系所別：人力資源管理研究所　科目：統計學

簡答計算題（共二十小題，每題五分）

1. We have explicitly mentioned five types of case:
   (1) Individual people or animals
   (2) Stimuli
   (3) Groups of people or animals
   (4) Neurons
   (5) Events or occasions

   Identify the type of case implied by each of the following questions.
   (*a*) Do small nations tend to spend more or less per capita for arms than large nations when per capita income is controlled?
   (*b*) Are more babies born per day on weekdays or weekends?
   (*c*) Has Judge A in an art contest consistently chosen paintings with bright colors over more subdued paintings in previous contests?
   (*d*) Are most married women more liberal politically than their husbands?

2. Students took a pretest of gymnastic ability (X), were trained in gymnastics by either method P or method Q, and then were tested on a posttest (Y). Parts 1 through 6 of Figure represent six possible situations. In each part, the two small squares represent the means of the scatterplots of scores of students taught by methods P and Q. The within-group regression lines are also shown.

   Six of the descriptions *a* to *j* below match a diagram in Figure while the other four descriptions match no diagram. In each diagram one of the two small squares is clearly closer to the origin—the lower left corner of the diagram. For each description give the number (if any) of the diagram fitting the description, and the appropriate letter (P or Q) of the square closer to the origin.
   (a) The P and Q groups did not offer in mean pretest ability, but the P group outperformed the Q group on posttest.
   (b) The two groups did not differ on average posttest score. However, group Q was better on pretest, so method P appears to be more effective.
   (c) The Q students outperformed the P students on both pretest and posttest. However, it appears that method Q is superior because (surprisingly) there is no relation between pretest and posttest scores within groups. Thus the Q students gained no unfair advantage over the P students by virtue of being more able at pretest.
   (d) Within groups there was no relation between pretest and posttest scores. However, we conclude that method P was superior to method Q because it started with poorer students and the difference between groups was smaller at posttest than at pretest.
   (e) Both methods P and Q were so different from what these students had seen before that in both groups the students who did best on pretest actually did worse on posttest. The P students did worse than the Q students on pretest, but this was actually an advantage for the P students because of the negative relationship. Therefore we conclude that Q is a better method even though the P's outperformed the Q's on the posttest.
   (f) Both methods P and Q were so different from what these students had seen before that in both groups the students who did best on pretest actually did worse on posttest. The Q students were superior on pretest and posttest, as well as on posttest after correcting for the difference on pretest.
   (g) Group Q was above group P on posttest. However, Q was so much higher than P on pretest, and the relation within groups between pretest and posttest was so strong, that after correcting for the difference in pretest scores, P appears to be the better method.

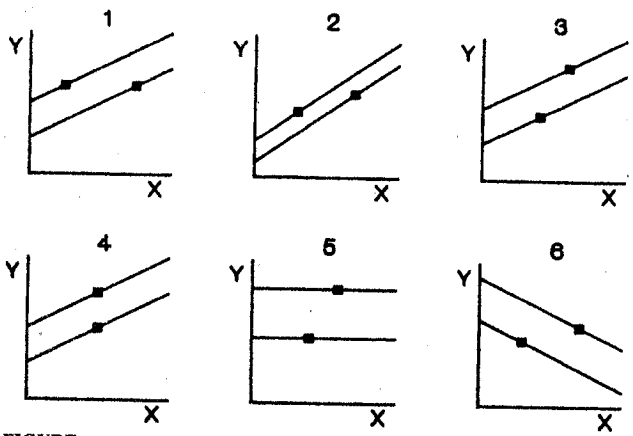

FIGURE
Six possible relations between treatment and control groups.

3. Suppose that the following contingency table was set up:

	B	B'
A	10	30
A'	25	35

What is the probability of
(a) $A \mid B$?
(b) $A \mid B'$?

4. In a random sample of 64 people, 48 were classified as "successful."
   (a) Determine the sample proportion p_s of "successful" people.
   (b) Determine the standard error of the sample proportion σ_{p_s}.

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5. The retailing manager of a supermarket chain wishes to determine whether product location has any effect on the sale of pet toys. Three different aisle locations are considered: front, middle, and rear. A random sample of 18 stores is selected with 6 stores randomly assigned to each aisle location. The size of the display area and price of the product are constant for all stores. At the end of a 1-week trial period, the sales volume (in thousands of dollars) of the product in each store was as follows:

Aisle Location		
Front	Middle	Rear
8.6	3.2	4.6
7.2	2.4	6.0
5.4	2.0	4.0
6.2	1.4	2.8
5.0	1.8	2.2
4.0	1.6	2.8

Aisle location:	Front	Middle	Rear
Sample means:	6.067	2.067	3.733
Sample standard deviations:	1.648	.653	1.418

$\bar{\bar{X}} = 3.956$

(a) At the .05 level of significance, is there evidence of a significant difference in average sales among the various aisle locations?
(b) If appropriate, which aisle locations appear to differ significantly in average sales?

critical values of F corresponding to a specified upper tail area (α)

Denominator df_2	Numerator df_1																		
	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9	248.0	249.1	250.1	251.1	252.2	253.3	254.3
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.50
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.36
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88

6. Given the following contingency table

	A	B	C	Total
1	10	30	50	90
2	40	45	50	135
Total	50	75	100	225

(a) Compute the expected frequencies for each cell.
(b) Compute the χ^2 statistic for this contingency table. Is it significant at $\alpha = .05$?
(c) If appropriate, use $\alpha = .05$ and determine which groups (A, B, C) are different.

Critical Values of χ^2

Degrees of Freedom	Upper Tail Areas (α)											
	.995	.99	.975	.95	.90	.75	.25	.10	.05	.025	.01	.005
1			0.001	0.004	0.016	0.102	1.323	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	0.575	2.773	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	1.213	4.108	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	1.923	5.385	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	2.675	6.626	9.236	11.071	12.833	15.086	16.750