

逢甲大學113學年度碩士班考試入學試題

編號：05

科目代碼：103

科目	統計學	適用 系所	統計學系統計與精算碩士班應 用統計暨計量財務組、精算組	時間	90分鐘
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※請務必在答案卷作答區內作答。

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1. A proficient examination for a certain skill was given to 100 employees of a firm. The breakdown of test results among men and women is shown in the accompanying diagram.

	Male	Female	Total
Pass	24	36	60
Fail	16	24	40
Total	40	60	100

- (a). Find the probability that the employee passed, given that the employee was a man. (3 pts)
- (b). Find the probability that the employee was a man, given that a passing grade was received. (3 pts)
- (c). Denote $S = \text{pass}$ and $F = \text{female}$. Find $E(S|F)$ and $var(S|F)$. (5 pts)
2. Among persons donating blood to a clinic, 85% have Rh^+ blood (that is, the Rhesus factor is present in their blood.) Six people donate blood at the clinic on a particular day.
- (a). Find the expected value and the variance of the number of Rh^+ people. (3 pts)
- (b). Find the probability that at least five of the six do have the Rh factor. (3 pts)
- (c). Find the probability that exact three of the six have the Rh factor. (3 pts)
3. The number of particles emitted by a radioactive source is generally well modeled by the Poisson distribution. If the average number of particles emitted by the source in an hour is four, find the following probabilities.
- (a). The number of emitted particles in a given hour is 2. (3 pts)
- (b). The number of emitted particles in a given hour will be at least 3. (3 pts)
- (c). No particles will be emitted in a given 30-minute period. (3 pts)
4. The random variable X of the life lengths (in hours) of batteries is associated with a probability density function of the form
- $$f(x) = \begin{cases} \frac{1}{2}e^{-\frac{x}{2}}, & x > 0 \\ 0, & \text{elsewhere.} \end{cases}$$
- (a). Find the probability that the life of a particular battery of this type is less than 2 or greater than 4 hours. (4 pts)
- (b). Find the probability that a battery of this type lasts more than 3 hours, given that it already has been in use for more than 2 hours. (4 pts)

5. According to *Reader's Digest*, 36% of primary care doctors think their patients receive unnecessary medical care.
- (a). Suppose a sample of 100 primary care doctors was taken. Specify the distribution form and parameters of the sampling distribution of the proportion of the doctors who think their patients receive unnecessary medical care. (5 pts)
- (b). Find the probability that sample proportion will be within ± 0.05 of the population proportion. (6 pts)
6. An experiment is conducted by a completely balanced randomized design. The treatment is set for two levels, A and B . Statistics for each level of treatment are provided in the following: $\bar{y}_A = 30$, $\bar{y}_B = 45$, $S_A^2 = 6$, $S_B^2 = 4$, $n_A = n_B = 5$. In the following calculations, use $\alpha = 0.05$.
- (a). Complete the partial ANOVA table. (5 pts)

Sources	SS	df	MS	F
Treatment	(i)	1	(ii)	112.5
Error	(iii)	(iv)	(v)	
Total	602.5	9		

- (b). Test whether the means for both treatments are equal. (5 pts)
- (c). Assume $\sigma_A^2 = \sigma_B^2$. Conduct a two-sample t -test for treatments. Discuss the compare the result in (b), i.e., relationship between t and F statistics in this case. (8 pts)

7. Given are five observations for two variables, x and y .

x_i	1	2	3	4	5
y_i	3	7	5	11	14

- (a). Complete the partial ANOVA table in the following. (6 pts)

	Sources	SS	df	MS	F
Regression	SSR	(i)	(ii)	(iii)	(iv)
Error	SSE	(v)	(vi)	4.133	
Total	SST	80.0	4		

- (b). Obtain the estimated regression equation. (8 pts)
- (c). Find the standard error of b_1 (round it to third decimal place) and construct the 95% confidence interval for b_1 . (10 pts)
- (d). Calculate predicted values and residuals. (10 pts)

obs.	x_1	x_2	x_3	x_4	x_5
\hat{y}_i	(i)	(ii)	(iii)	(iv)	(v)
e_i	(vi)	(vii)	(viii)	(ix)	(x)

Table 1: Cumulative Probabilities for the Standard Normal Distribution

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830

Table 2: *t* Distribution

Degrees of Freedom	Area in Upper Tail		
	.10	.05	.025
3	1.638	2.353	3.182
4	1.533	2.132	2.776
5	1.476	2.015	2.571

Table 3: *F* Distribution

Numerator Degrees of Freedom	Area in Upper Tail	Denominator Degrees of Freedom		
		7	8	9
1	.10	3.59	3.46	3.36
	.05	5.59	5.32	5.12
	.025	8.07	7.57	7.21