

1. 請簡述標準常態分佈的特性，並概要說明第一類錯誤( $\alpha$ -error)、第二類錯誤( $\beta$ -error)及檢力(power)。(7%)

2. 以螯合劑(chelating agent)施予四名鉛中毒病患，其施藥前後的血中鉛濃度變化情形如下表：

個案	血中鉛濃度(ug/dL)	
	施藥前	施藥後
1	45	41
2	70	50
3	60	50
4	100	70

請以您認為最適當、靈敏度較佳的統計方法來檢定是否所施予的藥物治療有效地改善血中鉛濃度？(13%)  
 [請寫出選定的統計方法及選擇的理由、虛無假設，以及統計判定的結果，同時請將過程中所需使用的平均值、標準差(standard deviation)、標準誤(standard error)等參數演算過程列出]

( $t_{3, 0.975}=3.182$ ,  $t_{3, 0.950}=2.353$ ,  $t_{4, 0.975}=2.776$ ,  $t_{4, 0.950}=2.132$ ,  $t_{5, 0.975}=2.571$ ,  
 $t_{5, 0.950}=2.015$ )

3. 有一項研究，選定三百名末期腎病變病人(End-Stage Renal Disease)與三百名健康人進行比較是否有特殊金屬暴露造成此病變。所得結果如下表所列。請計算其勝算比(odds ratio)，並說明其運算方式與其所代表意義。(10%)

	末期腎病變病人	健康人	
有特殊金屬暴露	200	100	300
無特殊金屬暴露	100	200	300
	300	300	600

4. 某一大腸癌篩檢結果與臨床確診結果比較如下表所示，請計算敏感度(sensitivity)、特定度(specificity)、陽性預測值(positive predictive value)、陰性預測值(negative predictive value)。並請說明在篩檢工具的選擇上，這些參數的意義與判定基準的原則為何？(10%)

		大腸癌		合計
		確診	未確診	
篩檢	陽性	150	850	1000
	陰性	50	6150	6200
		200	7000	7200

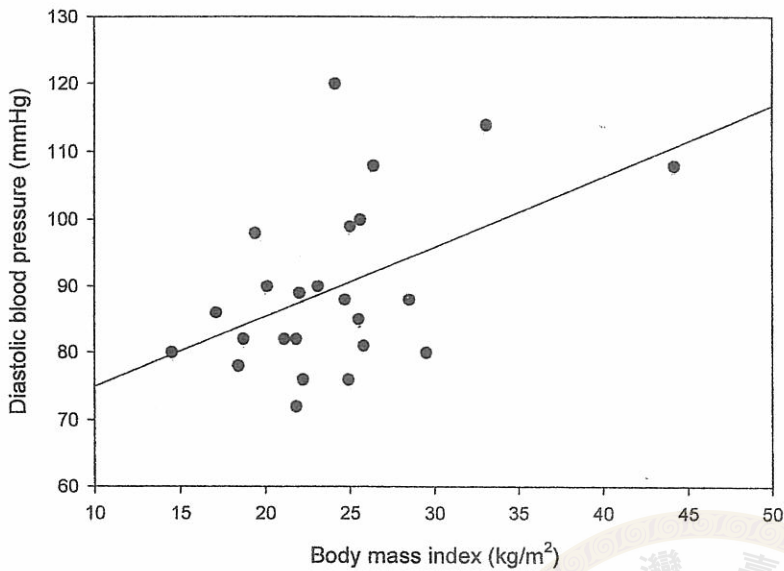
5. 針對施打H1N1疫苗之後的傷害事件，為釐清其是否為施打疫苗所引起，擬進行一項流行病學研究來探討其原因。請提出一項你認為最可行的研究方法，並說明選用此方法的理由與其基本研究架構內容、所需蒐集資料與參數，以及執行方式等。(10%)

6. What is causal inference? Please list and explain the criteria commonly used to assess the causal nature of observed associations. (10%)

7. Please define the terms 1) odds ratio; 2) risk ratio; and 3) rate ratio. For each ratio describe the type, or types, of epidemiology study where they might be calculated. (10%)

8. Please choose and justify the most appropriate study designs for the investigation of an association between 1) a rare exposure and a common outcome; 2) a rare exposure and a rare outcome; and 3) a common exposure and a rare outcome. (10%)

9. Please describe the following figure and write underlying requirements of this model. (10%)



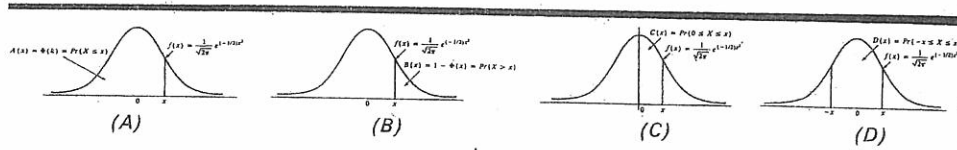
Diastolic blood pressure (mmHg) = 64.49 + 1.05 x body mass index (kg/m<sup>2</sup>)  
 n = 24, P = 0.015, R<sup>2</sup> = 0.24

10. A survey of usage of tea gas-cooker in the home was carried out among a random sample of primary school children, living in three communities. Records were made of each child's living community (rural and urban), and the conditions of usage of tea gas-cooker in the home (never, sometimes and usually), with the following results:

Community	Usage of tea gas-cooker in the home		
	Never	Sometimes	Usually
Rural	3	88	165
Urban	43	73	76

- (1) Do you think this amount of variation between the living communities could occur by chance? What statistical method can be used to assess this? (5%)
- (2) Carry out a significance test to assess whether there is evidence of an association. What is the P-value? (5%)

The Normal Distribution



x	A*	B†	C‡	D§	x	A	B	C	D
0.0	0.5000	0.5000	0.0	0.0	0.32	0.6255	0.3745	0.1255	0.2510
0.01	0.5040	0.4960	0.0040	0.0080	0.33	0.6293	0.3707	0.1293	0.2586
0.02	0.5080	0.4920	0.0080	0.0160	0.34	0.6331	0.3669	0.1331	0.2661
0.03	0.5120	0.4880	0.0120	0.0239	0.35	0.6368	0.3632	0.1368	0.2737
0.04	0.5160	0.4840	0.0160	0.0319	0.36	0.6406	0.3594	0.1406	0.2812
0.05	0.5199	0.4801	0.0199	0.0399	0.37	0.6443	0.3557	0.1443	0.2886
0.06	0.5239	0.4761	0.0239	0.0478	0.38	0.6480	0.3520	0.1480	0.2961
0.07	0.5279	0.4721	0.0279	0.0558	0.39	0.6517	0.3483	0.1517	0.3035
0.08	0.5319	0.4681	0.0319	0.0638	0.40	0.6554	0.3446	0.1554	0.3108
0.09	0.5359	0.4641	0.0359	0.0717	0.41	0.6591	0.3409	0.1591	0.3182
0.10	0.5398	0.4602	0.0398	0.0797	0.42	0.6628	0.3372	0.1628	0.3255
0.11	0.5438	0.4562	0.0438	0.0876	0.43	0.6664	0.3336	0.1664	0.3328
0.12	0.5478	0.4522	0.0478	0.0955	0.44	0.6700	0.3300	0.1700	0.3401
0.13	0.5517	0.4483	0.0517	0.1034	0.45	0.6736	0.3264	0.1736	0.3473
0.14	0.5557	0.4443	0.0557	0.1113	0.46	0.6772	0.3228	0.1772	0.3545
0.15	0.5596	0.4404	0.0596	0.1192	0.47	0.6808	0.3192	0.1808	0.3616
0.16	0.5636	0.4364	0.0636	0.1271	0.48	0.6844	0.3156	0.1844	0.3688
0.17	0.5675	0.4325	0.0675	0.1350	0.49	0.6879	0.3121	0.1879	0.3759
0.18	0.5714	0.4286	0.0714	0.1428	0.50	0.6915	0.3085	0.1915	0.3829
0.19	0.5753	0.4247	0.0753	0.1507	0.51	0.6950	0.3050	0.1950	0.3899
0.20	0.5793	0.4207	0.0793	0.1585	0.52	0.6985	0.3015	0.1985	0.3969
0.21	0.5832	0.4168	0.0832	0.1663	0.53	0.7019	0.2981	0.2019	0.4039
0.22	0.5871	0.4129	0.0871	0.1741	0.54	0.7054	0.2946	0.2054	0.4108
0.23	0.5910	0.4090	0.0910	0.1819	0.55	0.7088	0.2912	0.2088	0.4177
0.24	0.5948	0.4052	0.0948	0.1897	0.56	0.7123	0.2877	0.2123	0.4245
0.25	0.5987	0.4013	0.0987	0.1974	0.57	0.7157	0.2843	0.2157	0.4313
0.26	0.6026	0.3974	0.1026	0.2051	0.58	0.7190	0.2810	0.2190	0.4381
0.27	0.6064	0.3936	0.1064	0.2128	0.59	0.7224	0.2776	0.2224	0.4448
0.28	0.6103	0.3897	0.1103	0.2205	0.60	0.7257	0.2743	0.2257	0.4515
0.29	0.6141	0.3859	0.1141	0.2282	0.61	0.7291	0.2709	0.2291	0.4581
0.30	0.6179	0.3821	0.1179	0.2358	0.62	0.7324	0.2676	0.2324	0.4647

見背面



Percentage points of the chi-square distribution ( $\chi^2_{d,p}$ ) §

d	p													
	0.005	0.01	0.025	0.05	0.10	0.25	0.50	0.75	0.90	0.95	0.975	0.99	0.995	0.999
1	0.0*393*	0.0 <sup>3</sup> 157†	0.0 <sup>3</sup> 982‡	0.00393	0.02	0.10	0.45	1.32	2.71	3.84	5.02	6.63	7.88	10.83
2	0.0100	0.0201	0.0506	0.103	0.21	0.58	1.39	2.77	4.61	5.99	7.38	9.21	10.60	13.81
3	0.0717	0.115	0.216	0.352	0.58	1.21	2.37	4.11	6.25	7.81	9.35	11.34	12.84	16.27
4	0.207	0.297	0.484	0.711	1.06	1.92	3.36	5.39	7.78	9.49	11.14	13.28	14.86	18.47
5	0.412	0.554	0.831	1.15	1.61	2.67	4.35	6.63	9.24	11.07	12.83	15.09	16.75	20.52
6	0.676	0.872	1.24	1.64	2.20	3.45	5.35	7.84	10.64	12.59	14.45	16.81	18.55	22.46
7	0.989	1.24	1.69	2.17	2.83	4.25	6.35	9.04	12.02	14.07	16.01	18.48	20.28	24.32
8	1.34	1.65	2.18	2.73	3.49	5.07	7.34	10.22	13.36	15.51	17.53	20.09	21.95	26.12
9	1.73	2.09	2.70	3.33	4.17	5.90	8.34	11.39	14.68	16.92	19.02	21.67	23.59	27.88
10	2.16	2.56	3.25	3.94	4.87	6.74	9.34	12.55	15.99	18.31	20.48	23.21	25.19	29.59
11	2.60	3.05	3.82	4.57	5.58	7.58	10.34	13.70	17.28	19.68	21.92	24.72	26.76	31.26
12	3.07	3.57	4.40	5.23	6.30	8.44	11.34	14.85	18.55	21.03	23.34	26.22	28.30	32.91
13	3.57	4.11	5.01	5.89	7.04	9.30	12.34	15.98	19.81	22.36	24.74	27.69	29.82	34.53
14	4.07	4.66	5.63	6.57	7.79	10.17	13.34	17.12	21.06	23.68	26.12	29.14	31.32	36.12
15	4.60	5.23	6.27	7.26	8.55	11.04	14.34	18.25	22.31	25.00	27.49	30.58	32.80	37.70
16	5.14	5.81	6.91	7.96	9.31	11.91	15.34	19.37	23.54	26.30	28.85	32.00	34.27	39.25
17	5.70	6.41	7.56	8.67	10.09	12.79	16.34	20.49	24.77	27.59	30.19	33.41	35.72	40.79
18	6.26	7.01	8.23	9.39	10.86	13.68	17.34	21.60	25.99	28.87	31.53	34.81	37.16	42.31
19	6.84	7.63	8.91	10.12	11.65	14.56	18.34	22.72	27.20	30.14	32.85	36.19	38.58	43.82
20	7.43	8.26	9.59	10.85	12.44	15.45	19.34	23.83	28.41	31.41	34.17	37.57	40.00	45.32
21	8.03	8.90	10.28	11.59	13.24	16.34	20.34	24.93	29.62	32.67	35.48	38.93	41.40	46.80
22	8.64	9.54	10.98	12.34	14.04	17.24	21.34	26.04	30.81	33.92	36.78	40.29	42.80	48.27
23	9.26	10.20	11.69	13.09	14.85	18.14	22.34	27.14	32.01	35.17	38.08	41.64	44.18	49.73
24	9.89	10.86	12.40	13.85	15.66	19.04	23.34	28.24	33.20	36.42	39.36	42.98	45.56	51.18
25	10.52	11.52	13.12	14.61	16.47	19.94	24.34	29.34	34.38	37.65	40.65	44.31	46.93	52.62
26	11.16	12.20	13.84	15.38	17.29	20.84	25.34	30.43	35.56	38.89	41.92	45.64	48.29	54.05
27	11.81	12.88	14.57	16.15	18.11	21.75	26.34	31.53	36.74	40.11	43.19	46.96	49.64	55.48
28	12.46	13.56	15.31	16.93	18.94	22.66	27.34	32.62	37.92	41.34	44.46	48.28	50.99	56.89
29	13.12	14.26	16.05	17.71	19.77	23.57	28.34	33.71	39.09	42.56	45.72	49.59	52.34	58.30
30	13.79	14.95	16.79	18.49	20.60	24.48	29.34	34.80	40.26	43.77	46.98	50.89	53.67	59.70
40	20.71	22.16	24.43	26.51	29.05	33.66	39.34	45.62	51.81	55.76	59.34	63.69	66.77	73.40
50	27.99	29.71	32.36	34.76	37.69	42.94	49.33	56.33	63.17	67.50	71.42	76.15	79.49	86.66
60	35.53	37.48	40.48	43.19	46.46	52.29	59.33	66.98	74.40	79.08	83.30	88.38	91.95	99.61
70	43.28	45.44	48.76	51.74	55.33	61.70	69.33	77.58	85.53	90.53	95.02	100.42	104.22	112.32
80	51.17	53.54	57.15	60.39	64.28	71.14	79.33	88.13	96.58	101.88	106.63	112.33	116.32	124.84
90	59.20	61.75	65.65	69.13	73.29	80.62	89.33	98.64	107.56	113.14	118.14	124.12	128.30	137.21
100	67.33	70.06	74.22	77.93	82.36	90.13	99.33	109.14	118.50	124.34	129.56	135.81	140.17	149.45

\*=0.0000393 †=0.000157 ‡=0.000982 §  $\chi^2_{d,p}$  = pth percentile of a  $\chi^2$  distribution with d degrees of freedom.  
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Percentage points of the  $t$  distribution ( $t_{d,p}$ )\*

Degrees of freedom, $d$	$p$								
	0.75	0.8	0.85	0.9	0.95	0.975	0.99	0.995	0.9995
1	1.000	1.376	1.963	3.078	6.314	12.706	31.821	63.657	636.619
2	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	31.598
3	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	12.924
4	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	4.015
17	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.965
18	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.792
23	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.767
24	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.745
25	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.690
28	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.659
30	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.646
40	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.551
60	0.679	0.848	1.046	1.296	1.671	2.000	2.390	2.660	3.460
120	0.677	0.845	1.041	1.289	1.658	1.980	2.358	2.617	3.373
$\infty$	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.291

\*The  $p$ th percentile of a  $t$  distribution with  $d$  degrees of freedom.  
 (Table 5 is taken from Table III of Fisher and Yates: "Statistical Tables for Biological, Agricultural and Medical Research," published by Longman Group Ltd., London (previously published by Oliver and Boyd Ltd., Edinburgh) and by permission of the authors and publishers.)