

一、以下數據為一項人因工程的實驗，用以探討一般人體重(BW; Body Weight)以公斤(kg)為單位與四百米慢跑時間(RT; Run Time)以秒(second)為單位的關係。

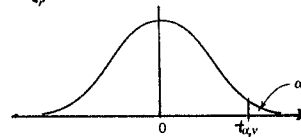
(以下數據純為虛擬，其所有可能的結果或結論，並不代表實際狀況。)

BW(kgs)	RT(Seconds)
59	242
68	269
53	219
58	234
60	237
53	228
64	248
68	255
50	212
70	258

請將題號 (含大標題與小標題) 依序標示於答案卷上，為確保獲得完整分數，作答時務必列出演算過程及式子。

- (1) 試求在 BW 之平均值(Mean) 加減一個標準偏差(Standard Deviation)下，指出所有不在此範圍內之體重觀測值？ (7分)
- (2) 求 BW 之中位數(Median)？ (2分)
- (3) 求 BW 之眾數(Mode)？ (2分)
- (4) 求 BW 之莖葉圖(Stem-and-Leaf Plot)？ (7分)
- (5) 求 RT 之箱形圖(Box Plot)？ (7分)
- (6) 求 BW 與 RT 之相關係數(Correlation Coefficient)？ (7分)
- (7) 試預測一般線性迴歸方程式  $\mu_{RT|BW} = \alpha + \beta BW$ ？ (6分) 其中  $\alpha$  與  $\beta$  為常數
- (8) 試於 0.1 之顯著水準下，檢定  $H_0: \alpha = 0$  vs  $H_1: \alpha \neq 0$ ？ (6分)
- (9) 承(8)試建構斜率  $\beta$  之 90% 信賴區間(Confidence Interval)？ (6分)

Percentage Points  $t_{\alpha, \nu}$  of the  $t$  Distribution



$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}$$

$$\hat{\beta}_1 = \frac{\sum_{i=1}^n y_i x_i - \frac{(\sum_{i=1}^n y_i)(\sum_{i=1}^n x_i)}{n}}{\sum_{i=1}^n x_i^2 - \frac{(\sum_{i=1}^n x_i)^2}{n}}$$

$$s^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}$$

$$r_{xy} = \frac{\sum_{i=1}^n (y_i - \bar{y})(x_i - \bar{x})}{\sqrt{\sum_{i=1}^n (y_i - \bar{y})^2 \sum_{i=1}^n (x_i - \bar{x})^2}}$$

$\nu$	$\alpha$	.40	.25	.10	.05	.025	.01	.005	.0025	.001	.0005
1		.325	1.000	3.078	6.314	12.706	31.821	63.657	127.32	318.31	636.62
2		.289	.816	1.886	2.920	4.303	6.965	9.925	14.089	23.326	31.598
3		.277	.765	1.638	2.353	3.182	4.541	5.841	7.453	10.213	12.924
4		.271	.741	1.533	2.132	2.776	3.747	4.604	5.598	7.173	8.610
5		.267	.727	1.476	2.015	2.571	3.365	4.032	4.773	5.893	6.869
6		.265	.718	1.440	1.943	2.447	3.143	3.707	4.317	5.208	5.959
7		.263	.711	1.415	1.895	2.365	2.998	3.499	4.029	4.785	5.408
8		.262	.706	1.397	1.860	2.306	2.896	3.355	3.833	4.501	5.041
9		.261	.703	1.383	1.833	2.262	2.821	3.250	3.690	4.297	4.781
10		.260	.700	1.372	1.812	2.228	2.764	3.169	3.581	4.144	4.587
11		.260	.697	1.363	1.796	2.201	2.716	3.106	3.497	4.025	4.437
12		.259	.695	1.356	1.782	2.179	2.681	3.055	3.428	3.930	4.318
13		.259	.694	1.350	1.771	2.160	2.650	3.012	3.372	3.852	4.221
14		.258	.692	1.345	1.761	2.145	2.624	2.977	3.326	3.787	4.140
15		.258	.691	1.341	1.753	2.131	2.602	2.947	3.286	3.733	4.073
16		.258	.690	1.337	1.746	2.120	2.583	2.921	3.252	3.686	4.015
17		.257	.689	1.333	1.740	2.110	2.567	2.898	3.222	3.646	3.965
18		.257	.688	1.330	1.734	2.101	2.552	2.878	3.197	3.610	3.922
19		.257	.688	1.328	1.729	2.093	2.539	2.861	3.174	3.579	3.883
20		.257	.687	1.325	1.725	2.086	2.528	2.845	3.153	3.552	3.850

$\nu$  = degrees of freedom.

(背面仍有題目,請繼續作答)

二、 1 請說明下列變數：(8%)

(1) 名義變數 (2) 次序變數 (3) 連續變數 (4) 間斷變數

2 何謂集中量數(measures of central location)? 一般而言, 集中量數包括哪幾種? 請分別說明其使用時機與情況。(7%)

3 何謂變異量數(measures of variation)? 變異量數包括哪幾種? 請分別說明其使用時機與情況。(7%)

4 何謂相對地位量數(measures of relative position)? 相對地位量數主要有哪幾種, 請分別說明其意義及重要性質?(7%)

5 請詳細說明二項分配與常態分配之間的關係?(7%)

6 在常態分配下, 請說明下列公式中, 各變數的實際意義? 包括:  $X, y, N, \sigma$  (7%)

$$y = \frac{N}{\sigma\sqrt{2\pi}} e^{-\frac{(X-\mu)^2}{2\sigma^2}}$$

又上述公式如何簡化為

$$y = \frac{1}{\sqrt{2\pi}} e^{-\frac{z^2}{2}}$$

7 "比西量表"( $\mu=100; \sigma=16$ )上的智商在 52~67 之間的兒童被定義為"輕度智能不足"。依此定義, 試求在常態分配下, 輕度智能不足兒童的百分比約佔多少百分比?(7%)

常態分配表

(續)

z	概率	y	z	概率	y	z	概率	y
.00	.0000	.3989	.50	.1915	.3521	1.00	.3413	.2420
.01	.0040	.3989	.51	.1950	.3503	1.01	.3438	.2395
.02	.0080	.3989	.52	.1985	.3485	1.02	.3461	.2371
.03	.0120	.3988	.53	.2019	.3467	1.03	.3485	.2347
.04	.0160	.3986	.54	.2054	.3448	1.04	.3508	.2323
.05	.0199	.3982	.55	.2088	.3429	1.05	.3531	.2299
.06	.0239	.3982	.56	.2123	.3410	1.06	.3554	.2275
.07	.0279	.3980	.57	.2157	.3391	1.07	.3577	.2251
.08	.0319	.3977	.58	.2190	.3372	1.08	.3599	.2227
.09	.0359	.3973	.59	.2224	.3352	1.09	.3621	.2202
.10	.0398	.3970	.60	.2257	.3332	1.10	.3643	.2179
.11	.0438	.3965	.61	.2291	.3312	1.11	.3665	.2155
.12	.0478	.3961	.62	.2324	.3292	1.12	.3687	.2131
.13	.0517	.3856	.63	.2357	.3271	1.13	.3708	.2107
.14	.0557	.3951	.64	.2389	.3251	1.14	.3729	.2083
.15	.0596	.3945	.65	.2422	.3230	1.15	.3749	.2059
.16	.0636	.3939	.66	.2454	.3209	1.16	.3770	.2036
.17	.0675	.3932	.67	.2486	.3187	1.17	.3790	.2012
.18	.0714	.3925	.68	.2517	.3166	1.18	.3810	.1989
.19	.0753	.3918	.69	.2549	.3144	1.19	.3830	.1965
.20	.0793	.3910	.70	.2580	.3123	1.20	.3849	.1942
.21	.0832	.3902	.71	.2611	.3101	1.21	.3869	.1919
.22	.0871	.3894	.72	.2642	.3079	1.22	.3888	.1895
.23	.0910	.3885	.73	.2673	.3056	1.23	.3907	.1872
.24	.0948	.3876	.74	.2704	.3034	1.24	.3925	.1849
.25	.0987	.3867	.75	.2734	.3011	1.25	.3944	.1826
.26	.1026	.3857	.76	.2764	.2989	1.26	.3962	.1804
.27	.1064	.3847	.77	.2794	.2966	1.27	.3980	.1781
.28	.1103	.3836	.78	.2823	.2943	1.28	.3997	.1758
.29	.1141	.3825	.79	.2852	.2920	1.29	.4015	.1736
.30	.1179	.3814	.80	.2881	.2897	1.30	.4032	.1714
.31	.1217	.3802	.81	.2910	.2874	1.31	.4049	.1691
.32	.1255	.3790	.82	.2939	.2850	1.32	.4066	.1669
.33	.1293	.3778	.83	.2967	.2827	1.33	.4082	.1647
.34	.1331	.3765	.84	.2995	.2803	1.34	.4099	.1626
.35	.1368	.3752	.85	.3023	.2780	1.35	.4115	.1604
.36	.1406	.3739	.86	.3051	.2756	1.36	.4131	.1582
.37	.1443	.3725	.87	.3078	.2732	1.37	.4147	.1561
.38	.1480	.3712	.88	.3106	.2709	1.38	.4162	.1539
.39	.1517	.3697	.89	.3133	.2685	1.39	.4177	.1518
.40	.1555	.3683	.90	.3159	.2661	1.40	.4192	.1497
.41	.1591	.3668	.91	.3186	.2637	1.41	.4207	.1476
.42	.1628	.3653	.92	.3212	.2613	1.42	.4222	.1455
.43	.1664	.3637	.93	.3238	.2589	1.43	.4236	.1435
.44	.1700	.3621	.94	.3264	.2565	1.44	.4251	.1415
.45	.1736	.3605	.95	.3289	.2541	1.45	.4265	.1394
.46	.1772	.3589	.96	.3315	.2516	1.46	.4279	.1374
.47	.1808	.3572	.97	.3340	.2492	1.47	.4292	.1354
.48	.1844	.3555	.98	.3365	.2468	1.48	.4306	.1334
.49	.1879	.3538	.99	.3389	.2444	1.49	.4319	.1315
.50	.1915	.3521	1.00	.3413	.2420	1.50	.4332	.1295

z	概率	y	z	概率	y	z	概率	y
1.50	.4332	.1295	2.00	.4772	.0540	2.50	.4933	.0175
1.51	.4345	.1276	2.01	.4778	.0529	2.51	.4940	.0171
1.52	.4357	.1257	2.02	.4783	.0519	2.52	.4947	.0167
1.53	.4370	.1238	2.03	.4788	.0508	2.53	.4954	.0163
1.54	.4382	.1219	2.04	.4793	.0498	2.54	.4961	.0159
1.55	.4394	.1200	2.05	.4798	.0488	2.55	.4968	.0154
1.56	.4406	.1182	2.06	.4803	.0478	2.56	.4975	.0151
1.57	.4418	.1163	2.07	.4808	.0468	2.57	.4982	.0147
1.58	.4429	.1145	2.08	.4812	.0459	2.58	.4989	.0143
1.59	.4441	.1127	2.09	.4817	.0449	2.59	.4995	.0139
1.60	.4452	.1109	2.10	.4821	.0440	2.60	.4993	.0136
1.61	.4463	.1092	2.11	.4825	.0431	2.61	.4995	.0132
1.62	.4474	.1074	2.12	.4830	.0422	2.62	.4996	.0129
1.63	.4484	.1057	2.13	.4834	.0413	2.63	.4997	.0125
1.64	.4495	.1040	2.14	.4838	.0404	2.64	.4998	.0122
1.65	.4505	.1023	2.15	.4842	.0396	2.65	.4999	.0119
1.66	.4515	.1006	2.16	.4846	.0387	2.66	.4999	.0115
1.67	.4525	.0989	2.17	.4850	.0379	2.67	.4999	.0113
1.68	.4535	.0973	2.18	.4854	.0371	2.68	.4999	.0110
1.69	.4545	.0957	2.19	.4857	.0363	2.69	.4999	.0107
1.70	.4554	.0940	2.20	.4861	.0355	2.70	.4999	.0104
1.71	.4564	.0925	2.21	.4864	.0347	2.71	.4999	.0101
1.72	.4573	.0909	2.22	.4868	.0339	2.72	.4999	.0099
1.73	.4582	.0893	2.23	.4871	.0332	2.73	.4999	.0096
1.74	.4591	.0878	2.24	.4875	.0325	2.74	.4999	.0093
1.75	.4599	.0863	2.25	.4878	.0317	2.75	.4999	.0091
1.76	.4608	.0848	2.26	.4881	.0310	2.76	.4999	.0088
1.77	.4616	.0833	2.27	.4884	.0303	2.77	.4999	.0086
1.78	.4625	.0818	2.28	.4887	.0297	2.78	.4999	.0084
1.79	.4633	.0804	2.29	.4890	.0290	2.79	.4999	.0081
1.80	.4641	.0790	2.30	.4893	.0283	2.80	.4999	.0079
1.81	.4649	.0775	2.31	.4896	.0277	2.81	.4999	.0077
1.82	.4656	.0761	2.32	.4898	.0270	2.82	.4999	.0075
1.83	.4664	.0748	2.33	.4901	.0264	2.83	.4999	.0073
1.84	.4671	.0734	2.34	.4904	.0258	2.84	.4999	.0071
1.85	.4678	.0721	2.35	.4905	.0252	2.85	.4999	.0069
1.86	.4686	.0707	2.36	.4907	.0246	2.86	.4999	.0067
1.87	.4693	.0694	2.37	.4911	.0241	2.87	.4999	.0065
1.88	.4699	.0681	2.38	.4913	.0235	2.88	.4999	.0063
1.89	.4706	.0669	2.39	.4916	.0229	2.89	.4999	.0061
1.90	.4713	.0656	2.40	.4918	.0224	2.90	.4999	.0060
1.91	.4719	.0644	2.41	.4920	.0219	2.91	.4999	.0058
1.92	.4726	.0632	2.42	.4922	.0213	2.92	.4999	.0056
1.93	.4732	.0620	2.43	.4925	.0208	2.93	.4999	.0055
1.94	.4738	.0608	2.44	.4927	.0203	2.94	.4999	.0053
1.95	.4744	.0596	2.45	.4929	.0198	2.95	.4999	.0051
1.96	.4750	.0584	2.46	.4931	.0194	2.96	.4999	.0050
1.97	.4756	.0573	2.47	.4932	.0189	2.97	.4999	.0048
1.98	.4761	.0562	2.48	.4934	.0184	2.98	.4999	.0047
1.99	.4767	.0551	2.49	.4936	.0180	2.99	.4999	.0046
2.00	.4772	.0540	2.50	.4938	.0175	3.00	.4987	.0044

(續)

z	概率	y	z	概率	y	z	概率	y
3.00	.4987	.0044	3.40	.4997	.0012	3.80	.4999	.0003
3.01	.4987	.0043	3.41	.4997	.0012	3.81	.4999	.0003
3.02	.4987	.0042	3.42	.4997	.0012	3.82	.4999	.0003
3.03	.4988	.0040	3.43	.4997	.0011	3.83	.4999	.0003
3.04	.4988	.0039	3.44	.4997	.0011	3.84	.4999	.0003
3.05	.4989	.0038	3.45	.4997	.0010	3.85	.4999	.0002
3.06	.4989	.0037	3.46	.4997	.0010	3.86	.4999	.0002
3.07	.4989	.0036	3.47	.4997	.0010	3.87	.4999	.0002
3.08	.4990	.0035	3.48	.4997	.0009	3.88	.4999	.0002
3.09	.4990	.0034	3.49	.4998	.0009	3.89	.4999	.0002
3.10	.4990	.0033	3.50	.4998	.0009	3.90	.4999	.0002
3.11	.4991	.0032	3.51	.4998	.0008	3.91	.4999	.0002
3.12	.4991	.0031	3.52	.4998	.0008	3.92	.4999	.0002
3.13	.4991	.0030	3.53	.4998	.0008	3.93	.4999	.0002
3.14	.4992	.0029	3.54	.4998	.0008	3.94	.4999	.0002
3.15	.4992	.0028	3.55	.4998	.0007	3.95	.4999	.0002
3.16	.4992	.0027	3.56	.4998	.0007	3.96	.4999	.0002
3.17	.4992	.0026	3.57	.4998	.0007	3.97	.4999	.0002
3.18	.4993	.0025	3.58	.4998	.0007	3.98	.4999	.0002
3.19	.4993	.0025	3.59	.4998	.0006	3.99	.4999	.0001
3.20	.4993	.0024	3.60	.4998	.0006	4.00	.4999	.0001
3.21	.4993	.0023	3.61	.4998	.0006	4.05	.4999	.0001
3.22	.4994	.0022	3.62	.4999	.0006	4.10	.4999	.00009
3.23	.4994	.0022	3.63	.4999	.0005	4.20	.4999	.00006
3.24	.4994	.0021	3.64	.4999	.0005	4.30	.4999	.00004
3.25	.4994	.0020	3.65	.4999	.0005	4.40	.4999	.00003
3.26	.4994	.0020	3.66	.4999	.0005	4.50	.4999	.00002
3.27	.4995	.0019	3.67	.4999	.0005	4.60	.4999	.00001
3.28	.4995	.0018	3.68	.4999	.0005	4.70	.4999	.000006
3.29	.4995	.0018	3.69	.4999	.0004	4.80	.4999	.000004
3.30	.4995	.0017	3.70	.4999	.0004	4.90	.4999	.000002
3.31	.4995	.0017	3.71	.4999	.0004	5.00	.4999	.000001
3.32	.4995	.0016	3.72	.4999	.0004			
3.33	.4996	.0016	3.73	.4999	.0004			
3.34	.4996	.0015	3.74	.4999	.0004			
3.35	.4996	.0015	3.75	.4999	.0004			
3.36	.4996	.0014	3.76	.4999	.0003			
3.37	.4996	.0014	3.77	.4999	.0003			
3.38	.4996	.0013	3.78	.4999	.0003			
3.39	.4997	.0013	3.					