewed.
  - B. ANOVA (Analysis of Variance) is a commonly used statistical tool to examine if the variances of several populations' are equal.
  - C. Coefficient of correlation does not change with the change of the measurement unit.
  - D. If the population is symmetric, then the population mean is equal to the population mode.
2. Which of the following statements is true?
  - A. Name of the airline is a quantitative data.
  - B. Histogram is good for quantitative data.
  - C. Boxplot is good for qualitative data.
  - D. A statistical procedure which is good for ordinal scale data would be appropriate for nominal scale data as well.
3. Which of the following statements is true?
  - A. The mean is the same as the standard deviation under the Poisson distribution.
  - B. Exponential distribution is skewed to the left.
  - C. The maximum value of a density function cannot be larger than 1.
  - D. Exponential distribution is memoryless.
4. Which of the following statements is true?
  - A. Two disjoint events are independent.
  - B. t-distribution has variance less than the Standard Normal distribution.
  - C. If the linear combination of two Normally distributed random variables is again normally distributed, then they are independent.
  - D. The difference of two independent Standard Normal random variable has variance equal to 2.

(背面仍有題目,請繼續作答)

編號: 202 系所: 民航研究所乙組

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5. Which of the following statements is true?

- A Central Limit Theorem ensures that the sample mean of normal population is normally distributed.
- B Sample mean is an unbiased estimator of the population mean is because of Law of Large Number.
- C Central Limit Theorem ensures that the sampling distribution of the sample mean obtained from an random sample is approximately normally distributed with sample size that is large enough for any population.
- D It is fine in practice to approximate a Binomial distribution with an appropriate normal distribution as long as the sample size is greater than 30.

6. If  $A$  and  $B$  are independent events with  $P(A) = 0.2$  and  $P(B) = 0.6$ , then  $P(A^c \cap B^c) =$

- A 0.12
- B 0.32
- C 0.88
- D 0.68

7. Jane wants to build a regression model to describe the number of accidents per 10 thousand flying hour. The explanatory variables include the capitalization, the number of aircrafts, and the ratio of the numbers of pilots to the number of maintenance engineers of an airline, whereas the response variable is the number of accidents per 10 thousand flying hour of an airline,  $y$ . She realizes that the response may not be normally distributed. What kind of transformation do you think is the most appropriate one to transform the response for normality in the following alternatives?

- A  $\log(y)$
- B  $1/y$
- C  $y^2$
- D  $1/y^2$

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8. In order to determine whether or not a particular medication was effective in curing the common cold, one group of patients was given the medication, while another group received sugar pills. The results of the study are shown below in table 1.

	Patients Cured	Patients Not Cured
Received medication	70	10
Received sugar pills	20	50

Table 1:

What is the expected frequency of those who received medication and were cured is

- A 70
  - B 150
  - C 28
  - D 48
9. Refer to Question 8, what is the value of the test statistic?
- A 10.08
  - B 54.02
  - C 1.96
  - D 1.645
10. Refer to Question 8, what is the distribution to compare with for the p-value?
- A  $\chi_1^2$
  - B  $\chi_4^2$
  - C  $F_{1,1}$
  - D  $F_{2,2}$

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11. The following information in Table 2 was obtained from independent random samples. Assume normally distributed populations with equal variances.

	Sample 1	Sample 2
Sample Mean	$\bar{x}_1 = 45$	$\bar{x}_2 = 42$
Sample Variance	$s_1^2 = 85$	$s_2^2 = 90$
Sample Size	$n_1 = 10$	$n_2 = 12$

Table 2:

What is the stand error of  $\bar{x}_1 - \bar{x}_2$ ?

- A 3.0  
B 4.0  
C 8.372  
D 16.0
12. Refer to Question 11, what is the distribution that the test statistic compares with to determine if there is any significance between the mean levels of these two groups?
- A  $t_{22}$   
B  $F_{10,12}$   
C  $t_{20}$   
D  $F_{9,11}$

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## 2 Problems 52%

1. (10%) John would like to study the impression of the civil airline pilots in Taiwan towards the service provided by the Civil Aeronautics Administration. For the initial study of this project, he wants to estimate the proportion of the pilots who satisfy with Civil Aeronautics Administration and keeps the maximum margin of error as 3% under the confidence level of 95%. If the total number of the civil airline pilots in Taiwan is 850 and the sampling design to be used is Simple Random Sampling Without Replacement, what is the sample size he needs to have the required preciseness?
2. (10%) Refer to Question 1, John found the sample proportion of the interviewed pilots who satisfy with Civil Aeronautics Administration 75% after the data has been collected and observed. Therefore, he claimed that the 95% confidence interval of the population proportion is  $(75 \pm 3)\%$ . Do you agree with his confidence interval? Why? If you do not agree with him, please give your version of the 95% confidence interval.
3. (10%) Refer to Question 1, Mary also wants to conduct a similar research, and her target population is again the civil airline pilots. However, she finds it is difficult to collect the data with Simple Random Sampling. What kind of sampling design would you recommend her in order to look after both of the sampling convenience and accuracy of the estimation, and why?

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4. (22%) Civil Aeronautics Administration would like to evaluate three different designs, denoted as system  $A$ ,  $B$ , and  $C$ , of the work station for the air traffic controllers. The system which have the best potential for reducing controllers stress will be selected. These three system are installed at the Kaohsiung International Airport. 6 air traffic controllers are randomly selected to participate in this study, and each of them is asked to operate these three system at a random order. A follow-up interview and a medical examination of each controller participating in this study provide a measure of the stress level of each controller on each system, The data is given in Table 3

	System		
	$A$	$B$	$C$
Controller 1	15	15	18
Controller 2	14	14	14
Controller 3	10	11	15
Controller 4	12	12	17
Controller 5	16	13	16
Controller 6	13	13	13

Table 3: Stress test For the Air Traffic Controller

- (a) (3%) What kind of experimental design is this study?
- (b) (4%) Why is this design used?
- (c) (15%) Give the appropriate ANOVA table based in the data in Table 3. Give the value of the test statistic and describe how you would use this test statistic to examine if there is any significant difference among these three systems. (You do NOT need to make the decision, just describe how you could make the decision.)