Cork Institute of Technology

Bachelor of Science (Honours) in Herbal Science – Stage 2

(SHERB_8_Y2)

Summer 2008

Biostatistics & Data Analysis

(Time: 3 Hours)

Instructions
Answer FIVE questions.
All questions carry 40 marks.

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Q1. The following table give the distances (*km)* driven by a fleet of hire cars in a week

Distance (km)	0-100	100-200	200-300	300-400	400-500	500-600	600-700
Number of cars	8	26	43	46	27	10	4

You are required to :

(i) Calculate the mean (average) distance traveled by the cars,

(ii) Determine the standard deviation from the mean.

(iii) Construct a Cumulative frequency distribution from the table and display the data by means of an Ogive (cumulative frequency curve)

(iv) Use the Ogive to estimate the median and inter-quartile range.

(v) Construct a Boxplot of the data.

(5x8 marks)

Q2.(a) The probabilities that ***machine A, machine B and machine C*** will be performing a useful function in four years time are 0.85, 0.6 and 0.7 respectively.

Given that ***Machines A,B and C*** are independent, draw a Venn diagram depicting these probabilities.

Calculate the probability that in four years time;

(i) ***Machines A*** and ***B*** will be operating a useful function.

(ii) none will be operating a useful function.

(iii) only ***machine A*** will be operating a useful function.

(iv) ***Machine A or Machine C*** will be operating.

(v) at least one of the machines will be operating a useful function.

Show (mark) probabilities (ii) and (iii) above on your Venn diagram. (20 marks)

(b) A manufacturer produces a product at three different plants . 40% is produced at plant **X**, 50% at plant **Y** and 10% at plant **Z**.

20% of that produced at **X** is defective While 10% and 16% of that produced at **Y** and **Z** respectively is defective. The products are mixed in a warehouse and are indistinguishable from each other.

A unit is selected at random.

Determine the probability that it:

(i) Was produced at plant **X** or **Z**;

(ii) Was produced at plant **Y** and is defective;

(iii) Is defective;

(iv) Is not defective

Given that one selected at random is defective, calculate the conditional probability that it was produced at plant **X**.

(20 marks)

Q3 (a) In a sample of 20 computer diskettes, chosen at random from a large consignment, five were found to be defective. Find (i) the 95% confidence limits (ii) 99.8% confidence limits, for the consignment proportion of defective disks.

What must the sample size be if you want to be 98% certain that the sample proportion differs from the population proportion by less than 0.02.

(20 marks)

(b) A computer company wishes to test if adding a particular memory chip to a personal computer will significantly reduce the time taken by the PC to process information. A specific task was assigned to each of six different models of PC both with and without the added chip and the process times recorded for each are given in the following table.

Model	A	B	C	D	E	F
Time without added chip	36	26	56	39	68	53
Time with added chip	31	22	54	41	54	51

Use a paired t-test to test if there significant evidence of a reduction in process time. Conduct the test at a 5% level of significance. (20 marks)

Q4. (a) Explain with the help of an example, what is meant by "***A goodness of fit test***". (10 marks)

(b) The following table shows the numbers of people of different ages drinking Beers, LIGHT, MEDIUM and DARK.

Type of Beer

AGE	LIGHT	MEDIUM	DARK
Under 25	**34**	**21**	**53**
25 to 50	**90**	**123**	**62**
Over 50	**21**	**23**	**16**

Conduct a Chi-squared test to find if there is an association between age and the type of beer consumed . (30 marks)

Q5. The body weights of eight randomly selected males of similar age and height were measured along with their diastolic blood pressure giving the following results;

(x) Body weight (kg)	70	77	65	84	66	86	94	82
(y) Diastolic B.P. mmHg	74	82	77	85	74	88	108	90

$\Sigma x = 624$; $\Sigma x^2 = 49577$; $\Sigma xy = 53705$; $\Sigma y = 678$; $\Sigma y^2 = 58338$

You are required to;

(i) Plot the sample data above on a scatter diagram and estimate a regression line.

(ii) Calculate the Pearson correlation coefficient between x and y.

(iii) Determine the coefficient of variation and interpret its value.

(iv) Estimate a value for y, given that x=57 kg.

(40 Marks)

Q6. Oil is stored in containers with a nominal volume of 50 liters. The volumes are in fact normally distributed with a mean of 50.15 liters and a standard deviation of 0.1 liters.

You are required to determine the probability that a container chosen at random contains;

(i) Less than 50.24 litre
(ii) Less than 50 litres.
(iii) Between 50.25 and 50.4 Litre
(iv) Between 50 and 50.4 litre.

(4 x 6 marks)

Below what value do the lowest 10% of volumes lie? (5 marks)

Between what two values do the middle 90% of volumes lie; (5 marks)

If the standard deviation remains at 0.1 litres. What must the mean be set to if less than 10% of containers contain more than 5.20 ml? (6 marks)

Q7. (a) Cars pass a point on a road at random according to the Poisson distribution at an average rate of 6 per minute. Calculate the probability that;

(i) Four cars pass this point.

(ii) Fewer than two pass.

(iii) More than two cars pass,

… in a particular minute.

What is the probability that five cars pass this point in a half-minute interval?

(16 marks)

(b) The probability that a patient will survive a particular illness for five years is 0.3.

Of ten such patients, determine the probability that

(i) Six patients;

(ii) At least one patient;

(iii) Less than the expected number of patients;

……will survive for five years.

(Use Binomial distribution.) (12 marks)

(c) A box contains ten similar items, four of which are defective. Seven items are selected at random from the box.

Using the Hypergeometric distribution, calculate the probability that the selection contains;

(i) two defectives ;

(ii) at least two defectives;

(iii) the maximum possible number of defectives. (12 marks)

STATISTICAL FORMULAE (Herb. Sc.)

Central Tendency and Dispersion

Mean of an array; $\bar{x}=\frac{\sum x}{n}$

Mean of a frequency distribution $\bar{x} = \frac{\sum fx}{\sum f}$. $\bar{x} = a + \frac{\sum fd}{\sum f}$

Standard Deviation of an array: $\sigma=\sqrt{\frac{\sum(x-\bar{x})^2}{n}}$ or $\sigma=\sqrt{\frac{\sum x^2}{n}-\left(\frac{\sum x}{n}\right)^2}$

Standard Deviation of a frequency distribution $\sigma = \sqrt{\frac{\sum f(x-\bar{x})^2}{\sum f}}$ or

$=\sqrt{\frac{\sum fx^2}{\sum f}-\left(\frac{\sum fx}{\sum f}\right)^2}$

Median $= L_M + C_M\left(\frac{\frac{1}{2}N - F_{M-1}}{f_M}\right)$

Mode $= L_M + C_M\left[\frac{f_M - f_{M-1}}{2f_M - (f_{M-1} + f_{M+1})}\right]$

Skewness $= \frac{3(\text{Mean - Median})}{\text{S.D.}}$

Coefficient of Variation $= \frac{\sigma}{\bar{x}} \times 100$

Probability distributions

Binomial Distribution; $P(r,n) = {}^nC_r p^r q^{n-r}$ ...mean = np ; variance = npq

Poisson Distribution; $P(x) = \frac{\lambda^x . e^{-\lambda}}{x!}$: $\lambda = mean = np$

Hypergeometric Distribution ; $P(x) = \frac{\binom{n_1}{x}\binom{n_2}{r-x}}{\binom{n}{r}}$ **or** $= \frac{{}^{n_1}C_x \times {}^{n_2}C_{(r-x)}}{{}^nC_r}$

Standard Normal Units; $Z=\frac{x-\mu}{\sigma}$

Baye's Rule (conditional probability) $P(A \mid B) = \frac{P(A) \times P(B \mid A)}{P(B)}$

Central Limit Formulae

$x \sim N\{\mu,\sigma\} \Rightarrow z = \frac{x-\mu}{\sigma}$; $\bar{x} \sim N\left\{\mu, \frac{\sigma}{\sqrt{n}}\right\} \Rightarrow z_{\bar{x}} = \frac{\bar{x}-\mu}{\sigma/\sqrt{n}}$;

$t_{\bar{x}} = \frac{\bar{x}-\mu}{s/\sqrt{n}}$

Confidence Limits for the population mean: $\bar{x} \pm z_c \frac{\sigma}{\sqrt{n}}$ ...σ known

$(\bar{x}_1 - \bar{x}_2) \sim N\left\{(\mu_1 - \mu_2), \sqrt{\left(\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}\right)}\right\}$ .....σ s known

$(\bar{x}_1 - \bar{x}_2) \sim t\left\{(\mu_1 - \mu_2), s_p\sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}\right\}$

.....σ s estimated ..... $s_p^2 = \frac{(n_1-1)s_1^2 + (n_2-2)s_2^2}{n_1+n_2-2}$

$p \sim N\left\{P, \sqrt{\frac{PQ}{n}}\right\}$; Confidence Limits for the population proportion: $p \pm z_c\sqrt{\frac{pq}{n}}$

. $(p_1 - p_2) \sim N\left\{(P_1 - P_2), \sqrt{\frac{P_1Q_1}{n_1} + \frac{P_2Q_2}{n_2}}\right\}$

A (100-α)% **Confidence Interval** for a **population variance** σ^2;

$\frac{(n-1)s^2}{\chi^2_{\alpha/2}} \le \sigma^2 \le \frac{(n-1)s^2}{\chi^2_{(1-\alpha/2)}}$

Chi-Squared Distribution ..... $\chi^2 = \sum \frac{(O-E)^2}{E}$

Regression and Correlation

Least Squares Regression Line : $\underline{y = a + bx}$;

$$S_{xx} = \Sigma(x-\bar{x})^2 = \Sigma x^2 - \frac{(\Sigma x)^2}{n}; \qquad S_{yy} = \Sigma(y-\bar{y})^2 = \sum y^2 - \frac{(\sum y)^2}{n};$$

$$S_{xy} = \Sigma(x-\bar{x})(y-\bar{y}) = \Sigma xy - \frac{\Sigma x \Sigma y}{n}$$

$$b = \frac{S_{xy}}{S_{xx}} = \frac{n\Sigma xy - \Sigma x \Sigma y}{n\Sigma x^2 - (\Sigma x)^2}; \qquad a = \bar{y} - b\bar{x}; \qquad \bar{y} = a + b\bar{x}$$

or $\quad a = \dfrac{\Sigma y - b\Sigma x}{n}$

Coefficient of Correlation:

$$r = \frac{S_{xy}}{\sqrt{S_{xx} \cdot S_{yy}}} = \frac{n\Sigma xy - \Sigma x \Sigma y}{\sqrt{n\Sigma x^2 - (\Sigma x)^2} \cdot \sqrt{n\Sigma y^2 - (\Sigma y)^2}};$$

(X)

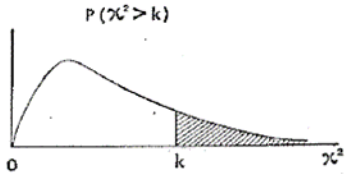
Achar faoin gCuar Normalach
Area under the Normal Curve

$$P(z \leqslant z_1) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{z_1} e^{-\frac{1}{2}z^2}\, dz .$$

z	0·00	0·01	0·02	0·03	0·04	0·05	0·06	0·07	0·08	0·09
0·0	0·5000	5040	5080	5120	5160	5199	5239	5279	5319	5359
0·1	0·5398	5438	5478	5517	5557	5596	5636	5675	5714	5753
0·2	0·5793	5832	5871	5910	5948	5987	6026	6064	6103	6141
0·3	0·6179	6217	6255	6293	6331	6368	6406	6443	6480	6517
0·4	0·6554	6591	6628	6664	6700	6736	6772	6808	6844	6879
0·5	0·6915	6950	6985	7019	7054	7088	7123	7157	7190	7224
0·6	0·7257	7291	7324	7357	7389	7422	7454	7486	7517	7549
0·7	0·7580	7611	7642	7673	7704	7734	7764	7794	7823	7852
0·8	0·7881	7910	7939	7967	7995	8023	8051	8078	8106	8133
0·9	0·8159	8186	8212	8238	8264	8289	8315	8340	8365	8389
1·0	0·8413	8438	8461	8485	8508	8531	8554	8577	8599	8621
1·1	0·8643	8665	8686	8708	8729	8749	8770	8790	8810	8830
1·2	0·8849	8869	8888	8907	8925	8944	8962	8980	8997	9015
1·3	0·9032	9049	9066	9082	9099	9115	9131	9147	9162	9177
1·4	0·9192	9207	9222	9236	9251	9265	9279	9292	9306	9319
1·5	0·9332	9345	9357	9370	9382	9394	9406	9418	9429	9441
1·6	0·9452	9463	9474	9484	9495	9505	9515	9525	9535	9545
1·7	0·9554	9564	9573	9582	9591	9599	9608	9616	9625	9633
1·8	0·9641	9649	9656	9664	9671	9678	9686	9693	9699	9706
1·9	0·9713	9719	9726	9732	9738	9744	9750	9756	9761	9767
2·0	0·9772	9778	9783	9788	9793	9798	9803	9808	9812	9817
2·1	0·9821	9826	9830	9834	9838	9842	9846	9850	9854	9857
2·2	0·9861	9864	9868	9871	9875	9878	9881	9884	9887	9890
2·3	0·9893	9896	9898	9901	9904	9906	9909	9911	9913	9916
2·4	0·9918	9920	9922	9925	9927	9929	9931	9932	9934	9936
2·5	0·99379	99396	99413	99430	99446	99461	99477	99492	99506	99520
2·6	0·99534	99547	99560	99573	99585	99598	99609	99621	99632	99643
2·7	0·99653	99664	99674	99683	99693	99702	99711	99720	99728	99736
2·8	0·99744	99752	99760	99767	99774	99781	99788	99795	99801	99807
2·9	0·99813	99819	99825	99831	99836	99841	99846	99851	99856	99861
3·0	0·99865	99869	99874	99878	99882	99886	99889	99893	99897	99900
3·1	0·99903	99906	99910	99913	99916	99918	99921	99924	99926	99929
3·2	0·99931	99934	99936	99938	99940	99942	99944	99946	99948	99950
3·3	0·99952	99953	99955	99957	99958	99960	99961	99962	99964	99965
3·4	0·99966	99968	99969	99970	99971	99972	99973	99974	99975	99976
	0·99977	99978	99978	99979	99980	99981	99981	99982	99983	99983
	0·99984	99985	99985	99986	99986	99987	99987	99988	99988	99989
	0·99989	99990	99990	99990	99991	99991	99992	99992	99992	99992
	0·99993	99993	99993	99994	99994	99994	99994	99995	99995	99995
	0·99995	99995	99996	99996	99996	99996	99996	99996	99997	99997

χ^2-DÁILEADH χ^2-DISTRIBUTION

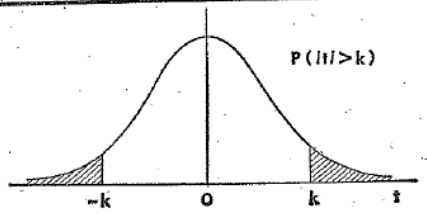
	·99	·95	·50	·20	·10	·05	·025	·01
1	·0002	·0039	·45	1·64	2·71	3·84	5·02	6·63
2	·020	·103	1·39	3·22	4·61	5·99	7·38	9·21
3	·115	·352	2·37	4·64	6·25	7·81	9·35	11·34
4	·30	·71	3·36	5·99	7·78	9·49	11·14	13·28
5	·55	1·15	4·35	7·29	9·24	11·07	12·83	15·09
6	·87	1·64	5·35	8·56	10·64	12·59	14·45	16·81
7	1·24	2·17	6·35	9·80	12·02	14·07	16·01	18·48
8	1·65	2·73	7·34	11·03	13·36	15·51	17·53	20·09
9	2·09	3·33	8·34	12·24	14·68	16·92	19·02	21·67
10	2·56	3·94	9·34	13·44	15·99	18·31	20·48	23·21
11	3·05	4·57	10·34	14·63	17·28	19·68	21·92	24·72
12	3·57	5·23	11·34	15·81	18·55	21·03	23·34	26·22
13	4·11	5·89	12·34	16·98	19·81	22·36	24·74	27·69
14	4·66	6·57	13·34	18·15	21·06	23·68	26·12	29·14
15	5·23	7·26	14·34	19·31	22·31	25·00	27·49	30·58
16	5·81	7·96	15·34	20·47	23·54	26·30	28·85	32·00
17	6·41	8·67	16·34	21·61	24·77	27·59	30·19	33·41
18	7·02	9·39	17·34	22·76	25·99	28·87	31·53	34·81
19	7·63	10·12	18·34	23·90	27·20	30·14	32·85	36·19
20	8·26	10·85	19·34	25·04	28·41	31·41	34·17	37·57
21	8·90	11·59	20·34	26·17	29·62	32·67	35·48	38·93
22	9·54	12·34	21·34	27·30	30·81	33·92	36·78	40·29
23	10·20	13·09	22·34	28·43	32·01	35·17	38·08	41·64
24	10·86	13·85	23·34	29·55	33·20	36·42	39·36	42·98
25	11·52	14·61	24·34	30·68	34·38	37·65	40·65	44·31
26	12·20	15·38	25·34	31·79	35·56	38·89	41·92	45·64
27	12·88	16·15	26·34	32·91	36·74	40·11	43·19	46·96
28	13·57	16·93	27·34	34·03	37·92	41·34	44·46	48·28
29	14·26	17·71	28·34	35·14	39·09	42·56	45·72	49·59
30	14·95	18·49	29·34	36·25	40·26	43·77	46·98	50·89
40	22·16	26·51	39·34	47·27	51·81	55·76	59·34	63·69
50	29·71	34·76	49·33	58·16	63·17	67·50	71·42	76·15
60	37·48	43·19	59·33	68·97	74·40	79·08	83·30	88·38
70	45·44	51·74	69·33	79·71	85·53	90·53	95·02	100·43
80	53·54	60·39	79·33	90·41	96·58	101·88	106·63	112·33
90	61·75	69·13	89·33	101·05	107·57	113·15	118·14	124·12
100	70·06	77·93	99·33	111·67	118·50	124·34	129·56	135·81



(2)

t-DÁILEADH — t-DISTRIBUTION

	20	10	5	2	1	0·2
1	3·078	6·314	12·706	31·821	63·657	318·310
2	1·886	2·920	4·303	6·965	9·925	22·327
3	1·638	2·353	3·182	4·541	5·841	10·215
4	1·533	2·132	2·776	3·747	4·604	7·173
5	1·476	2·015	2·571	3·365	4·032	5·893
6	1·440	1·943	2·447	3·143	3·707	5·208
7	1·415	1·895	2·365	2·998	3·499	4·785
8	1·397	1·860	2·306	2·896	3·355	4·501
9	1·383	1·833	2·262	2·821	3·250	4·297
10	1·372	1·812	2·228	2·764	3·169	4·144
11	1·363	1·796	2·201	2·718	3·106	4·025
12	1·356	1·782	2·179	2·681	3·055	3·930
13	1·350	1·771	2·160	2·650	3·012	3·852
14	1·345	1·761	2·145	2·624	2·977	3·787
15	1·341	1·753	2·131	2·602	2·947	3·733
16	1·337	1·746	2·120	2·583	2·921	3·686
17	1·333	1·740	2·110	2·567	2·898	3·646
18	1·330	1·734	2·101	2·552	2·878	3·610
19	1·328	1·729	2·093	2·539	2·861	3·579
20	1·325	1·725	2·086	2·528	2·845	3·552
21	1·323	1·721	2·080	2·518	2·831	3·527
22	1·321	1·717	2·074	2·508	2·819	3·505
23	1·319	1·714	2·069	2·500	2·807	3·485
24	1·318	1·711	2·064	2·492	2·797	3·467
25	1·316	1·708	2·060	2·485	2·787	3·450
26	1·315	1·706	2·056	2·479	2·779	3·435
27	1·314	1·703	2·052	2·473	2·771	3·421
28	1·313	1·701	2·048	2·467	2·763	3·408
29	1·311	1·699	2·045	2·462	2·756	3·396
30	1·310	1·697	2·042	2·457	2·750	3·385
40	1·303	1·684	2·021	2·423	2·704	3·307
60	1·296	1·671	2·000	2·390	2·660	3·232
120	1·289	1·658	1·980	2·358	2·617	3·160
∞	1·282	1·645	1·960	2·326	2·576	3·090



MATAMAITIC FHEIDHMEACH

Aonad faid: méadar (m)
Aonad mais: cileagram (kg)
Aonad fórsa: Niútan (N) = kgm/s^2
Aonad oibre: giúl (J) = Nm
Aonad cumhachta: vata (W) = J/s

Gluaiseacht i líne faoi luasghéarú tairiseach: $v = u+ft$; $s = ut+\frac{1}{2}ft^2$; $v^2 = u^2+2fs$

Fuinneamh Poitéinsiúil: mgh. Fuinneamh cinéatach (obair déanta): $\frac{1}{2}mv^2$.
I gcóras imchoimeádach: Fuinneamh poitéinsiúil + fuinneamh cinéatach = méad tairiseach.

Móiminteam chaithnín: $\overrightarrow{mu}$
Spreagadh fórsa = athrú san móiminteam.
Comhéifeacht chúitimh (comhéifeacht leaisteachais):

$$e = -\left(\frac{\text{luas gaolmhar indhiaidh iombhualadh}}{\text{luas gaolmhar roimh iombhualadh}}\right)$$

Luasghéarú láraimsitheach: $\frac{v^2}{r} = \omega^2 r$

Dlí Hooke le haghaidh téada leaistigh: $p = kx$ (p an fórsa, x an sineadh, tairiseach don téad é k).

Meánlár:

Stua, gath r; uillinn 2θ ag an lár: $\frac{r \sin\theta}{\theta}$ ón lárphointe.

Teascóg diosca; gath r, uillinn 2θ: $\frac{2}{3}r\,\frac{\sin\theta}{\theta}$ ón lárphointe.

Lann triantánach: $\frac{1}{3}$ ón mbonn feadh an mheánline.

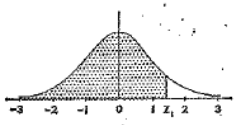
Meáchanlár:
Leathsféar, gath r: $\frac{3}{8}r$ ón lárphointe.
Sceall leathsféarach, gath r: $\frac{1}{2}r$ ón lárphointe.
Drón-chón ciorclach, airde h: $\frac{1}{4}h$ ón bhonn.

Brú ag pointe i leacht: ρgh.
Sá ar dhromcla átá báite: achar × brú ag an meánlár.

Móimintí na táimhe:
Bata aonfhoirmeach, fad $2l$: lár: $\frac{1}{3}ml^2$; foirceann: $\frac{4}{3}ml^2$
Fonsa aonfhoirmeach, gath r: lár: mr^2; lárline: $\frac{1}{2}mr^2$
Diosca aonfhoirmeach, gath r: lár: $\frac{1}{2}mr^2$; lárline: $\frac{1}{4}mr^2$
Dlúth-sféar aonfhoirmeach, gath r: lár line: $\frac{2}{5}mr^2$

Achar faoin gCuar Normalach
Area under the Normal Curve

$$P(z \leqslant z_1) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{z_1} e^{-\frac{1}{2}z^2}\, dz\,.$$



z	0·00	0·01	0·02	0·03	0·04	0·05	0·06	0·07	0·08	0·09
0·0	0·5000	5040	5080	5120	5160	5199	5239	5279	5319	5359
0·1	0·5398	5438	5478	5517	5557	5596	5636	5675	5714	5753
0·2	0·5793	5832	5871	5910	5948	5987	6026	6064	6103	6141
0·3	0·6179	6217	6255	6293	6331	6368	6406	6443	6480	6517
0·4	0·6554	6591	6628	6664	6700	6736	6772	6808	6844	6879
0·5	0·6915	6950	6985	7019	7054	7088	7123	7157	7190	7224
0·6	0·7257	7291	7324	7357	7389	7422	7454	7486	7517	7549
0·7	0·7580	7611	7642	7673	7704	7734	7764	7794	7823	7852
0·8	0·7881	7910	7939	7967	7995	8023	8051	8078	8106	8133
0·9	0·8159	8186	8212	8238	8264	8289	8315	8340	8365	8389
1·0	0·8413	8438	8461	8485	8508	8531	8554	8577	8599	8621
1·1	0·8643	8665	8686	8708	8729	8749	8770	8790	8810	8830
1·2	0·8849	8869	8888	8907	8925	8944	8962	8980	8997	9015
1·3	0·9032	9049	9066	9082	9099	9115	9131	9147	9162	9177
1·4	0·9192	9207	9222	9236	9251	9265	9279	9292	9306	9319
1·5	0·9332	9345	9357	9370	9382	9394	9406	9418	9429	9441
1·6	0·9452	9463	9474	9484	9495	9505	9515	9525	9535	9545
1·7	0·9554	9564	9573	9582	9591	9599	9608	9616	9625	9633
1·8	0·9641	9649	9656	9664	9671	9678	9686	9693	9699	9706
1·9	0·9713	9719	9726	9732	9738	9744	9750	9756	9761	9767
2·0	0·9772	9778	9783	9788	9793	9798	9803	9808	9812	9817
2·1	0·9821	9826	9830	9834	9838	9842	9846	9850	9854	9857
2·2	0·9861	9864	9868	9871	9875	9878	9881	9884	9887	9890
2·3	0·9893	9896	9898	9901	9904	9906	9909	9911	9913	9916
2·4	0·9918	9920	9922	9925	9927	9929	9931	9932	9934	9936
2·5	0·99379	99396	99413	99430	99446	99461	99477	99492	99506	99520
2·6	0·99534	99547	99560	99573	99585	99598	99609	99621	99632	99643
2·7	0·99653	99664	99674	99683	99693	99702	99711	99720	99728	99736
2·8	0·99744	99752	99760	99767	99774	99781	99788	99795	99801	99807
2·9	0·99813	99819	99825	99831	99836	99841	99846	99851	99856	99861
3·0	0·99865	99869	99874	99878	99882	99886	99889	99893	99897	99900
3·1	0·99903	99906	99910	99913	99916	99918	99921	99924	99926	99929
3·2	0·99931	99934	99936	99938	99940	99942	99944	99946	99948	99950
3·3	0·99952	99953	99955	99957	99958	99960	99961	99962	99964	99965
3·4	0·99966	99968	99969	99970	99971	99972	99973	99974	99975	99976
	0·99977	99978	99978	99979	99980	99981	99981	99982	99983	99983
	0·99984	99985	99985	99986	99986	99987	99987	99988	99988	99989
	0·99989	99990	99990	99990	99991	99991	99992	99992	99992	99992
	0·99993	99993	99993	99994	99994	99994	99994	99995	99995	99995
	0·99995	99995	99996	99996	99996	99996	99996	99996	99997	99997

χ^2-DÁILEADH — χ^2-DISTRIBUTION

	·99	·95	·50	·20	·10	·05	·025	·01
1	·0002	·0039	·45	1·64	2·71	3·84	5·02	6·63
2	·020	·103	1·39	3·22	4·61	5·99	7·38	9·21
3	·115	·352	2·37	4·64	6·25	7·81	9·35	11·34
4	·30	·71	3·36	5·99	7·78	9·49	11·14	13·28
5	·55	1·15	4·35	7·29	9·24	11·07	12·83	15·09
6	·87	1·64	5·35	8·56	10·64	12·59	14·45	16·81
7	1·24	2·17	6·35	9·80	12·02	14·07	16·01	18·48
8	1·65	2·73	7·34	11·03	13·36	15·51	17·53	20·09
9	2·09	3·33	8·34	12·24	14·68	16·92	19·02	21·67
10	2·56	3·94	9·34	13·44	15·99	18·31	20·48	23·21
11	3·05	4·57	10·34	14·63	17·28	19·68	21·92	24·72
12	3·57	5·23	11·34	15·81	18·55	21·03	23·34	26·22
13	4·11	5·89	12·34	16·98	19·81	22·36	24·74	27·69
14	4·66	6·57	13·34	18·15	21·06	23·68	26·12	29·14
15	5·23	7·26	14·34	19·31	22·31	25·00	27·49	30·58
16	5·81	7·96	15·34	20·47	23·54	26·30	28·85	32·00
17	6·41	8·67	16·34	21·61	24·77	27·59	30·19	33·41
18	7·02	9·39	17·34	22·76	25·99	28·87	31·53	34·81
19	7·63	10·12	18·34	23·90	27·20	30·14	32·85	36·19
20	8·26	10·85	19·34	25·04	28·41	31·41	34·17	37·57
21	8·90	11·59	20·34	26·17	29·62	32·67	35·48	38·93
22	9·54	12·34	21·34	27·30	30·81	33·92	36·78	40·29
23	10·20	13·09	22·34	28·43	32·01	35·17	38·08	41·64
24	10·86	13·85	23·34	29·55	33·20	36·42	39·36	42·98
25	11·52	14·61	24·34	30·68	34·38	37·65	40·65	44·31
26	12·20	15·38	25·34	31·79	35·56	38·89	41·92	45·64
27	12·88	16·15	26·34	32·91	36·74	40·11	43·19	46·96
28	13·57	16·93	27·34	34·03	37·92	41·34	44·46	48·28
29	14·26	17·71	28·34	35·14	39·09	42·56	45·72	49·59
30	14·95	18·49	29·34	36·25	40·26	43·77	46·98	50·89
40	22·16	26·51	39·34	47·27	51·81	55·76	59·34	63·69
50	29·71	34·76	49·33	58·16	63·17	67·50	71·42	76·15
60	37·48	43·19	59·33	68·97	74·40	79·08	83·30	88·38
70	45·44	51·74	69·33	79·71	85·53	90·53	95·02	100·43
80	53·54	60·39	79·33	90·41	96·58	101·88	106·63	112·33
90	61·75	69·13	89·33	101·05	107·57	113·15	118·14	124·12
100	70·06	77·93	99·33	111·67	118·50	124·34	129·56	135·81