

考試科目	統計學	所(組)別	統計學系	考試時間	105 年 11 月 6 日 星期日 10:00-11:40
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注意事項: 本科目有五份試題，第一份試題之答案請寫在第一卷上，餘類推。

第一份試題(答案請寫在第一卷上)

1. (8%) Each of the following four stem-and-leaf plots contains 18 observations.

1	123	1	1	1	12	1	123456
2	456	2	23	2	345	2	78
3	789	3	456789	3	6789	3	9
4	789	4	456789	4	6789	4	9
5	456	5	23	5	345	5	78
6	123	6	1	6	12	6	123456

Assume that leaf unit = 1. Which distribution exhibits greatest variation among the four? Which one exhibits the least? Order them from the greatest to the least.

2. (12%) The five-number-summary for the prices of used cars (in thousands of US dollars) advertised for sale at two different car dealers are given as follows.

Dealer 1: 10-10-15-16-20

Dealer 2: 6-8-10-13-18

- (a) (2%) The first two numbers of the five-number-summary for the first dealer are both 10. Explain how it could happen.
- (b) (2%) For the second dealer, would you expect the mean selling price to be higher or lower than the median? Explain.
- (c) (4%) Draw an appropriate picture to compare the two distributions. Are there any outliers?
- (d) (4%) Write a few sentences discussing what these data show.

第二份試題(答案請寫在第二卷上)

1. (6%) 隨機變數 X 服從常態分配，平均數為 50，標準差為 10。已知 $z_{.8413}=1.0$ ， $z_{.9772}=2.0$ ， $z_{.1}=1.28$ ， $z_{.05}=1.645$

(a)(3%)求 $P(30 < X < 60)$ ；(b)(3%)求 X 的第 90 百分位數。

2. (8%)【兩獨立事件一定是互斥事件。】請證明此敘述或舉出反例。

3. (6%) 隨機變數 X 的機率密度函數為 $f(x)=1-.5x$, $0 < x < 2$; $f(x)=0$, $x > 2$ 或 $x < 0$ 。

(a)(3%)求 $P(X > 1)$ ；(b)(3%)求 $P(X = 1.5)$ 。

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第三份試題(答案請寫在第三卷上)

1. (20%) Consider the following population data: $\{0, 2, 3, 4, 5\}$.
 1. (5%) Calculate the population range, denoted as θ .
 2. (10%) Consider to randomly draw a sample of size 2 with replacement. Find the sampling distribution of the sample range, R .
 3. (5%) Is the sample range R a good point estimator of the population range θ ? Explain it.

第四份試題(答案請寫在第四卷上)

1. (20%) Gamification is the use of game mechanics to motivate, modify, or reward distinct behaviors. In the context of sales effectiveness, it is deployed to encourage both sales accomplishments and non-sales activities. A survey of end-users sales organizations indicates that 31 of 37 gamification-user organizations provide mobile access to customer research management (CRM), whereas 138 of 275 non-gamification-user organizations provide mobile access to CRM.
 - (1) Please first construct a 2×2 contingency table for these data. (4%)
 - (2) Apply a χ^2 test at the 0.05 level of significance to examine whether there is evidence of a difference between gamification-user sales organizations and non-gamification-user sales organizations in the proportion that provide mobile access to CRM. (10%)
 - (3) Find the p -value in part (2) and interpret its meaning. (6%)

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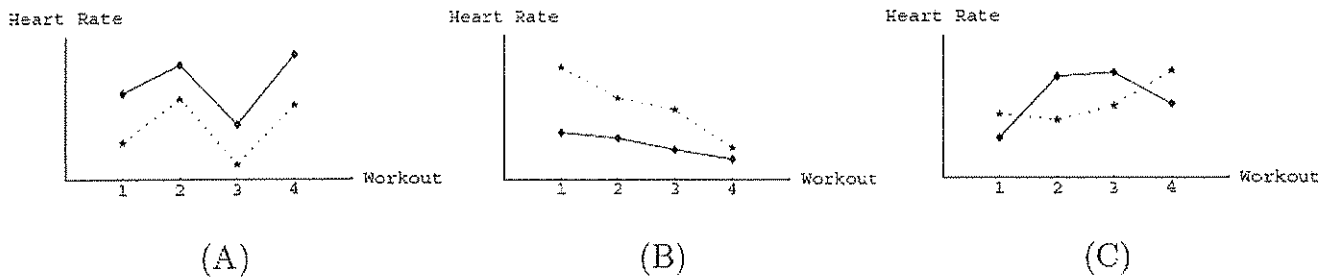
第五份試題(答案請寫在第五卷上)

1. The human resource department of a software company encourages their employees to participate in a wellness program. They sampled twenty-four employees, three males and three females from four different workout routines and measured their heart rate. A table from the two way ANOVA model follows.

Source	DF	SS	MS	F	P
Workout	3	548.5542	(i)	8.5183	0.0013
Gender	1	45.8652	45.8652	2.136674	0.1632
Interaction	(ii)	65.3214	21.7737	1.0144	0.4122
Error	16	343.4512	21.4657		
Total	23	1003.1920			

(a) (4pts). Please complete the above ANOVA table.

(b) (3pts). Which of the followings would be most likely the interaction plot for this study?



(c) (3pts). What is the proportion to which the two way ANOVA model accounts for the total variation? Namely, please compute the proportion of the overall variation that is explained by the main and interaction effects of the two factors workout routine and gender. Show your work.

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2. A researcher analyzed the relationship between monthly salary (in thousands) and three independent variables: length of service (measured in months), job type (0 = technical, 1 =clerical) and gender (0=male, 1=female). Following is the ANOVA output.

Predictor	Coef	SE	T	P
Constant	9.4871	3.2213	2.9451	0.0067
Service	0.1490	0.0623	2.3917	0.0243
Job	(i)	0.2284	-1.2421	0.2253
Gender	2.2775	1.0913	2.0870	0.0468

Analysis of Variance

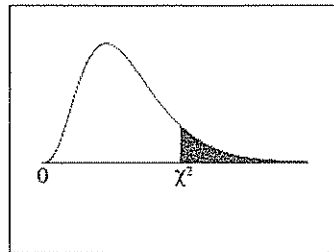
Source	DF	SS	MS	F	P
Regression	3	100.4347	33.4782	5.9573	0.0031
Error	26	(ii)	5.6197		
Total	29	246.5469			

- (a) (4pts). Please complete the above output.
- (b) (3pts). Which of the following statements is correct? The global F test of the multiple regression model at a 0.05 significance level will
- (A) not be rejected.
 - (B) conclude that salary is related to at least one of the independent variables.
 - (C) conclude that salary is related to all of the independent variables.
 - (D) None of the above.
- (c) (3pts) How much does a male on the average earn salary more or less than a female?

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附錄:

Chi-Square Distribution Table



The shaded area is equal to α for $\chi^2 = \chi^2_{\alpha}$.

df	$\chi^2_{.995}$	$\chi^2_{.990}$	$\chi^2_{.975}$	$\chi^2_{.950}$	$\chi^2_{.900}$	$\chi^2_{.100}$	$\chi^2_{.050}$	$\chi^2_{.025}$	$\chi^2_{.010}$	$\chi^2_{.005}$
1	0.000	0.000	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.070	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.300
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.041	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.195	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.953	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169