國立高雄大學 109 學年度研究所碩士班招生考試試題

科目：統計學
考試時間：100 分鐘

系所：
經營管理研究所(無組別)　　是否使用計算機：是
本科原始成績：100 分

I.　(60％)MULTIPLE CHOICE QUESTION

　　所有的答案請寫在答案卷，答案寫法如下列所示:

　All answers must be written on the answer sheet

for example:

1	a	6	a	11		16	
2	b	7	b	12		17	
3	c	8	c	13		18	
4	d	9	d	14		19	
5	a	10	a	15		20	

1.　Which of the following statement on a simple OLS regression function $\hat{Y} = \hat{\alpha} + \hat{\beta}X$ is true ?

a)　Coefficient of determination R^2 is equal to the correlation coefficient of the sample value X and Y.

b)　More samples necessarily leads to a lower $Var(\hat{\beta})$.

c)　$Var(\hat{\beta})$ is always greater than $Var(\hat{\alpha})$.

d)　Under the same significant level, if $\hat{\beta}$ is significantly greater than zero, then $\hat{\alpha}$ is also significantly greater than zero.

2. Which of the following statements is true?

a)　Third degree central moment equal to zero is a sufficient condition for a distribution to be symmetric.

b)　Fourth degree central moment is used to evaluate the skewness of a distribution.

c)　Fourth degree central moment is no less than third degree central moment for a symmetric distribution.

d)　A distributions skew to the right has positive third degree central moment.

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3. Which of the following statement about uniform distribution is true ?

a) It is a symmetric distribution.

b) The cumulated probability function is independent of the random variable.

c) Uniform distribution has zero mean .

d) All the uniform distributions have equal variance.

4. Which of the following statement about Poisson distribution is **not** true ?

a) It is not a symmetric distribution.

b) Its mean and variance are equal.

c) Value of the random variable needs to be nonnegative.

d) Sum of two independent Poisson distributions is not a Poisson distribution.

5. Which of the following statement about a χ^2 distribution is true?

a) The shape of its probability density curve depends on the degree of freedom.

b) It is a symmetric distribution.

c) The value of the random variable can be negative.

d) It is a ratio of two t distributions.

6. N samples is randomly selected from a normal distribution population with $X \sim N(\mu, \sigma^2)$.

$$p \lim \frac{1}{N} \sum_{i=1}^{N} X_i =$$

a) σ^2

b) μ^2

c) $\sigma^2 + \mu^2$

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d) $\dfrac{\sigma^2 + \mu^2}{2}$

7. Along with 6, if we have two estimators $\bar{X} = \dfrac{1}{N}\sum_{i=1}^{N} X_i$ and $\tilde{X} = \dfrac{1}{N+1}\sum_{i=1}^{N} X_i$ to estimate μ, which of the following statement is true?

a) Both are unbias.

b) Only $\bar{X}$ is asymptotically unbias.

c) $\tilde{X}$ is more efficient than $\bar{X}$.

d) Only $\bar{X}$ is a consistent estimator.

8. If random variable X is uniformly distributed between 2 and 4 , then $Var(X) =$

a) $\dfrac{1}{2}$.

b) $\dfrac{1}{3}$.

c) $\dfrac{1}{4}$.

d) $\dfrac{1}{12}$.

9. In a simple OLS regression function, which of the following distribution can be used to test whether X has a significant impact on Y ?

a) binomial distribution

b) t distribution

c) chi-square distribution

d) hypergeometric distribution

10. The distribution of a standardized random variable will approach a standard normal

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distribution when the sample size is large enough is called _____.

a) The central limit theorem

b) Law of big data

c) Law of normal distribution.

d) Law of large number

11. To test that per capita GDP of Taiwan in 2019 is no less than twenty thousand US dollars, if the significant level is 5%, which of the following statement is true?

a) Two tailors test is needed.

b) Right tailor is needed.

c) If the P-value is 0.03, then we cannot rejected null hypothesis.

d) For a given sample, the P-value is negatively related to the per capita GDP level that we want to test.

12. If random variables X and Y are independent, and $V(X) = 20$, $V(Y) = 16$，then $V(2X + 0.5Y) =$

a) 48.

b) 64.

c) 84.

d) 96.

13. The sum of three binomial random variables is a

a) Poisson distribution.

b) Laplace distribution.

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c) hypergeometric distribution.

d) normal distribution.

14. Which of the following statements about the property of an estimator is **not** true ?

a) Unbias cannot assure consistent.

b) Consistent not necessarily assures unbias.

c) There are only one estimator with the properties of both unbias and consistency.

d) An unbias estimator is not necessarily more efficient than a bias estimator.

15. When we use n random samples (X_i, Y_i) to obtain the OLS regression function $\hat{Y}_i = \hat{\alpha} + \hat{\beta} X_i$, the coefficient of determination R^2 is not equal to

a) r_{XY}^2

b) $r_{\hat{Y}Y}^2$

c) $\dfrac{\hat{\beta} \sum (X_i - \bar{X})^2}{\sum (Y_i - \bar{Y})^2}$

d) $\dfrac{\sum (Y_i - \hat{Y}_i)^2}{\sum (Y_i - \bar{Y})^2}$

16. In general, we use _____ to test whether the variance of two populations are equal.

a) z-test

b) t-test

c) χ^2 test

d) F test

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17. According to Chebyshev inequality, the probability that the distance between a random variable and the expected value of the random variable is no greater than three times of standard deviation is no less than

a) $\dfrac{1}{4}$

b) $\dfrac{3}{4}$

c) $\dfrac{8}{9}$

d) $\dfrac{15}{16}$

18. The probability density function of random variable X is $f(x) = \dfrac{e^{-3}3^x}{x!}, x = 0, 1, 2 \ldots\ldots$.

$Var(X) = $?

a) 1

b) 3

c) 6

d) 9

19. A normal distribution is $X \sim N(\mu, \theta)$ with known mean μ and unknown variance θ. If we have n samples $x_1, x_2, \ldots x_n$, the maximum likelihood estimator of θ is

a) $\dfrac{1}{n}\sum_{i=1}^{n}(x_i - \mu)^2$.

b) $\dfrac{1}{n-1}\sum_{i=1}^{n}(x_i - \mu)^2$.

c) $\dfrac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2$.

d) $\dfrac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2$.

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20. There are two projects as follows:

Project A : If success, the profit is 400,000; if not success : the loss is 40,000.

Project B : If success, the profit is 500,000; if not success : the loss is 115,000.

If they have the same success probability and expected profit, the success probability is

a) $\dfrac{1}{4}$.

b) $\dfrac{2}{7}$.

c) $\dfrac{3}{7}$.

d) $\dfrac{4}{7}$.

II (20%) $Y = \alpha + \beta X + \varepsilon$ is the impact of X on Y in the population. If we have 40 random

samples of (x_i, y_i), and have $r_{XY} = 0.9$ ， $\bar{X} = 600$ ， $\bar{Y} = 6$ ， $S_X = 60$ ， $S_Y = 0.8$

(i) Find the OLS equation $\hat{Y} = \hat{\alpha} + \hat{\beta} X$ and R^2.

(ii) If we transform the 40 random samples to regress $2 + 0.8 y_i$ on $100 + 1.2 x_i$, find the OLS

equation $\tilde{Y} = \tilde{\alpha} + \tilde{\beta} X$ and R^2.

III (20%) Let $Y_1, Y_2, Y_3 \ldots, Y_n$ be n uncorrelated random variables with the same mean μ and

variance σ^2 and denote $\bar{Y}$ as the sample average.

(i) Find $E(\bar{Y})$ and $Var(\bar{Y})$.

(ii) If we define the class of linear estimators of μ as $G = a_1 Y_1 + a_2 Y_2 + \ldots + a_n Y_n$,

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where every a_i is constant, if G is an unbiased estimator of μ, what restriction on the a_i needed?

(iii) Find $Var(G)$

(iv) Along with (i)-(iii), show that $Var(G) \geq Var(\bar{Y})$.