國立成功大學
111學年度碩士班招生考試試題

編　號：244

系　所：企業管理學系

科　目：統計學

日　期：0220

節　次：第 3 節

備　註：不可使用計算機

編號： 244

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※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Part A. **Multiple Choice. Please choose <u>the best answer</u> for each question.**
Totally 80 points/ 5 points for each question

Q1. Some descriptive statistics describe "location" information, while others provide "variation" information. How many following indexes: "mean, median, maximum value, interquartile rang (IQR), standard deviation, range, and 3rd quartile", are providing "variation" messages?

(A) 1　(B) 2　(C) 3　(D) 4　(E) 5

Q2. At present, the average salary of employees is NTD 40,000 in a company, with standard deviation NTD 8,000. The chairman decides to adjust employees' salary in the following way: 1.1 times each person's current salary and adds NTD1,000. What are the average salary and standard deviation after the adjustment?

(A) average = NTD4,4000, SD = NTD8,800
(B) average = NTD4,5000, SD = NTD8,900
(C) average = NTD4,6000, SD = NTD8,800
(D) average = NTD4,5000, SD = NTD8,800
(E) average = NTD4,4000, SD = NTD8,900

Q3. A manager gathers data from employees of his corporation. The data have two variables, X=the average hours the employee exercised each week, and Y= the annual amount dollar of health insurance claims applied by the employee for the year, respectively. The summary results are as following table. What is the slope? What is the slope of the line of best fit? If an employee does the exercise an average of 12 hours a week. What is the value of health insurance claims applied by this employee for a year? (with correlation coefficient = - 0.7)

	X (hours)	Y (NTD)
Mean	10	4000
Standard Deviation	2	600

(A) slope= - 210, insurance claims = NTD 3580;
(B) slope= 210, insurance claims = NTD 3580;
(C) slope= - 230, insurance claims = NTD 1380;
(D) slope= 230, insurance claims = NTD 1380;
(E) slope= - 210, insurance claims = NTD 3280

Q4. An investor has found the following stock investment percentages are available: 40% are low risk, 35% are medium risk, and 25% are high risk. He finally chooses to buy 2 stocks at random and independently of one another. (1) What is the probability that both stocks he chosen are low risk or both are medium risk? (2) What is the probability that at least one of the stocks is high risk?

(A) (1) = 0.2630; (2) = 0.4375;
(B) (1) = 0.2825; (2) = 0.5625;
(C) (1) = 0.2630; (2) = 0.5625;
(D) (1) = 0.7175; (2) = 0.5625;
(E) (1) = 0.2825; (2) = 0.4375

Q5. A cumulative density function of random variable x is as follows. What is the expect value of $Y=10X^2-2X$?

$$F_x(x)=\begin{cases}0 & ,x\le 0\\ \sqrt{x} & ,0<x\le 1\\ 1 & ,x>1\end{cases}$$

(A) $-\frac{2}{3}$　(B) $\frac{2}{3}$　(C) $\frac{4}{3}$　(D) $-\frac{4}{3}$　(E) $\frac{1}{3}$

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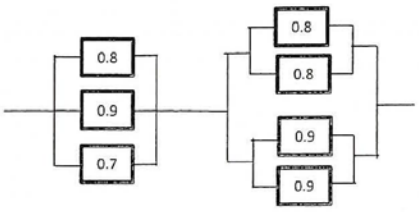
Q6. Consider the following component system. The numbers shown in the boxes are the assigned working probabilities of each component. Assume that malfunctions occur to each component are independently. What is the probability that this system is working?

(A) 0.9842
(B) 0.9936
(C) 0.9658
(D) 0.9786
(E) 0.9447



Q7. A continuous random variable X has the probability density function shown as

$$f(x)=\begin{cases}k(2-x)x, & \text{if } 0<x<1\\ 0, & \text{otherwise}\end{cases}.$$

What is the value of k? Find f (x | x > 0.5).

(A) $k=\frac{2}{3}$, $f(x\mid x>0.5)=\frac{\frac{2}{3}(2-x)x}{0.6875}$

(B) $k=\frac{3}{2}$, $f(x\mid x>0.5)=\frac{\frac{3}{2}(2-x)x}{0.6875}$

(C) $k=\frac{2}{3}$, $f(x\mid x>0.5)=\frac{\frac{2}{3}(2-x)x}{0.3125}$

(D) $k=\frac{3}{2}$, $f(x\mid x>0.5)=\frac{\frac{3}{2}(2-x)x}{0.3125}$

(E) None of the above is correct.

Q8. There are two random variables presented as follows: $y_1 = 0.4x_1 + 0.2x_2$, $y_2 = 0.5x_1 + 0.7x_2$, with covariance matrix $\sum_x=\begin{bmatrix}1 & 0.2\\ 0.2 & 1\end{bmatrix}$. Which of the following description is correct?

(A) Var (y_1) = 0.200
(B) Var(y_2) = 0.740
(C) Cov(Y_1, Y_2) = 0.416
(D) Cov(Y_1, Y_2) = 0.340
(E) $\rho_{y_1y_2}$(correlation coefficient) = 0.272

Q9. An assembly line is examined as a final test. Suppose the flaws occur randomly in the processes, and the flaws occur according to a Poisson distribution with parameter λ =0.03. Which of the following description is correct? ($e^{0.03}$ = 1.0305; $e^{-0.03}$ = 0.9704)

(A) The probability that an assembly will have exactly one defect is 0.1291
(B) The probability that an assembly will have exactly one defect is 0.0309
(C) The probability that an assembly will have one or more defect is 0.9704
(D) The probability that an assembly will have one or more defect is 0.0296
(E) None of the above description is correct.

Q10. The interval of calling time for customer service can be represented as an Exponential distribution with mean equal to 8 minutes. What is the probability for the next customer call in more than 6 minutes?

(A) $e^{-\frac{3}{4}}$
(B) $e^{-\frac{4}{3}}$
(C) $e^{\frac{3}{4}}$
(D) $e^{\frac{4}{3}}$
(E) none of the above is correct

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Q11. Assume X_i (i=1,2,3,4) are iid (independently identically distributed) with $N(\mu, \sigma^2)$. Which of the following description is ***incorrect***?

(A) $\frac{(X_1-X_2)^2}{(X_3-X_4)^2} \to F(1,1)$

(B) $(\frac{X_3-X_4}{\sqrt{2}\sigma})^2 \to \chi^2(1)$

(C) $X_1+X_2-2X_3 \to N(0,4\sigma^2)$

(D) $\frac{X_1+X_2-2\mu}{\sqrt{2}\sigma} \to N(0,1)$

(E) $\frac{X_1^2+X_2^2}{X_3^2+X_4^2} \to F(2,2)$

Q12. Which of following description about Type I Error (α) and Type II Error (β) is ***incorrect***?

(A) Type I Error is the probability of rejecting the null hypothesis when it is actually true – generally referred to as a false positive.

(B) The Type II Error is the probability of not rejecting the null hypothesis when it is actually false.

(C) Type I and Type II Errors are simultaneously increasing or decreasing.

(D) More stringent significance levels require larger samples to achieve the desired power Level.

(E) Any increase in power is most likely achieved by increased sample size.

Q13.~Q16.

An insurance company has analyzed the amount of time required to process health insurance claims and determined that the times follow a normal distribution with mean time μ=45 hours. The manager has developed a new procedure for processing the insurance claims that requires use of new computer software. He believes that the new procedure will decrease the population mean amount of time required to process insurance claims. A random sample of 25 loan applications are selected after training a group of insurance claim staffs. Besides, the average amount of time required to process the insurance claims will be calculated. If the switch is made to the new procedure, the cost of the additional software will be more than offset by the savings in manpower required to process the insurance claims.

Q13. Based on the description, the most suitable alternative hypothesis should be:

(A) $H_1: \mu = 0$　(B) $H_1: \mu = 45$　(C) $H_1: \mu \neq 45$　(D) $H_1: \mu > 45$　(E) $H_1: \mu < 45$

Q14. If the sample mean is 43.118 hours with the sample standard deviation s=5.5 hours. The test statistic is:

(A) - 1.711　(B) - 0.342　(C) - 1/1.711　(D) - 1/0.342　(E) none of the above is correct

Q15. The 99% confidence interval of population μ should be: [$t_{0.025,24}$ =2.0639 ; $t_{0.01,24}$ = 2.492 ; $t_{0.005,24}$ =2.797]

(A) [40.0413, 46.1947]　(B) [41.2359, ∞]　(C) [-∞, 41.2359]

(D) [45.8592, ∞]　(E) [-∞, 45.8592]

Q16. Therefore, your data support which statement more?

(A) $\mu = 0$　(B) $\mu \neq 0$　(C) $\mu \neq 45$　(D) $\mu \geqq 45$　(E) $\mu \leqq 45$

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Part B. Please write down the answers from (1) to (10) in order.
Totally 20points/ 2 points for each blank

An education organization wants to know the impact of different teaching methods (M) and computer software (S) used in the lecture on student performance (grades). There are three teaching methods (M1, M2 , & M3) and two computer software (S1 & S2). For each combination of teaching method and computer software has three students attending the experiment. The organization also want to know whether there is interaction between the teaching method and the computer software. The data set is shown in following table. Please finish the ANOVA Table and answer the questions.

Data set (student grades under different M & S combinations)

	M1	M2	M3	$y_{j.}$
S1	88, 90, 92 (sum=270)	86, 87, 90 (263)	84, 85, 86 (255)	788
S2	80, 84, 88 (252)	78, 82, 83 (243)	76, 78, 81 (235)	730
$y_{i..}$	522	506	490	y...=1518

The numbers you may need: $\sum\sum\sum y^2 = 128368$; $\frac{(y_{...})^2}{18} = 128018$; $788^2+730^2=1153844$;

$522^2+506^2+490^2= 768620$; $270^2+263^2+255^2+252^2+243^2+235^2=384872$

ANOVA Table

Source	SS	df	MS	F	P-value
Methods (M)	(1)	2	(5)	6.621	0.012
Software (S)	186.888	1	186.888	(7)	0.000
Interaction	0.444	2	0.222	0.034	0.966
Error (Within/ Repeat)	77.333	(3)	(6)		
Total	(2)	(4)			

What are the null hypothesis and alternative hypothesis if we want to test the significance of teaching methods? Let μ_i represents the mean value of student performance of teaching method i

H_0 : _____(8)_____; H_1: _____(9)_____

According to the ANOVA Table, what is your conclusion of testing the significance of teaching methods at α=0.05?

_____(10)_____