國立成功大學 104 學年度碩士班招生考試試題

系所組別:土木工程學系丙、戊組 考試科目:工程統計

考試日期:0211,節次:3

第1頁,共2頁

編號: 104

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

- 1. A contractor is required by a city construction division to submit one, two, three, four, or five forms (depending on the nature of the project) for a building permit. Let Y = the number of forms required of the next applicant. The probability that the y forms are required is known to be proportion to y that is, p(y) = ky for y = 1,..., 5. (1) What is the value of k? (2) What is the probability that at most three forms are required? (3) What is the probability that between two and four forms (inclusive) are required? (4) Could $p(y) = y^2/50$ for y = 1, ..., 5 be the pmf of Y? (16 points)
- 2. The Young's modulus (E) of samples of steel can be modeled by a normal distribution with a mean of 29,576 ksi and a standard deviation of 1,507 ksi. (12 points)
 - (1) What is the probability that a sample's E is between 28,000 and 29,500 ksi?
 - (2) If the 90th percentile value of the Young's modulus is desired, what's this E value?
 - (3) The commonly used Young's modulus for steel is 29,000 ksi. What percentile is this value located?

Values Provided for Your Calculations

z	-1.05	-0.38	-0.05	0.50	0.6	1.22	1.28	1.64	t _{0.05, 6}	t _{0.025, 6}	t _{0.025, 16}	t _{0.025, 17}
Φ(z)	0.147	0.35	0.48	0.69	0.73	0.89	0.9	0.95	1.943	2.45	2.210	2.000

3. A study was conducted to analyze the derailment of a freight train due to the catastrophic failure of a traction motor armature bearing. A sample of 17 high-mileage traction motors was selected, and the amount of cone penetration (mm/10) was determined for pinion bearing and for the commutator armature bearing, resulting in the data shown below. (1) Calculate the 95% confidence interval for the population mean difference between penetration for the commutator armature bearing and penetration for the pinion bearing. (2) Would you say that the population mean difference has been precisely estimated? (3) Does it look as though population mean penetration differs for the two types of bearings? Explain. (12 points)

Variable	N	Mean	Median	StDev	Minimum	Maximum	Q1	Q3
Commutator	17	259.88	270	31.28	209	305	233	278
Pinion	17	264.06	273	27.41	208	315	243	281
Difference	17	-4.18	-4	35.85	-71	67	-19	1

4. Answer following four questions: (16 points)

(1) If two random variables X and Y have standard deviation of 7 and 24 respectively, what is the standard deviation of X-Y ?

(2) Suppose a certain type of fertilizer has an expected yield per acre of μ_1 with variance σ_2 , whereas the expected yield for a second type of fertilizer is μ_2 with the same variance σ_2 . Let S_1^2 and S_2^2 denote the sample variances of yields based on sample sizes n_1 and n_2 , respectively, of the two fertilizers. Show that the pooled

(combined) estimator, $\hat{\sigma}^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}$, is an unbiased estimator of σ^2 .

(3) Suppose a researcher is interested in testing the hypotheses H_o: µ = 6 vs. H_a: µ ≠ 6. Her test statistic is 0.6. Calculate the p-value.

國立成功大學 104 學年度碩士班招生考試試題

系所組別:土禾工程學系丙、戊組

考試科目:工程統計

編號: 104

考試日期:0211,節次:3

2頁,	共2頁					
く考生	請注意:本試題	可使用計算機。	請於答案者	巻(卡)作答・カ	於本試題紙上	作答者,不予計分
(4)	The following con	ifidence intervals fo	or μ were found.	99%:(0.015, 0.	447), 96%:(0.0	59, 0.404), 95%:(0.066
	0.396), and 90%:	(0.093, 0.369). Fc	or testing the hy	potheses Ho: μ	= 0.4 vs. Ha: µ	$1 \neq 0.4$, what is the rang
	the p-value? Sho	w your rationale. (a) 0.01 – 0.04 (b) 0.04 – 0.05 (c) 0.05 – 0.1 (d)	< 0.01 (e) > 0.1
An ex	periment was cari	ried out to compare	electrical resist	ivity for six diffe	erent low-perme	eability concrete bridge
mixtu	res. There were 20	6 measurements or	n concrete cylin	ders for each m	iixture; these w	vere obtained after 28-da
curing	g. (1) Fill in the rer	naining ANOVA tab	le shown below	(5 points), (2) W	/rite appropriate	e hypotheses (4 points),
and (3	3) Make conclusio	on regarding the me	an values (4 pc	oints)		,
	Source	SS df	MS	F	<u> </u>	Table F = 2.27
	Mixture	* ······				
	Error		15			Ň
	Total	6000				
. A proi	fessor of civil engi	neering wants to st	udy the relation	ship between a	nnual income ((y, in \$1000s) and educa
. A prot (x. in	fessor of civil engi vears). A random	ineering wants to st sample of eight ind	udy the relation	ship between a and the result:	nnual income (s are shown be	(y, in \$1000s) and educa slow: (31 points)
. A prof (x, in Para	fessor of civil engi years). A random imeter Estimates	ineering wants to st sample of eight ind	udy the relation lividuals is taker	ship between a n and the result	nnual income (s are shown be	(y, in \$1000s) and educa elow: (31 points)
. A prof (x, in Para	fessor of civil engi years). A random imeter Estimates Term	ineering wants to st sample of eight ind Estimate	udy the relation lividuals is taker Std Error	ship between a n and the result t-value	nnual income (s are shown be Prob> t]	(y, in \$1000s) and educa elow: (31 points)
. A proi (x, in Para	fessor of civil engi years). A random imeter Estimates <u>Term</u> Intercept	ineering wants to st sample of eight ind <u>Estimate</u> 10	lividuals is taker Std Error 4.35	ship between a n and the results <u>t-value</u> 2.44	nnual income (s are shown be <u>Prob> t </u> 0.0506	(y, in \$1000s) and educa elow: (31 points)
. A proi (x, in Para	fessor of civil engi years). A random meter Estimates <u>Term</u> Intercept <u>Education</u>	ineering wants to st sample of eight ind <u>Estimate</u> 10 <u>3</u>	udy the relation lividuals is taker <u>Std Error</u> 4.35 0.35	ship between a n and the results <u>t-value</u> 2.44 8.44	nnual income (s are shown be <u>Prob> t </u> 0.0506 <u>0.0002</u>	(y, in \$1000s) and educa
A prof (x, in Para ANOVA	fessor of civil engi years). A random imeter Estimates <u>Term</u> Intercept <u>Education</u> Source	ineering wants to st sample of eight ind <u>Estimate</u> 10 <u>3</u> SS	lividuals is taker Std Error 4.35 0.35 df	ship between a n and the results <u>t-value</u> 2.44 <u>8.44</u> MS	nnual income (s are shown be <u>Prob> t </u> 0.0506 <u>0.0002</u> F	(y, in \$1000s) and educa elow: (31 points)
. A prof (x, in Para ANOVA	fessor of civil engi years). A random imeter Estimates <u>Term</u> Intercept <u>Education</u> Source Model	ineering wants to st sample of eight ind <u>Estimate</u> 10 <u>3</u> SS 420	lividuals is taker Std Error 4.35 0.35 df	ship between a n and the results <u>t-value</u> 2.44 <u>8.44</u> MS	nnual income (s are shown be <u>Prob> t </u> 0.0506 <u>0.0002</u> F	(y, in \$1000s) and educa elow: (31 points)
. A prof (x, in Para ANOVA	fessor of civil engi years). A random imeter Estimates <u>Term</u> Intercept <u>Education</u> Source Model Error	ineering wants to st sample of eight ind <u>Estimate</u> 10 <u>3</u> SS 420	lividuals is taker Std Error 4.35 0.35 df	ship between a n and the results <u>t-value</u> 2.44 <u>8.44</u> MS	nnual income (s are shown be <u>Prob> t </u> 0.0506 <u>0.0002</u> F	(y, in \$1000s) and educa elow: (31 points)
. A prof (x, in Para	fessor of civil engi years). A random imeter Estimates <u>Term</u> Intercept <u>Education</u> Source Model <u>Error</u> Total	ineering wants to st sample of eight ind <u>Estimate</u> 10 3 SS 420 456	lividuals is taker Std Error 4.35 0.35 df	ship between a n and the results <u>t-value</u> 2.44 <u>8.44</u> MS	nnual income (s are shown be <u>Prob> t </u> 0.0506 <u>0.0002</u> F	(y, in \$1000s) and educa elow: (31 points)
. A prof (x, in Para ANOVA (1)	fessor of civil engi years). A random imeter Estimates <u>Term</u> Intercept <u>Education</u> Source Model <u>Error</u> Total Fill in the blanks	ineering wants to st sample of eight ind <u>Estimate</u> 10 3 SS 420 456 in the ANOVA table	udy the relation lividuals is taker 4.35 0.35 df	ship between a n and the results 2.44 8.44 MS	nnual income (s are shown be <u>Prob> t </u> 0.0506 <u>0.0002</u> F	(y, in \$1000s) and educa elow: (31 points) give an interpretation.(3
A prof (x, in Para ANOVA (1) (3)	fessor of civil engi years). A random meter Estimates <u>Term</u> Intercept <u>Education</u> Source Model Error Total Fill in the blanks For an individual	ineering wants to st sample of eight ind <u>Estimate</u> 10 3 SS 420 456 in the ANOVA table in the sample (x=1)	udy the relation lividuals is taker <u>Std Error</u> 4.35 0.35 df e shown above.(6, y=59), what i	ship between a n and the results <u>t-value</u> 2.44 <u>8.44</u> MS 7 points) (2) Cal s the residual b	nnual income (s are shown be <u>Prob>[t]</u> 0.0506 <u>0.0002</u> F Iculate R ² and g ased on the lea	(y, in \$1000s) and educa elow: (31 points) give an interpretation.(3 ast squares estimate?(3
A prof (x, in Para ANOVA (1) (3) (4)	fessor of civil engi years). A random meter Estimates <u>Term</u> Intercept <u>Education</u> Source Model <u>Error</u> Total Fill in the blanks For an individual What is the prob	ineering wants to st sample of eight ind <u>Estimate</u> 10 3 SS 420 456 in the ANOVA table in the sample (x=1) ability that this indiv	udy the relation lividuals is taker <u>Std Error</u> 4.35 0.35 df e shown above.(6, y=59), what i vidual (x=16) wil	ship between a n and the results <u>t-value</u> 2.44 <u>8.44</u> MS 7 points) (2) Cal s the residual b	nnual income (s are shown be <u>Prob> t </u> 0.0506 <u>0.0002</u> F Iculate R ² and g ased on the lea \$61,000? (3 po	(y, in \$1000s) and educa elow: (31 points) give an interpretation.(3 ast squares estimate?(3
A proi (x, in Para ANOVA (1) (3) (4) (5)	fessor of civil engi years). A random imeter Estimates <u>Term</u> Intercept <u>Education</u> Source Model Error Total Fill in the blanks For an individual What is the proba	ineering wants to st sample of eight ind <u>Estimate</u> 10 3 SS 420 456 in the ANOVA table in the sample (x=1) ability that this indiv ence to show that E	udy the relation lividuals is taker <u>Std Error</u> 4.35 0.35 df e shown above.(6, y=59), what i <i>i</i> idual (x=16) will Education is use	ship between a n and the results <u>t-value</u> 2.44 <u>8.44</u> MS 7 points) (2) Cal s the residual b I make at least eful to predict in	Innual income (s are shown be <u>Prob> t </u> 0.0506 0.0002 F Iculate R ² and g ased on the lea \$61,000? (3 po come? Set up	(y, in \$1000s) and educa elow: (31 points) give an interpretation.(3 ast squares estimate?(3 ints) appropriate hypotheses
A prof (x, in Para ANOVA (1) (3) (4) (5)	fessor of civil engi years). A random meter Estimates <u>Term</u> Intercept <u>Education</u> Source Model <u>Error</u> Total Fill in the blanks For an individual What is the proba Is there any evid carry out the test	ineering wants to st sample of eight ind <u>Estimate</u> 10 3 SS 420 456 in the ANOVA table in the sample (x=1) ability that this indiv ence to show that E at a 0.05 level. (3 p	udy the relation lividuals is taker <u>Std Error</u> 4.35 0.35 df e shown above.(6, y=59), what i vidual (x=16) wil Education is use points)	ship between a n and the results <u>t-value</u> 2.44 <u>8.44</u> MS 7 points) (2) Cal s the residual b I make at least eful to predict in	Innual income (s are shown be Prob>[t] 0.0506 0.0002 F Iculate R ² and g ased on the lea \$61,000? (3 po come? Set up a	(y, in \$1000s) and educated on the second se
. A prof (x, in Para ANOVA (1) (3) (4) (5) (6)	fessor of civil engi years). A random meter Estimates <u>Term</u> Intercept <u>Education</u> Source Model <u>Error</u> Total Fill in the blanks For an individual What is the proba Is there any evid carry out the test Based on the lea	ineering wants to st sample of eight ind <u>Estimate</u> 10 3 SS 420 456 in the ANOVA table in the sample (x=1) ability that this indiv ence to show that E at a 0.05 level. (3 p st squares estimate	udy the relation lividuals is taker <u>Std Error</u> 4.35 0.35 df e shown above.(6, y=59), what i vidual (x=16) will Education is use points) e, if a person ge	ship between a n and the results <u>t-value</u> 2.44 <u>8.44</u> MS 7 points) (2) Cal s the residual b I make at least eful to predict in	nnual income (s are shown be <u>Prob>[t]</u> 0.0506 <u>0.0002</u> F Iculate R ² and g ased on the lea \$61,000? (3 po come? Set up a pre of education	(y, in \$1000s) and educated on the selow: (31 points) give an interpretation.(3) ast squares estimate?(3) ints) appropriate hypotheses n, what would you expendent
. A prof (x, in Para ANOVA (1) (3) (4) (5) (6)	fessor of civil engi years). A random imeter Estimates <u>Term</u> Intercept <u>Education</u> Source Model Error Total Fill in the blanks For an individual What is the proba Is there any evid carry out the test Based on the lea change in her ind	ineering wants to st sample of eight ind <u>Estimate</u> 10 3 SS 420 456 in the ANOVA table in the sample (x=1) ability that this indiv ence to show that E at a 0.05 level. (3 p st squares estimate come to be?(3 point)	udy the relation lividuals is taker <u>Std Error</u> 4.35 0.35 df e shown above.(6, y=59), what i vidual (x=16) will Education is use points) e, if a person ge ts)	ship between a n and the results <u>t-value</u> 2.44 <u>8.44</u> MS 7 points) (2) Cal s the residual b I make at least eful to predict in	nnual income (s are shown be <u>Prob> t </u> 0.0506 0.0002 F Iculate R ² and g ased on the lea \$61,000? (3 po come? Set up a pre of education	(y, in \$1000s) and educated on the selow: (31 points)

(8) John has a two year college degree (x=14). Calculate a 95% prediction interval for his income. ($\overline{x} = 12$, stdev of x: $s_x = 3$)(3 points)

and carry out the test at 0.05 level.(3 points)

(9) Doug has less than 9 year education. The 95% prediction interval for Doug's income as compared with the 95% prediction interval for John's income will be wider _____ or narrower _____ or not enough information is given _____.($\bar{x}=12$)(3 points)