UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama
Sidang 1991/1992

Oktober/November 1991

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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(DTM 323/2)

Bahagian A (Wajib)

1. (a) Sekeping duit syiling yang seimbang dilambung lima kali. Cari kebarangkalian bahawa dalam lima lambungan itu:

(i) Tiada kepala didapati

(ii) 1 kepala dan 4 bunga didapati

(iii) Sekurangkurangnya 3 kepala didapati

(10 markah)

(b) Dalam satu penghantaran telur, min bilangan telur yang pecah ialah 6. Dengan menganggap bahawa bilangan telur yang pecah mengikut taburan Poisson, apakah kebarangkalian:

(i) Tiada telur yang pecah

(ii) Lebih daripada 3 telur yang pecah

(10 markah)

2. Seorang penyelidik percaya bahawa min jumlah luas tanah yang ditanam dengan sayuran adalah kurang daripada 6 ekar. Penyelidik itu mengirimkan beberapa soalan kepada 25 orang petani meminta mereka melaporkan jumlah luas tanah yang ditanam dengan sayuran. Min sampel dan sisihan piawai sampel tersebut ialah 5 dan 1.5 ekar masing-masing. Pada paras keertian 0.05, adakah data yang dikumpul oleh penyelidik itu menyokong kepercayaannya? Lakukan ujian statistik untuk menerangkan jawapan anda.

(20 markah)

Bahagian B (Jawab DUA soalan dari yang berikut:-)

3. Nelayan-nelayan di sepanjang Sungai Siput mengadu bahawa pencemaran air sungai telah menyebabkan banyak ikan mati. Pakar-pakar statistik telah mengambil ukuran-ukuran aras pencemaran air Sungai Siput dan koleksi data adalah seperti berikut:

45	86	53	86	39	47	50	68
76	49	81	75	84	59	52	55
82	63	90	76	72	62	62	46
66	74	56	49	92	54	49	78
87	85	38	40	53	76	71	84
62	48	82	52	59	70	80	82
57	55	75	64	72	81	86	71
69	70	69	82	66	86	65	57
79	89	57	76	78	64	53	67
72	77	72	51	57	75	49	60

Pencemaran air dengan ukuran 50 dianggap merbahaya kepada ikan.

(a) Bina suatu jadual kekerapan terkumpul dengan menggunakan 35 sebagai had bawah selang kelas pertama.

(10 markah)

(b) Bina suatu jadual kekerapan melonggok 'lebih daripada'

(10 markah)

(c) Lukis poligon kekerapan melonggok 'lebih daripada'

(5 markah)

...4/-

(d) Apakah peratusan data yang menunjukkan kedudukan merbahaya kepada ikan di Sungai Siput?

(5 markah)

4. Berat (kg) 8 ekor ikan yang dipilih secara rawak diukur seperti berikut:

1.13	1.20	1.10	1.30	1.05
1.20	1.40	1.35		

Hitung min dan varians populasi.

Anggapkan berat ikan itu mengikut taburan normal dengan varians 0.00154 kg^2. Ujikan pada paras keertian 3% bahawa min populasi ikan adalah 1.20 kg bertentangan dengan hipotesis bahawa min populasi melebihi 1.20 kg.

(30 markah)

...5/-

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5.

Spesies A Y_1	Spesies B Y_2
3.81	5.22
4.18	5.08
3.78	4.74
4.07	4.01
3.88	4.69
4.33	4.39
3.29	4.87
4.13	4.29
3.38	4.42
4.22	4.85
3.64	

$\Sigma y_1 = 46.45$ $\Sigma y_2 = 46.56$

$\Sigma y_1^2 = 180.9961$ $\Sigma y_1^2 = 218.0506$

Data di atas menunjukkan panjang gigi geraham dua spesies Hyopsodus.

Ujikan sama ada terdapat perbezaan panjang gigi geraham di antara dua spesies tersebut?

(30 markah)

...6/-

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Formula yang mungkin diperlukan

A. AM

(i) $$\frac{\Sigma x^2-\frac{(\Sigma x)^2}{n}}{n-1}$$

(ii) $$\frac{\Sigma x^2-\frac{(\Sigma x)^2}{n}}{n(n-1)}$$

B. UJIAN STATISTIK t dan z bagi satu sampel

$$t = \frac{\bar{x}-\mu}{s/\sqrt{n}} \qquad z = \frac{\bar{x}-\mu}{s/\sqrt{n}}$$

C. UJIAN STATISTIK t bagi 2 sampel

(i) $$S_p^2 = \frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{n_1+n_2-2}$$

(ii) $$t = \frac{\bar{x}_1-\bar{x}_2-0}{S_p\left(\frac{1}{n_1}+\frac{1}{n_2}\right)^{\frac{1}{2}}}$$

(iii) $$S_d^2 = \frac{n\Sigma d^2-(\Sigma d)^2}{n(n-1)}$$

(iv) $$t = \frac{\bar{d}-0}{S_d/\sqrt{n}}$$

...7/-

D. BINOMIAL

(i) $\binom{n}{x} = \frac{n!}{x!(n-x)!}$

(ii) $P(x) = \binom{n}{x} p^x q^{n-x}$

E. POISSON

(i) $P(x=k) = \frac{\lambda^x e^{-\lambda}}{x!}$

(ii) $\lambda = NP$

F. KORELASI DAN REGRESI

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

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

(iii) $\frac{\Sigma xy - \frac{(\Sigma x)(\Sigma y)}{n}}{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}$

(iv) $\frac{\Sigma xy - \frac{(\Sigma x)(\Sigma y)}{n}}{\left\{\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right]\left[\Sigma y^2 - \frac{(\Sigma y)^2}{n}\right]\right\}^{\frac{1}{2}}}$

(v) $t = \frac{r-0}{\left(\frac{1-r^2}{n-2}\right)^{\frac{1}{2}}}$

G. ANOVA

$TSS = \Sigma\Sigma Y_{i,j}^2 - \frac{G^2}{n}$

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

8/-...

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Jadual 1

Values of $e^{-\lambda}$ for the Poisson distribution

$(0 < \lambda < 1)$

λ	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09
0·0	1·0000	·9900	·9802	·9704	·9608	·9512	·9418	·9324	·9231	·9139
0·1	·9048	·8958	·8869	·8781	·8694	·8607	·8521	·8437	·8353	·8270
0·2	·8187	·8106	·8025	·7945	·7866	·7788	·7711	·7634	·7558	·7483
0·3	·7408	·7334	·7261	·7189	·7118	·7047	·6977	·6907	·6839	·6771
0·4	·6703	·6636	·6570	·6505	·6440	·6376	·6313	·6250	·6188	·6126
0·5	·6065	·6005	·5945	·5886	·5827	·5770	·5712	·5655	·5599	·5543
0·6	·5488	·5434	·5379	·5326	·5273	·5220	·5169	·5117	·5066	·5016
0·7	4966	·4916	·4868	·4819	·4771	·4724	·4677	·4630	·4584	·4538
0·8	·4493	·4449	·4404	·4360	·4317	·4274	·4232	·4190	·4148	·4107
0·9	·4066	·4025	·3985	·3946	·3906	·3867	·3829	·3791	·3753	·3716

$(\lambda = 1, 2, 3, \ldots, 10)$

λ	1	2	3	4	5	6	7	8	9	10
$e^{-\lambda}$	·36788	·13534	·04979	·01832	·006738	·002479	·000912	·000335	·000123	·000045

To calculate values of $e^{-\lambda}$ for other values of λ use the law of exponents. For instance, $e^{-1\cdot55} = (e^{-1\cdot00})(e^{-0\cdot55}) = (\cdot36788)(\cdot5770) = \cdot2123$.

. . . 9/-

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Jadual 2

Binomial Probabilities

n	k	p = .05	.10	.15	.20	.25	.30	.35	.40	.45	.50
1	0	.9500	.9000	.8500	.8000	.7500	.7000	.6500	.6000	.5500	.5000
	1	.0500	.1000	.1500	.2000	.2500	.3000	.3500	.4000	.4500	.5000
2	0	.9025	.8100	.7225	.6400	.5625	.4900	.4225	.3600	.3025	.2500
	1	.0950	.1800	.2550	.3200	.3750	.4200	.4550	.4800	.4950	.5000
	2	.0025	.0100	.0225	.0400	.0625	.0900	.1225	.1600	.2025	.2500
3	0	.8574	.7290	.6141	.5120	.4219	.3430	.2746	.2160	.1664	.1250
	1	.1354	.2430	.3251	.3840	.4219	.4410	.4436	.4320	.4084	.3750
	2	.0071	.0270	.0574	.0960	.1406	.1890	.2389	.2880	.3341	.3750
	3	.0001	.0010	.0034	.0080	.0156	.0270	.0429	.0640	.0911	.1250
4	0	.8145	.6561	.5220	.4096	.3164	.2401	.1785	.1296	.0915	.0625
	1	.1715	.2916	.3685	.4096	.4219	.4116	.3845	.3456	.2995	.2500
	2	.0135	.0486	.0975	.1536	.2109	.2646	.3105	.3456	.3675	.3750
	3	.0005	.0036	.0115	.0256	.0469	.0756	.1115	.1536	.2005	.2500
	4	.0000	.0001	.0005	.0016	.0039	.0081	.0150	.0256	.0410	.0625
5	0	.7738	.5905	.4437	.3277	.2373	.1681	.1160	.0778	.0503	.0312
	1	.2036	.3280	.3915	.4096	.3955	.3602	.3124	.2592	.2059	.1562
	2	.0214	.0729	.1382	.2048	.2637	.3087	.3364	.3456	.3369	.3125
	3	.0011	.0081	.0244	.0512	.0879	.1323	.1811	.2304	.2757	.3125
	4	.0000	.0004	.0022	.0064	.0146	.0284	.0488	.0768	.1128	.1562
	5	.0000	.0000	.0001	.0003	.0010	.0024	.0053	.0102	.0185	.0312
6	0	.7351	.5314	.3771	.2621	.1780	.1176	.0754	.0467	.0277	.0156
	1	.2321	.3543	.3993	.3932	.3560	.3025	.2437	.1866	.1359	.0938
	2	.0305	.0984	.1762	.2458	.2966	.3241	.3280	.3110	.2780	.2344
	3	.0021	.0146	.0415	.0819	.1318	.1852	.2355	.2765	.3032	.3125
	4	.0001	.0012	.0055	.0154	.0330	.0595	.0951	.1382	.1861	.2344
	5	.0000	.0001	.0004	.0015	.0044	.0102	.0205	.0369	.0609	.0938
	6	.0000	.0000	.0000	.0001	.0002	.0007	.0018	.0041	.0083	.0516
7	0	.6983	.4783	.3206	.2097	.1335	.0824	.0490	.0280	.0152	.0078
	1	.2573	.3720	.3960	.3670	.3115	.2471	.1848	.1306	.0872	.0547
	2	.0406	.1240	.2097	.2753	.3115	.3177	.2985	.2613	.2140	.1641
	3	.0036	.0230	.0617	.1147	.1730	.2269	.2679	.2903	.2918	.2734
	4	.0002	.0026	.0109	.0287	.0577	.0972	.1442	.1935	.2388	.2734
	5	.0009	.0002	.0012	.0043	.0115	.0250	.0466	.0774	.1172	.1641
	6	.0000	.0000	.0001	.0004	.0013	.0036	.0084	.0172	.0320	.0547
	7	.0000	.0000	.0000	.0000	.0001	.0002	.0006	.0016	.0037	.0078
8	0	.6634	.4305	.2725	.1678	.1001	.0576	.0319	.0168	.0084	.0039
	1	.2793	.3826	.3847	.3355	.2670	.1977	.1373	.0896	.0548	.0312
	2	.0515	.1488	.2376	.2936	.3115	.2965	.2587	.2090	.1569	.1094
	3	.0054	.0331	.0839	.1468	.2076	.2541	.2786	.2787	.2568	.2188
	4	.0004	.0046	.0815	.0459	.0865	.1361	.1875	.2322	.2627	.2734

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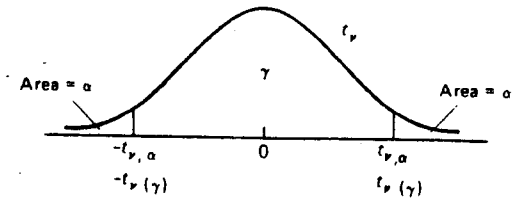
Jadual 3

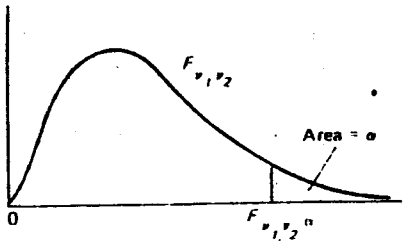


The *t* distribution

	$t_{\nu,.25}$ $t_{\nu(.5)}$	$t_{\nu,.2}$ $t_{\nu(.6)}$	$t_{\nu,.15}$ $t_{\nu(.7)}$	$t_{\nu,.1}$ $t_{\nu(.8)}$	$t_{\nu,.05}$ $t_{\nu(.9)}$	$t_{\nu,.025}$ $t_{\nu(.95)}$	$t_{\nu,.01}$ $t_{\nu(.98)}$	$t_{\nu,.005}$ $t_{\nu(.99)}$
1	1.000	1.376	1.963	3.078	6.314	12.706	31.821	63.657
2	.817	1.061	1.386	1.886	2.920	4.303	6.965	9.925
3	.765	.978	1.250	1.638	2.353	3.183	4.541	5.841
4	.741	.941	1.190	1.533	2.132	2.776	3.747	4.604
5	.727	.920	1.156	1.476	2.015	2 571	3.365	4.032
6	.718	.906	1.134	1 440	1.943	2.447	3.143	3.707
7	.711	.896	1:119	1.415	1.895	2.365	2.998	3.500
8	.706	.889	1.108	1.397	1.860	2.306	2.896	3.355
9	.703	.883	1.100	1.383	1.833	2.262	2.821	3.250
10	.700	.879	1.093	1.372	1.813	2.228	2.764	3.169
11	.697	.876	1.088	1.363	1.796	2.201	2.718	3.106
12	.696	.873	1.083	1.356	1.782	2.179	2.681	3.055
13	.694	.870	1.079	1.350	1.771	2.160	2.650	3.012
14	.692	.868	1.076	1.345	1.761	2.145	2.624	2.977
15	.691	.866	1.074	1 341	1.753	2.132	2.602	2.947
16	.690	.865	1.071	1.337	1 746	2.120	2.583	2.921
17	.689	.863	1.069	1.333	1.740	2.110	2.567	2.898
18	.688	.862	1.067	1.330	1.734	2.101	2.552	2.878
19	.688	.861	1.066	1.328	1.729	2.093	2.539	2.861
20	.687	.860	1.064	1.325	1.725	2.086	2.528	2.845
21	.686	859	1.063	1.323	1.721	2.080	2.518	2.831
22	.686	858	1.061	1 321	1.717	2 074	2.508	2 819
23	.685	858	1 060	1.319	1.714	2.069	2.500	2.807
24	685	857	1.059	1.318	1 711	2.064	2.492	2 797
25	.684	.856	1.058	1.316	1.708	2.060	2.485	2.787
26	.684	.856	1 058	1.315	1.706	2.056	2.479	2 779
27	.684	855	1 057	1.314	1 703	2.052	2.473	2 771
28	.683	855	1 056	1 313	1.701	2.048	2 467	2.763
29	.683	.854	1 055	1.311	1.699	2.045	2.462	2.756
30	.683	854	1.055	1.310	1.697	2.042	2.457	2.750
31	.683	854	1.054	1.310	1.696	2.040	2 453	2.744
32	.682	.853	1 054	1.309	1 694	2.037	2 449	2.739
33	.682	853	1.053	1 308	1.692	2.035	2 445	2.733
34	.682	852	1.053	1.307	1.691	2.032	2 441	2.728
35	682	852	1 052	1.306	1.690	2.030	2.438	2.724
36	.681	852	1 052	1.306	1.688	2.028	2.434	2.720
37	681	.852	1 051	1 305	1.687	2.026	2.431	2.716
38	681	.851	1.051	1.304	1.686	2.024	2.428	2.712
39	.681	.851	1 050	1.304	1 685	2 023	2.426	2.708
40	.681	851	1 050	1 303	1.684	2.021	2 423	2.705
50	.679	.849	1 047	1.299	1.676	2.009	2.403	2.678
60	.679	.848	1 046	1.296	1 671	2.000	2.390	2.660
70	.678	.847	1.044	1.294	1.667	1.995	2.381	2.648
80	.678	846	1.043	1.292	1 664	1.990	2.374	2.639
90	.677	846	1.043	1.291	1.662	1.987	2.368	2.632
100	.677	845	1.042	1.290	1.660	1.984	2.364	2.626
∞	674	.842	1.036	1 282	1.645	1.960	2.326	2.576

...11/-

The *F* distribution*



Entries in the table are $F_{\nu_1,\nu_2,\alpha}$

		ν_1															
ν_2	α	1	2	3	4	5	6	7	8	9	10	11	12	15	20	24	30
(20)	.25	1.40	1.49	1.48	1.47	1.45	1.44	1.43	1.42	1.41	1.40	1.39	1.39	1.37	1.36	1.35	1.34
	.1	2.97	2.59	2.38	2.25	2.16	2.09	2.04	2.00	1.96	1.94	1.91	1.89	1.84	1.79	1.77	1.74
	.05	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.31	2.28	2.20	2.12	2.08	2.04
	.025	5.87	4.46	3.86	3.51	3.29	3.13	3.01	2.91	2.84	2.77	2.72	2.68	2.57	2.46	2.41	2.35
	.01	8.10	5.85	4.94	4.43	4.10	3.87	3.70	3.56	3.46	3.37	3.29	3.23	3.09	2.94	2.86	2.78
	.005	9.94	6.99	5.82	5.17	4.76	4.47	4.26	4.09	3.96	3.85	3.76	3.68	3.50	3.32	3.22	3.12
(24)	.25	1.39	1.47	1.46	1.44	1.43	1.41	1.40	1.39	1.38	1.38	1.37	1.36	1.35	1.33	1.32	1.31
	.1	2.93	2.54	2.33	2.19	2.10	2.04	1.98	1.94	1.91	1.88	1.85	1.83	1.78	1.73	1.70	1.67
	.05	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.21	2.18	2.11	2.03	1.98	1.94
	.025	5.72	4.32	3.72	3.38	3.15	2.99	2.87	2.78	2.70	2.64	2.59	2.54	2.44	2.33	2.27	2.21
	.01	7.82	5.61	4.72	4.22	3.90	3.67	3.50	3.36	3.26	3.17	3.09	3.03	2.89	2.74	2.66	2.58
	.005	9.55	6.66	5.52	4.89	4.49	4.20	3.99	3.83	3.69	3.59	3.50	3.42	3.25	3.06	2.97	2.87
(30)	.25	1.38	1.45	1.44	1.42	1.41	1.39	1.38	1.37	1.36	1.35	1.35	1.34	1.32	1.30	1.29	1.28
	.1	2.88	2.49	2.28	2.14	2.05	1.98	1.93	1.88	1.85	1.82	1.79	1.77	1.72	1.67	1.64	1.61
	.05	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.13	2.09	2.01	1.93	1.89	1.84
	.025	5.57	4.18	3.59	3.25	3.03	2.87	2.75	2.65	2.57	2.51	2.46	2.41	2.31	2.20	2.14	2.07
	.01	7.56	5.39	4.51	4.02	3.70	3.47	3.30	3.17	3.07	2.98	2.91	2.84	2.70	2.55	2.47	2.39
	.005	9.18	6.35	5.24	4.62	4.23	3.95	3.74	3.58	3.45	3.34	3.25	3.18	3.01	2.82	2.73	2.63
(40)	.25	1.36	1.44	1.42	1.40	1.39	1.37	1.36	1.35	1.34	1.33	1.32	1.31	1.30	1.28	1.26	1.25
	.1	2.84	2.44	2.23	2.09	2.00	1.93	1.87	1.83	1.79	1.76	1.73	1.71	1.66	1.61	1.57	1.54
	.05	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.04	2.00	1.92	1.84	1.79	1.74
	.025	5.42	4.05	3.46	3.13	2.90	2.74	2.62	2.53	2.45	2.39	2.33	2.29	2.18	2.07	2.01	1.94
	.01	7.31	5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.89	2.80	2.73	2.66	2.52	2.37	2.29	2.20
	.005	8.83	6.07	4.98	4.37	3.99	3.71	3.51	3.35	3.22	3.12	3.03	2.95	2.78	2.60	2.50	2.40
(60)	.25	1.35	1.42	1.41	1.38	1.37	1.35	1.33	1.32	1.31	1.30	1.29	1.29	1.27	1.25	1.24	1.22
	.1	2.79	2.39	2.18	2.04	1.95	1.87	1.82	1.77	1.74	1.71	1.68	1.66	1.60	1.54	1.51	1.48
	.05	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.95	1.92	1.84	1.75	1.70	1.65
	.025	5.29	3.93	3.34	3.01	2.79	2.63	2.51	2.41	2.33	2.27	2.22	2.17	2.06	1.94	1.88	1.82
	.01	7.08	4.98	4.13	3.65	3.34	3.12	2.95	2.82	2.72	2.63	2.56	2.50	2.35	2.20	2.12	2.03
	.005	8.49	5.80	4.73	4.14	3.76	3.49	3.29	3.13	3.01	2.90	2.82	2.74	2.57	2.39	2.29	2.19