※ 考生請注意：本試題 ☑可　□不可 使用計算機

1. 填答要求：

(a)「壹」是非題：於答案卷上，請以「直」式方式標示「壹」與題號後，再於其後方填寫答案○或x

(b)「貳」應用選擇題：於答案卷上，請以「直」式方式標示「貳」與題號後，再於其後方填寫答案

(c)「參」計算題請列出計算過程

2. 請注意！未寫題號或將計算與答案混一起者，一律不給分。

壹、是非題（○或x）（每題 2 分）

1. When σ is unknown, $\overline{X}$ follows a t-distribution.

2. In linear regression analysis, $\hat{\sigma}$ should be interpreted as "A measure of the scatter of the y values around their mean".

3. P(A)+P(B) may be larger than 1 when A and B are independent.

4. Multiple regression is always better than simple regression, providing a sufficient number of data points available.

5. Increasing the sample size is the only way to increase the precision of the interval while maintain the same confidence level.

6. A VP of Human Resources of American First Banks(AFB) is reviewing the employee training programs of AFB banks. His staff compiled the following table of regional statistics on teller training hours. So according to the following table, we can conclude that the Southwest distribution is skewed to the left.

	Southeast Region	Southwest Region
Mean	19	29
Median	19	21
Mode	19	23
Standard deviation	8	8

7. For any random variables U and V, $[E(UV)]^2 \leq E(U^2)E(V^2)$

8. Let X and Y have the following joint density. $\Pr(X = x, Y = y) = c, 0 \leq y \leq x \leq 1$. The value of c is equal to 2.

9. A small investor is considering a $200 investment in growth stocks for two years. Let X denote the gain in buying and holding for two year one $100 share of stock 1, and let Y be defined similarly for one $100 share of stock 2. Assume E(X)=50, E(Y)=50, Var(X)=64, and Var(Y)=81. Consider the following options: (a) buy two shares of stock 1, (b) buy two shares of stock 2, (c) buy one share each of stock 1 and 2. We can conclude that all three options have the same expected gain.

10. Refer to Question 9, If Cov(X,Y)=60, we can conclude that the option (a) is less risky than options (c) and (b).

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11. Let Z_1, Z_2, Z_3 be independent random variables each with mean 0 and variance 1. The correlation coefficient between $X = 2Z_1 - Z_2$ and $Y = 2Z_2 + Z_3$ is 1/3.

12. If the errors in the Classic Linear Regression (CLR) model are not normally distributed, although the OLS estimator is no longer BLUE, it is still unbiased.

13. Consider the case $(X_i, Y_i) = (10, 25)$ in a simple linear regression study with estimated regression function $\hat{Y} = 60.0 - 3.0X$. The residual for this case is 5.

14. A shoe salesperson has ten different boots to display in her showcase window. She can display only four at one time. So there are 210 sets of four boots can be selected.

15. Randomly choose 3 balls from a bag containing 5 red balls, 3 white balls and 9 blue balls. The probability that at least one of the three is white is 0.464?

16. Suppose there are three events A, B, and C with probabilities: P(A)=0.5, P(B)=0.4, P(C)=0.3, A and C are mutually exclusive; A and B are independent; and P(B and C)=0.05. Let A', B', and C' be the complement event of A, B, and C, respectively. We can calculate that $P(B' \mid A)$ is greater than 0.65.

17. The Chi-square test can be used to test whether sample data indicate that a particular model for a population distribution does or does not fit the data.

18. An unbiased estimator is one that closely approximates the parameter.

19. Suppose a researcher wants to conduct a study to estimate the population mean. He plans to use a 95% level of confidence to estimate the mean, and the population standard deviation is approximately 34. The researcher wants the error to be no more than 4. The sample size should be at least 290.

20. If the ANOVA F test is significant in a single-factor completely randomized design, multiple comparison test is appropriate for finding out which treatment group means are significantly different from others.

貳、應用選擇題(a~e)(每題 5 分)

1. A confidence interval for a normal population mean, 5 ± 0.6533 was constructed with a sample of size 36 and a 0.95 confidence coefficient. If the population variance was known, what is it?
   (a) 4.2　　　(b) 4.1　　　(c) 4　　　(d) 2　　　(e) 2.1

2. Suppose P(A_1)=0.25, P(A_2)=0.75, P($B_1 \mid A_1$)=0.10 and P($B_1 \mid A_2$)=0.30, then P($A_1 \mid B_1$)=?
   (a) 0.100　　　(b) 0.250　　　(c) 0.173　　　(d) 0.211　　　(e) 0.025

3. The following data are obtained for estimation of the linear relationship. Your estimate of α is?

   $y = \alpha + \beta(X - \overline{X})$, $\Sigma X = 10$　$\Sigma X^2 = 30$　$\Sigma XY = 68$

   $\Sigma Y = 40$　$\Sigma Y^2 = 336$　N=36

   (a) 0.4250　　　(b) 0.5306　　　(c) 0.5100　　　(d) 0.6212　　　(e) 0.375

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4. Refer to Question 3 , Your estimate of β is?

   (a) 2.1230　　(b) 2.0898　　(c) 1.965　　(d) 2.0012　(e) 2.0792

5. The life of a light bulb in 1000hr. units gas a gamma distribution whose mean is two and whose variance is four. The value of λ and α are?

   (a) 1 & 1　　(b) 1 & 0.5　(c) 2 & 1　　(d) 0.5 & 2　(e) 0.5& 1

6. Refer to Question 5, what is the probability that such a light bulb will have a life time between 900 and 1100 hours?

   (a) $e^{-0.45} - e^{-0.55}$ (b) $e^{0.45} - e^{0.55}$ (c) $e^{-0.55} - e^{-0.45}$ (d) $e^{-0.45} + e^{-0.55}$ (e) $e^{0.45} - e^{-0.55}$

7. Given $\sum x_i = 180$ and $\sum x_i^2 = 2000$ for a random sample of size 20 from $f(x ; \sigma) = \dfrac{1}{\sqrt{2\pi}\sigma} e^{\frac{-1}{2}(\frac{x-10}{\sigma})^2}$, the 90% confidence interval of σ^2 is?

   (a) (11.73, 37.87)　(b) (12.73 , 36.87)　(c) (12.23 , 37.87)　(d) (11.73 , 36.87)　(e) (12.73, 35.87)

8. Given that X~N(10,3) and Y~N(7,4), X and Y are independent .What is the distribution of 3X-Y?

   (a) N(22, 30)　(b) N(23 , 30)　(c) N(23 , 31)　(d) N(22 , 31)　(e) N(23, 29)

9. Given that a joint p.d.f. f(x,y)=2, $0 \leq x \leq y \leq 1$.What is the value of E(X) and E(Y)?

   (a) 1/4 & 2/3　(b) 1/2 & 1/3　(c) 1/3& 1/3　(d) 2/3 & 1/2　(e) 1/3 & 2/3

10. Refer to Question 9, What is the value of Cov(X,Y) and ρ_{xy} ?

   (a) 1/36 & 1/2　(b) 1/32 & 1/2　(c) 1/25 & 1/3 (d) 1/27 & 1/3　(e) 3/38 & 1/3

參、計算題(10 分)

A. Given $\overline{X} = 20$ for a random sample of size 25 from the density $f(x|\mu) = \dfrac{e^{-\left[\frac{(x-\mu)^2}{32}\right]}}{4\sqrt{2\pi}}$

(1)Find a 90% confidence interval for μ

(2)If the resulting confidence interval in (1) were to be half as long, how large a sample wanted be needed?