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 statements about standard normal distribution is **not** true ?

a) It has a zero mean.

b) The variance is 1.

c) It is a symmetric distribution.

d) No matter how large is the sample size, it can always be used to do hypothesis testing.

2. Which of the following distributions is a symmetric distribution?

a) Chi-squared distribution

b) t distribution

c) binary distribution

d) Poisson distribution

3. The skewness of the distribution of a standard random variable can evaluated by

　　_____ of the random variable.

a)　first moment

b)　second moment

c)　third moment

d)　forth moment

4. If average time interval between two buses is 10 minutes, the probability of waiting time X

　　less than t minutes is $P(X \leq t) = 1 - e^{-\frac{t}{10}}$, the variance of X is

a)　1

b)　10

c)　90

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d) 100

5. There is a game as follows: The player tosses a fair coin until "head" happens, and wins 2^n if he tosses n times. If John with a utility function as $\ln M$ want to play the game where M is the money he wins, his expected utility is

a) $2^n \ln 2$
b) $2 \ln 2$
c) n
d) ∞

6. A random variable $Y = X - \dfrac{X - \mu}{\sigma}$, where X is also a random variable with mean μ and variance σ^2, has $Var(Y) =$

a) σ^2
b) $\sigma^2 - 1$
c) $(\sigma - 1)^2$
d) $\sigma^2 + 1$

7. Following 6., the correlation coefficient between X and Y (i.e. $Corr(X, Y)$) is

a) 0
b) 0.2
c) 0.5
d) 1

8. Which of the following statements about simple linear regression equation is true ?

a) If the coefficient of determination is zero, there is no relation between dependent variable and independent variable.
b) To test the significance of the slope, the sampling distribution of the slope estimator must be a normal distribution is not necessarily required.
c) When the distribution of the disturbance term is not normal distribution, the OLS estimators will no longer be unbias.
d) If the value of estimated intercept is very small and near zero, then the intercept will not be significantly different from zero.

9. Which of the following statements about simple linear regression is true ?

a) If all the Gauss-Markov assumptions hold, the OLS、BLUE and MLE estimators are all the same.

b) If the dependent variable is housing price and the independent variable is family income, a small variance of family income is more good.

c) If the slope is not significant, there is no relation between dependent and independent variables.

d) t-test is the only test that can be used to test the significance of the slope.

10. If the population is $Y = \beta X + \varepsilon$ and $\varepsilon \sim N(0, \sigma^2)$, there are three estimators for estimating

β: $\tilde{\beta}_1 = \dfrac{\overline{Y}}{\overline{X}}$, $\tilde{\beta}_2 = \dfrac{\sum X_i Y_i}{\sum X_i^2}$ and $\tilde{\beta}_3 = \dfrac{\sum (X_i - \overline{X})(Y_i - \overline{Y})}{\sum (X_i - \overline{X})^2}$, which of them is/are unbias?

a) only $\tilde{\beta}_1$

b) only $\tilde{\beta}_1$ and $\tilde{\beta}_2$

c) only $\tilde{\beta}_2$ and $\tilde{\beta}_3$

d) all.

11. Following 10., which one of the three estimators has a smallest variance ?

a) $\tilde{\beta}_1$

b) $\tilde{\beta}_2$

c) $\tilde{\beta}_3$

d) all of the three.

12. The simple regression equation is $\hat{Y} = \hat{\alpha} + \hat{\beta}X$, we have 30 samples summarized as follows:

$\sum X_i = 120$、$\sum Y_i = 21$、$\sum Y_i^2 = 110$、$\sum X_i Y_i = 320$ and $\sum X_i^2 = 1800$. The R^2 of the regression equation is

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a) 0.34
b) 0.44
c) 0.54
d) 0.74

13. When the units of both the dependent and independent variables is changed, which of the original regression equation will not be affected in the new regression equation ?
a) slope
b) intercept
c) residual sum of square
d) correlation coefficient of explain and explained variable.

14. Which of the following statements is true?
a) An unbiased estimator must be a consistent estimator.
b) An unbiased estimator is always more efficient than a bias estimator.
c) A consistent estimator is always more efficient than an unbias estimator.
d) An unbias estimator is not necessarily consistent, a consistent estimator is not necessarily unbias.
.
15. The probability density function of a discrete random variable x is :

$$f(x=1)=1-\frac{1}{2n}, f(x=n)=\frac{1}{2n}.$$

$p \lim x =$
a) 0

b) $1-\dfrac{1}{2n}$

c) $\dfrac{1}{2n}$

d) 1

16. Which of the following statements about hypothesis testing is true?
a) The higher the confidence level, the more easy to reject null hypothesis.
b) When p-value rejects null hypothesis in a two-tailor test, it will also reject null hypothesis in an one-tailor test.
c) The more high the significant level in a two-tailor test, the more easy to reject null hypothesis.

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d) p-value is unrelated to the parameters of the population.

17. Which of the following statements is not true?

a) More samples must lead to a higher variance.

b) The central limit theorem tells that, the sample distribution will approach normal distribution when the sample size is large enough.

c) More samples does not necessarily change the result of hypothesis testing.

d) The variance of sampling distribution of a consistent estimators will approach zero when the sample size is large enough.

18. Which of the following statements on binary distribution is true?

a) It is a symmetric distribution.

b) When the population is a binary distribution, we can not do hypothesis testing.

c) When the distribution of a random variable is a binary distribution, all the value of random variable must be positive.

d) When n samples is collected from a binary distribution population, if n is high enough, the sampling distribution approaches normal distribution.

19. Consider the following regression model: $Y = \alpha + \beta X + \varepsilon$, which of the following is a property of Ordinary Least Square (OLS) estimates of this model and their associated statistics?

a) The point of sampling mean $(\overline{X}, \overline{Y})$ always lies on the OLS regression line.

b) The sample covariance between the regressors and the OLS residuals is positive.

c) The sum of the OLS residuals is negative.

d) The sample average of the OLS residuals is positive.

20. The joint probability density function of X and Y is as follows:

$$f_{XY}(a,b) = \begin{cases} h(a+b) \\ 0 \end{cases}, \quad \text{if} \quad \begin{cases} 0 \le a \le 4, 0 \le b \le 4 \\ otherwise \end{cases}.$$

$F_{XY}(2,2) =$

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

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

c) $\dfrac{1}{8}$

d) $\dfrac{1}{16}$

II. (16%)We want to know the relation between Y (dependent variable) and X (dependent variable) and have 30 samples summarized as follows:

$$\sum X_i = 120 \; 、 \; \sum Y_i = 21 \; 、 \; \sum Y_i^2 = 110 \; 、 \; \sum X_i Y_i = 320 \ \text{ and } \ \sum X_i^2 = 1800.$$

Please answer the following questions.

(a) $Var(2X - Y)$ (4%)

(b) If the population equation is $Y = \alpha + \beta X + \varepsilon$, the regression function is $Y_i = \hat{\alpha} + \hat{\beta} X_i$, what are

the OLS estimators $\hat{\alpha}$ and $\hat{\beta}$? (4%)?　Is $\hat{\beta}$ significantly different from zero under a 5%

significant level? (4%)

(c) If we develop another regression function as $y_i = \hat{\alpha}' + \hat{\beta}' x_i$, where $y_i = Y_i - \bar{Y}$, $x_i = X_i - \bar{X}$,

what are the OLS estimators $\hat{\alpha}'$ 與 $\hat{\beta}'$? (4%)

Hint: $t_{27}^c = 2.052$ 、 $t_{28}^c = 2.048$ 、 $t_{29}^c = 2.045$ 、 $t_{30}^c = 2.042$, where $P(-t^c \le t \le t^c) = 0.95$ ；

$F_{1,27}^c = 4.21$ 、 $F_{1,28}^c = 4.20$ 、 $F_{1,29}^c = 4.18$ 、 $F_{1,30}^c = 4.17$ 、 $F_{2,27}^c = 3.35$ 、 $F_{2,28}^c = 3.34$ 、 $F_{2,29}^c = 3.33$ 、

$F_{2,30}^c = 3.32$, where $P(F \le F^c) = 0.95$.

III. (8%) The probability density function of a continuous random variable x is:

$$f(x) = \begin{cases} \dfrac{3x^2}{8} \\ 0 \end{cases} , \quad \text{if} \quad \begin{cases} 0 \le x \le 2 \\ otherwise \end{cases}.$$

If a new random variable is $y = 4x^2 - 2$, what is

(a) the probability density function $f(y)$? (4%)

(b) the cumulative probability $F(0 \le y \le 2)$? (4%)

IV. (16%) The following table is the probability distribution of X 、 Y 、 Z, where $f(X,Y,Z)$ is the probability.

X	Y	Z	$f(X,Y,Z)$
2	3	4	0.1
2	3	6	0.3
2	6	4	0
2	6	6	0.1
4	3	4	0.2
4	3	6	0.1
4	6	4	0
4	6	6	0.2

Please answer the following questions.

(a) What are the respective probability distributions of X and Y ?(4%)

(b) Are X and Y independent? (4%)

(c) Covariance of X and Y (i.e. $Cov(X,Y)$) is ? Correlation coefficient of X and Y (i.e. $Corr(X,Y)$) is ? (4%)

(d) If $W = X + Y + Z$, $\mathrm{E}(W) = ?$ $\mathrm{V}ar(W) = ?$ (4%)