UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama
Sidang 1989/1990

Oktober/November 1989

DTM 323/2 Biostatistik

Masa: [2 jam]

Bahagian A adalah **Wajib** dan mengandungi **DUA** soalan.

Tiap-tiap soalan bernilai 20 markah.

Bahagian B. DUA soalan mesti dijawab di mana tiap-tiap soalan bernilai 30 markah.

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Bahgian A (Wajib)

1. (a) Dalam satu eksperimen kacukan bunga raya, anda telah diberitahu bahawa hasil bunga yang akan didapati ialah 90% merah dan 10% kuning. Jika anda mendapat 4 kuntum bunga hasil daripada kacukan ini apakah kemungkinan satu diantaranya berwarna kuning?

(b) Berbalik kepada soalan (a), jika anda mendapat 1000 kuntum hasil daripada kacukan ini, apakah kemungkinan 120 atau kurang berwarna kuning.

(20 markah)

2. Kandungan hidrokarbon di kawasan bandar George Town telah ditentukan selama 10 hari. Nilai yang didapati (dalam unit $\mu g/m^3$) ialah:-

Hari	1	1	3	4	5	6	7	8	9	10
Hidrokarbon	108	118	89	71	66	33	88	76	68	96

(a) Apakah selang keyakinan 95% bagi min kandungan hidrokarbon di sekitar bandar George Town?

(b) Jika min kandungan hidrokarbon di sekitar bandar George Town bagi kajian-kajian terdahulu ialah 79 $\mu g/m^3$, apa dapat anda simpulkan tentang pencemaran udara di bandar tersebut?.

(20 markah)

Bahagian B (Jawab DUA soalan dari yang berikut:)

3. Sejak lebih kurang 2 tahun lepas, Stesen Luar Kajihayat telah menjalankan penyelidikan pemuliharaan penyu. Dalam penyelidikan ini telur penyu hijau (Chelonia mydas) telah dikutip di Pantai Keracut, Pantai Teluk Kampe dan Pantai Teluk Kertang. Jumlah telur mengikut sarang adalah seperti berikut.

Sarang	Pantai Keracut	Teluk Kampe	Teluk Kertang
1	90	100	65
2	63	90	50
3	87	60	72
4	110	136	60
5	74	84	60

Adakah jumlah telur penyu per sarang sama atau berbeza di antara tiga pantai ini?

(30 markah)

4. Sejenis ubat dikatakan boleh mententeramkan seseekor anjing dan juga menurunkan kadar pengaliran darahnya. Sebanyak 14 ekor anjing telah dikaji kadar aliran darah dari ventrikel kirinya (ml per min. per 100 gm ventrikel kiri) ditentukan sejam sebelum dan selepas diberi ubat tadi. Datanya adalah seperti berikut:

	Anjing													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sebelum ubat	125	52	91	97	53	71	128	71	63	66	107	144	106	82
Selepas ubat	79	82	47	58	33	66	82	84	27	47	38	95	73	30

Jalankan ujian statistik bagi menetukan sama ada dakwaan berkenaan ubat itu betul atau tidak.

(30 markah)

5. Satu eksperimen akuakultur telah dijalankan di mana 1000 ekor anak ikan keli telah dilepaskan ke dalam dua kolam ternakan yang agak serupa saiznya. Penyelidik ingin tahu adakah kedua kolam ini memberi kesan yang sama atau tidak terhadap pembesaran ikan tadi. Olahan yang sama telah diberi kepada kedua-dua kolam seperti jenis makanan, jumlah makanan, jumlah air dan sebagainya. Selepas 6 bulan, 6 ekor ikan keli telah ditangkap dari kolam A dan 6 ekor lagi dari kolam B. Datanya adalah seperti berikut:

	Berat ikan (Kg)					
Kolam A	0.561	0.472	0.281	0.512	0.339	0.450
Kolam B	0.425	0.318	0.510	0.211	0.536	0.440

Gunakan kaedah nonparametrik untuk menganalisis data ini. Apakah kesimpulan yang dapat dibuat?

(30 markah)

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FORMULA YANG MUNGKIN DIPERLUKAN

A. AM

(i) $\frac{1}{n-1}\left[\Sigma Y_i^2 - \frac{(\Sigma Y_i)^2}{n}\right]$

(ii) $\frac{1}{n-1}\left[\Sigma d_i^2 - \frac{(\Sigma d_i)^2}{n}\right]$

(iii) $\bar{y} \pm 2\sigma\bar{y}$

(iv) $\bar{y} \pm Z\alpha/_2\sigma\bar{y}$

(v) $\bar{y} \pm Z\alpha\sigma\bar{y}$

(vi) $\bar{y} \pm t\alpha\sigma\bar{y}$

(vii) $\bar{y} \pm t\alpha/_2\sigma\bar{y}$

B. ANOVA

$TSS = \Sigma\Sigma Y_{ij}^2 - \frac{G^2}{n}$

$SSB = \frac{\Sigma T_i^2}{n_i} - \frac{G^2}{n}$

C. BINOMIAL

(i) $P(y) = \frac{n!}{y!(n-y)!} p^y q^{n-y}$

(ii) $\mu = np$

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(iii) $\sigma = \sqrt{npq}$

(iv) $\hat{p} = y/n$

(v) $\sigma\hat{p} = \sqrt{\frac{pq}{n}}$

D. REGRASI

(i) $SSxx = \Sigma x^2 - \frac{(\Sigma x)^2}{n}$

(ii) $SSxy = \Sigma xy - \frac{(\Sigma x)(\Sigma y)}{n}$

E. UJIAN MANN-WHITNEY

$$Z = \frac{U - \frac{n_1 n_2}{2}}{\sqrt{\frac{n_1 n_2 (n+1)}{12}}}$$

$$\sigma u = \sqrt{\frac{n_1 n_2}{N_1^2 - N} \cdot \frac{N^3 - N - \Sigma T}{12}}$$

$$U = n_1 n_2 + \frac{n_1 (n_1 + 1)}{2} - R_1$$

$$U' = n_1 n_2 - U$$

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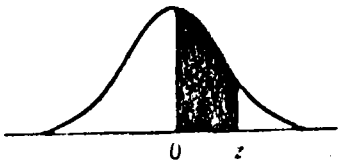
Jadual 1:

Kawasan Kelok Normal



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

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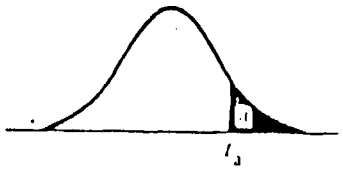
Jadual 2: Titik Peratusan Taburan t



df	a = .10	a = .05	a = .025	a = .010	a = .005
1	3.078	6.314	12.706	31.821	63.657
2	1.886	2.920	4.303	6.965	9.925
3	1.638	2.353	3.182	4.541	5.841
4	1.533	2.132	2.776	3.747	4.604
5	1.476	2.015	2.571	3.365	4.032
6	1.440	1.943	2.447	3.143	3.707
7	1.415	1.895	2.365	2.998	3.499
8	1.397	1.860	2.306	2.896	3.355
9	1.383	1.833	2.262	2.821	3.250
10	1.372	1.812	2.228	2.764	3.169
11	1.363	1.796	2.201	2.718	3.106
12	1.356	1.782	2.179	2.681	3.055
13	1.350	1.771	2.160	2.650	3.012
14	1.345	1.761	2.145	2.624	2.977
15	1.341	1.753	2.131	2.602	2.947
16	1.337	1.746	2.120	2.583	2.921
17	1.333	1.740	2.110	2.567	2.898
18	1.330	1.734	2.101	2.552	2.878
19	1.328	1.729	2.093	2.539	2.861
20	1.325	1.725	2.086	2.528	2.845
21	1.323	1.721	2.080	2.518	2.831
22	1.321	1.717	2.074	2.508	2.819
23	1.319	1.714	2.069	2.500	2.807
24	1.318	1.711	2.064	2.492	2.797
25	1.316	1.708	2.060	2.485	2.787
26	1.315	1.706	2.056	2.479	2.779
27	1.314	1.703	2.052	2.473	2.771
28	1.313	1.701	2.048	2.467	2.763
29	1.311	1.699	2.045	2.462	2.756
inf.	1.282	1.645	1.960	2.326	2.576

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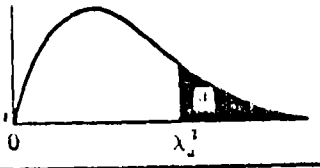
Jadual 3:

Titik Peratusan Taburan Chi-Gandadua



df	$\alpha = .995$	$\alpha = .990$	$\alpha = .975$	$\alpha = .950$	$\alpha = .900$
1	0.0000393	0.0001571	0.0009821	0.0039321	0.0157908
2	0.0100251	0.0201007	0.0506356	0.102587	0.210720
3	0.0717212	0.114832	0.215795	0.351846	0.584375
4	0.206990	0.297110	0.484419	0.710721	1.063623
5	0.411740	0.554300	0.831211	1.145476	1.61031
6	0.675727	0.872085	1.237347	1.63539	2.20413
7	0.989265	1.239043	1.68987	2.16735	2.83311
8	1.344419	1.646482	2.17973	2.73264	3.48954
9	1.734926	2.087912	2.70039	3.32511	4.16816
10	2.15585	2.55821	3.24697	3.94030	4.86518
11	2.60321	3.05347	3.81575	4.57481	5.57779
12	3.07382	3.57056	4.40379	5.22603	6.30380
13	3.56503	4.10691	5.00874	5.89186	7.04150
14	4.07468	4.66043	5.62872	6.57063	7.78953
15	4.60094	5.22935	6.26214	7.26094	8.54675
16	5.14224	5.81221	6.90766	7.96164	9.31223
17	5.69724	6.40776	7.56418	8.67176	10.0852
18	6.26481	7.01491	8.23075	9.39046	10.8649
19	6.84398	7.63273	8.90655	10.1170	11.6509
20	7.43386	8.26040	9.59083	10.8508	12.4426
21	8.03366	8.89720	10.28293	11.5913	13.2396
22	8.64272	9.54249	10.9823	12.3380	14.0415
23	9.26042	10.19567	11.6885	13.0905	14.8479
24	9.88623	10.8564	12.4011	13.8484	15.6587
25	10.5197	11.5240	13.1197	14.6114	16.4734
26	11.1603	12.1981	13.8439	15.3791	17.2919
27	11.8076	12.8786	14.5733	16.1513	18.1138
28	12.4613	13.5648	15.3079	16.9279	18.9392
29	13.1211	14.2565	16.0471	17.7083	19.7677
30	13.7867	14.9535	16.7908	18.4926	20.5992
40	20.7065	22.1643	24.4331	26.5093	29.0505
50	27.9907	29.7067	32.3574	34.7642	37.6886
60	35.5346	37.4848	40.4817	43.1879	46.4589
70	43.2752	45.4418	48.7576	51.7393	55.3290
80	51.1720	53.5400	57.1532	60.3915	64.2778
90	59.1963	61.7541	65.6466	69.1260	73.2912
100	67.3276	70.0648	74.2219	77.9295	82.3581

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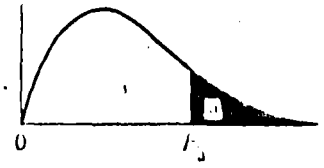
Jadual 4:

Titik Peratusan Taburan F



Degrees of freedom ($\alpha = .05$)

df_2 \ df_1	1	2	3	4	5	6	7	8	9
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88

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Jadual 5:

Nilai Genting Bagi Taburan U Mann-Whitney

		α(2):	0.20	0.10	0.05	0.02	0.01	0.005	0.002	0.001
		α(1):	0.10	0.05	0.025	0.01	0.005	0.0025	0.001	0.0005
n_1	n_2									
4	32		91	98	104	110	114	117	120	122
	33		94	101	107	113	117	120	124	126
	34		96	104	110	116	120	124	127	130
	35		99	107	113	120	124	127	131	133
	36		102	110	116	123	127	131	135	137
	37		105	113	119	126	131	134	138	141
	38		107	116	122	130	134	138	142	144
	39		110	116	125	133	137	141	145	148
4	40		113	121	129	136	141	145	149	152
5	5		20	21	23	24	25	--	--	--
	6		23	25	27	28	29	30	--	--
	7		26	29	30	32	34	35	--	--
	8		30	32	34	36	38	39	40	--
	9		33	36	38	40	42	43	44	45
	10		37	39	42	44	46	47	48	50
	11		40	43	46	48	50	52	53	54
	12		43	47	49	52	54	56	58	59
	13		47	50	53	56	58	60	62	63
	14		50	54	57	60	63	64	67	68
	15		53	57	61	64	67	69	71	72
	16		57	61	65	68	71	73	75	77
	17		60	65	68	72	75	77	80	81
	18		63	68	72	76	79	81	84	86
	19		67	72	76	80	83	86	88	90
	20		70	75	80	84	87	90	93	95
	21		73	79	83	88	91	94	97	99
	22		77	82	87	92	96	98	102	104
	23		80	86	91	96	100	103	106	108
	24		84	90	95	100	104	107	110	113
	25		87	93	98	104	108	111	115	117
	26		90	97	102	108	112	115	119	121
	27		94	100	106	112	116	120	123	126
	28		97	104	110	116	120	124	128	130
	29		100	107	113	120	124	128	132	135
	30		104	111	117	124	128	132	136	139
	31		107	115	121	128	133	136	141	144
	32		110	118	125	132	137	141	145	148
	33		114	122	128	136	141	145	150	153
	34		117	125	132	140	145	149	154	157
	35		120	128	136	144	149	153	158	161
	36		124	132	140	148	153	158	163	166
	37		127	136	144	152	157	162	167	170
	38		130	140	147	156	161	166	171	175
	39		134	143	151	160	165	170	176	179
5	40		137	147	155	164	169	174	180	184
6	6		27	29	31	33	34	35	--	--
	7		29	34	36	38	39	40	42	--
6	8		35	38	40	42	44	45	47	48

. . .12/-

Jadual 6:

Nilai Genting Bagi Ujian Pangkat Bertanda Wilcoxon

$n = 5(1)50$

One-sided	*Two-sided*	$n = 5$	$n = 6$	$n = 7$	$n = 8$	$n = 9$	$n = 10$	$n = 11$	$n = 12$	$n = 13$	$n = 14$	$n = 15$	$n = 16$
.05	.10	1	2	4	6	8	11	14	17	21	26	30	36
.025	.05		1	2	4	6	8	11	14	17	21	25	30
.01	.02			0	2	3	5	7	10	13	16	20	24
.005	.01				0	2	3	5	7	10	13	16	19

		$n = 17$	$n = 18$	$n = 19$	$n = 20$	$n = 21$	$n = 22$	$n = 23$	$n = 24$	$n = 25$	$n = 26$	$n = 27$	$n = 28$
.05	.10	41	47	54	60	68	75	83	92	101	110	120	130
.025	.05	35	40	46	52	59	66	73	81	90	98	107	117
.01	.02	28	33	38	43	49	56	62	69	77	85	93	102
.005	.01	23	28	32	37	43	49	55	61	68	76	84	92

		$n = 29$	$n = 30$	$n = 31$	$n = 32$	$n = 33$	$n = 34$	$n = 35$	$n = 36$	$n = 37$	$n = 38$	$n = 39$
.05	.10	141	152	163	175	188	201	214	228	242	256	271
.025	.05	127	137	148	159	171	183	195	208	222	235	250
.01	.02	111	120	130	141	151	162	174	186	198	211	224
.005	.01	100	109	118	128	138	149	160	171	183	195	208

		$n = 40$	$n = 41$	$n = 42$	$n = 43$	$n = 44$	$n = 45$	$n = 46$	$n = 47$	$n = 48$	$n = 49$	$n = 50$
.05	.10	287	303	319	336	353	371	389	408	427	446	466
.025	.05	264	279	295	311	327	344	361	379	397	415	434
.01	.02	238	252	267	281	297	313	329	345	362	380	398
.005	.01	221	234	248	262	277	292	307	323	339	356	373

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