國立成功大學 108 學年度碩士班招生考試試題

系　　所：企業管理學系

考試科目：統計學

考試日期：0224，節次：3

※ 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. [80 Points, 5 points each]

Choose the most appropriate answer.

1. There is a data set including 20 observations and resulting in average = 18. If one observation is corrected from 31 to 21. The correct average of these 20 observations should be:

   (a) 16　　(b)16.5　　(c) 17　　(d) 17.5　　(e)18.5

2. Which of following statement is correct about figure 1 or figure 2?

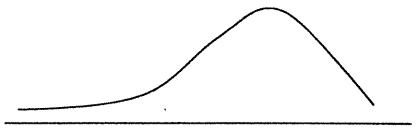


figure 1

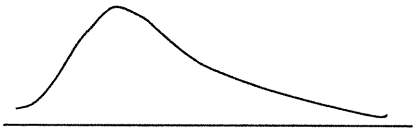


figure 2

   (a) figure 1: positive skewness or right skewness, mode > median > average

   (b) figure 1: negative skewness or left skewness, average > median > mode

   (c) figure 2: positive skewness or right skewness, average > median > mode

   (d) figure 2: positive skewness or right skewness, median > mode > average

   (e) figure 2: negative skewness or left skewness, mode > median > average

3. At ABC University, 20% of the students have scholarships. Among these scholarship students, half of the them are male and half are female. Of the students that have no scholarship, 45% are female and 55% are male. From the information given, the percentage of all females at ABC University that have scholarships should be:

   (a) 30.8%　　(b) 15.6%　　(c) 44.0%　　(d)　36.0%　　(e) No of the above

4. X is a random variable as the time (in minutes) consumed to produce a watch. The probability density function of X is given by:

$$X = f(x) = \begin{cases} 2x - 6, & 3 < x \leq 4 \\ 0, & otherwise \end{cases}$$

   Each watch will bring the profit in dollars as function h(X), which is

$$h(X) = 12 - 2X$$

   What is the probability that each watch will bring greater than 5 dollars in profit?

   (a)0.25　　(b) 0.55　　(c) 0.65　　(d) 0.75　　(e) 0.95

5. Given the expect value of (2x+6) is 12 (i.e. E(2x+6)=12), and $E[(2x+6)^2] = 468$. The standard deviation of x should be:

(a) 18 (b)15 (c) 12 (d) 9 (e) 6

6. The joint probability function of X and Y is shown as following table:

$f_{X,Y}(x,y)$		y		
		0	1	2
x	0	1/6	2/6	0
	1	0	2/6	1/6

And, let Z=X+Y. Which of the following statement is ***incorrect***?

(a) Pr(Z=1)=1/3 (b) Pr (Z=2)= 1/6 (c) Pr (Z=3)= 1/6 (d) Pr (Z=4)=0 (e) X and Y are not independent

7. Matrix A is the covariance matrix of X, Y, and Z, which is $A=\begin{bmatrix}144 & 96 & 126\\ 96 & 256 & 56\\ 126 & 56 & 196\end{bmatrix}$. Therefore, the correlation coefficient matrix can be shown as $B=\begin{bmatrix}1 & d & e\\ d & 1 & f\\ e & f & 1\end{bmatrix}$. The value of d, e, and f should be:

(a) d=0.5, e=0.75, f=0.25 (b) d= 0.25, e=0.5, f=0.75 (c) d= 0.75, e=0.5, f=0.25

(d) d= 0.5, e=0.25, f=0.75 (e) d= 0.25, e=0.75, f=0.5

8. In the past, compact audio cassette (卡式錄音帶) was a common tool for recording. The recording quality could be affected by the flaws occurred on the types. In a specific condition, flaws on a cassette type occurred on the average of one flaw per 200 feet. If one flaw assumes a Poisson distribution, what is the distribution of X, the number of flaws in a 1000-foor type roll?

(a) $f(x) = \frac{0.2^x e^{-5}}{x!}$ (b) $f(x) = \frac{0.2^x e^{0.2}}{x!}$ (c) $f(x) = \frac{5^x e^5}{x!}$

(d) $f(x) = \frac{5^x e^{-0.2}}{x!}$ (e) $f(x) = \frac{5^x e^{-5}}{x!}$

9. Continuous on question 8, what is the roughly probability of flaw-free (no flaw) in a 1000-foot roll (P1)? And, what is the roughly probability of three or more flaws occurred in a 1000-foot roll (P2)?

(a) P1=0.020; P2=0.565 (b) P1=0.007; P2=0.871 (c) P1=0.030; P2=0.885

(d) P1=0.819; P2=0.001 (e) P1=0.007; P2=0.001

[$e^{0.2} = 1.221$; $e^{-0.2} = 0.819$; $e^5 = 148.413$; $e^{-5} = 0.007$]

10. The safe weight load of an elevator in department of Business Administration at school is 600 kg. The average weight of people in this department is roughly normally distributed with mean = 65 kg and standard deviation=10kg. If there are 9 people in this elevator, what the probability this elevator will exceed the safe weight load? Please see the Z-table in the appendix.

(a) 0.6915 (b) 0.3085 (c) 0.8944 (c) 0.9535 (d) 0.6064 (e) None of the above

11. Continuous on question 10, if the elevator is designed for accommodating 9 people, and the chance of alarm for 9 people is set only 2.5%. What should the safe weight load of this elevator be roughly changed to ?

(a) 610kg (b) 625kg (c) 645kg (d) 660kg (e) 680kg

12. $F_{\alpha}(1,\nu)$ is equal to which distribution following?

(a) $F_{1-\alpha}(\nu, 1)$ (b) χ_1^2 / χ_ν^2 (c) $1-Z_{\alpha/2}$ (d) $t_{\alpha/2}^2(\nu)$ (e) None of the above

13. The definitions of Type I error and Type II error can be defined as following table:

		Action	
		Reject H_0	Accept H_0
The true condition	H_0 is true	Type I error	Correct
	H_0 is false	Correct	Type II error

And now, A and B are good friends that they usually trust each other. Recently, because of some rumors, A has accused B of lying. If it turns out that B was in fact telling the truth, what type of error did A commit?

(a) Type I error (b) Type II error (c) Both Type I and Type II error
(d) No errors were committed (e) None of the above is correct

Please consider the following information and finish **questions 14 to 16.**

A snack manufacturer claims that the average weight of their product per pack is no less than 500 gram. To test this claim, a random sample of 100 packs of this manufacturer's product was analyzed. As result, the average weight is 499 grams and the standard deviation is 5 grams. Construct a hypothesis test with α=0.05 to test if the claim can be accepted or not.

14. The null and alternative hypotheses should be properly set as:

(a) $H_0 : \mu = 500;\ H_1 : \mu \neq 500$ (b) $H_0 : \mu \geq 500;\ H_1 : \mu < 500$ (c) $H_0 : \mu \leq 500;\ H_1 : \mu > 500$
(d) $H_0 : \mu \leq 499;\ H_1 : \mu > 499$ (e) $H_0 : \mu \geq 499;\ H_1 : \mu < 499$

15. The Z-statistic and p-value of the test are:

(a) Z-statistic=2, p-value=0.9772 (b) Z-statistic=2, p-value=0.0228

(c) Z-statistic=-2, p-value=0.9772 (d) Z-statistic=-2, p-value=0.0456

(e) None of the above is correct

(Please see the Z-table in the appendix.)

16. Thus, according to the 95% confidence interval (CI) of the population mean, should we accept or reject the H_0 claim? ($Z_{0.95} = 1.645$; $Z_{0.975} = 1.96$; $Z_{0.99} = 2.326$)

(a) 95% CI of μ is [499.980,∞], since 500 is included, H_0 is accepted

(b) 95% CI of μ is [499.823,∞], since 499 is not included, H_0 is rejected

(c) 95% CI of μ is [-∞, 499.823], since 500 is not included, H_0 is rejected

(d) 95% CI of μ is [-∞, 499.980], since 499 is included, H_0 is accepted

(e) None of the above is correct

Part B. [20 Points] Calculation

Two effects, A (in three levels) and B (in two levels) are suspected to have impacts on the brightness (measured on a 20-points scale) of the digital pictures. Three observations were taken at each combinations of A and B effects:

		Effect A			
Effect B		Level 1	Level 2	Level 3	Sum
	Level 1	8, 2, 0 (10)	7, 5,10 (22)	6,9,13 (28)	60
	Level 2	10, 15,6 (31)	9, 12, 16 (37)	9,18,17 (44)	112
	Sum	41	59	72	172

The following numbers are given: Sum of squared = 2064; $\frac{172^2}{18}$=1643.556; $41^2+59^2+72^2$= 10346;

60^2+112^2=16144; $10^2+22^2+28^2+31^2+37^2+44^2$=5634

(1) [14 points, 1 point each alphabet]

Please finish the ANOVA table below and show the answers in alphabet order.

ANOVA

Source	SS	df	MS	F statistic	p-value
A	(a)	(f)	(k)	2.606	0.115
B	(b)	(g)	(l)	9.692	0.009
A*B	(c)	(h)	(m)	0.111	0.896
Error	(d)	(i)	(n)		
Total	(e)	(j)			

(2) [4 points]

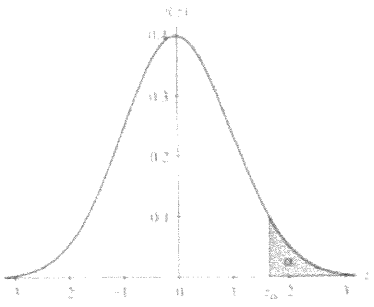
Assume μ_1, μ_2, and μ_3 represent the average of three levels of effect A, respectively. Please state the null and alternative hypotheses for testing the effect A. In addition, according to the p-value of effect A, show your conclusion with level of significance $\alpha = 0.001$.

(3) [2 points]

What is the coefficient of determination (R-squared) of the model?

Appendix

The Normal Distribution



$P(Z > z_\alpha) = \alpha$

$P(Z < -z) = 1 - \Phi(z) = \Phi(-z)$

z_α	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002