UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013

COURSE NAME	:	BASIC STATISTICS (STATISTIK ASAS)
COURSE CODE	:	BBR 33803
PROGRAMME	:	SARJANA MUDA PENDIDIKAN (SEKOLAH RENDAH)
EXAMINATION DATE	:	JUNE 2013
DURATION	:	3 HOURS
INSTRUCTIONS	:	ANSWER ONLY FIVE (5) QUESTIONS FROM SIX (6) QUESTIONS

THIS QUESTION PAPER CONSISTS OF 13 PAGES

Q1 (a) State whether each of the following variable is qualitative or quantitative. If the variable is quantitative, classify the following variable as discrete or continuous.

(i) The color of the shirt
(ii) The number of hand phone the students own
(iii) Rate of growth of the bacteria
(iv) Types of house

(6 marks)

(b) Data below shows the amount of Thai chili sauce (in ml) for 50 bottles that was produced by a manufacturer.

123	121	121	120	119
119	121	119	117	121
120	117	123	120	119
118	118	121	121	119
122	125	115	120	120
128	126	116	122	116
123	118	119	117	118
120	121	120	119	116
122	120	118	119	117
119	120	121	125	122

Table Q1(b) : Thai chili sauce (in ml) for 50 bottles

(i) Find the class interval (integer).
(ii) Construct a frequency distribution. Show the class limit, class boundary, frequency and cumulative frequency.
(iii) Draw the frequency polygon.

(14 marks)

Q2 Given the table Q2.

Class limit	Lower boundary	x_i	f_i	$f_i x_i$	x_i^2	$f_i x_i^2$
100 – 119			4			
120 – 139			5			
140 – 159			2			
160 – 179			3			
180 – 199			6			
			$\Sigma f_i =$	$\Sigma f_i x_i =$		$\Sigma f_i x_i^2 =$

Table Q2

(a) Fill up the table.

(8 marks)

(b) Find the

(i) mean
(ii) standard deviation
(iii) median

(12 marks)

Q3 (a) The English test scores of student were approximately normal distribution with mean, 70 and standard deviation, 20. Find the probability of student who received the scores that is

(i) less than 50
(ii) more than 74
(iii) between 65 and 80

(10 marks)

(b) Suppose that you sell 179 washing machines in a month. You offer the buyer the opportunity to purchase an extended warranty with each sale. The probability that any individual will buy the extended warranty is 0.38.

(i) Find μ and σ where $\mu = np$ and $\sigma^2 = npq$.
(ii) Hence by using binomial approximation to normal, find the probability that 70 or more will buy the extended warranty.

(10 marks)

Q4 (a) Random variable X is binomially distributed with $n = 50$ and $p = 0.08$. By using binomial distribution table, find

(i) $P(X \geq 7)$

(ii) $P(2 \leq X \leq 9)$

(6 marks)

(b) A married couple plans to have only three children. Assume that the probability of success which is getting a boy is the same as getting a girl. Find the probability that the married couple have

(i) all girls

(ii) at least one boy

(7 marks)

(c) At the police station, on average, the reported number of accident is three per a day. Find the probability that

(i) five accidents were reported per day

(ii) less than three accidents were reported per day

(7 marks)

Q5 (a) The random variable X, representing the number of raisin in a cornflake box, has the following probability distribution:

x	4	5	6	7
$P(X = x)$	0.25	0.35	0.3	0.1

(i) Find the mean μ and the variance σ^2 of X.

(ii) Find the mean $\mu_{\bar{X}}$ and the variance $\sigma^2_{\bar{X}}$ of the sampling distribution $\overline{X}$ for random samples of 36 box of cornflakes.

(10 marks)

(b) Suppose that the population of the gripping strengths of industrial workers is known to have mean 120, and standard deviation, 15. For a random sample of 81 workers, what is the probability that the sample mean gripping strength will be between 119 and 125?

(10 marks)

Q6 (a) The dean of the faculty wishes to estimate the average age of the student enrolled. From past studies, the standard deviation is known to be 2 years. A sample of 50 students is selected, and the mean is found to be 23.2 years. Find the 95% confidence interval of the population mean.

(10 marks)

(b) Ten randomly selected automobiles were stopped, and the tread depth of the right front tire was measured. The mean was 0.32 inch, and the standard deviation was 0.08 inch. Find the 95% confidence interval of the mean depth. Assume that the variable is approximately normally distributed.

(10 marks)

- END OF QUESTIONS -

S1 (a) Nyatakan sama ada setiap pembolehubah berikut adalah kualitatif atau kuantitatif. Jika pembolehubah tersebut adalah kuantitatif, klasifikasikan pembolehubah tersebut sebagai diskrit atau selanjar.

(i) Warna baju
(ii) Bilangan telefon bimbit pelajar
(iii) Kadar pembiakan bakteria
(iv) Jenis rumah

(6 markah)

(b) Data di bawah menunjukkan jumlah sos cili Thai (dalam ml) untuk 50 botol yang dihasilkan oleh pengilang.

123	121	121	120	119
119	121	119	117	121
120	117	123	120	119
118	118	121	121	119
122	125	115	120	120
128	126	116	122	116
123	118	119	117	118
120	121	120	119	116
122	120	118	119	117
119	120	121	125	122

Jadual S1 (b): Sos cili Thai (dalam ml) untuk 50 botol

(i) Dapatkan selang kelas (integer).
(ii) Bina taburan kekerapan. Tunjukkan had kelas, sempadan kelas, kekerapan dan kekerapan terkumpul.
(iii) Lukiskan poligon kekerapan.

(14 markah)

S2 Di beri jadual S2.

Had kelas	Sempadan bawah	x_i	f_i	$f_i x_i$	x_i^2	$f_i x_i^2$
100 – 119			4			
120 – 139			5			
140 – 159			2			
160 – 179			3			
180 – 199			6			
			$\Sigma f_i =$	$\Sigma f_i x_i =$		$\Sigma f_i x_i^2 =$

Jadual S2

(a) Lengkapkan jadual.

(8 markah)

(b) Dapatkan

(i) min
(ii) sisihan piawai
(iii) median

(12 markah)

S3 (a) Skor ujian Bahasa Inggeris pelajar adalah bertabur hampIr normal dengan min, 70 dan sisihan piawai , 20. Cari kebarangkalian pelajar mendapat markah

(i) kurang dari 50
(ii) lebih dari 74
(iii) antara 65 dan 80

(10 markah)

(b) Katalah anda menjual 179 mesin basuh dan bagi setiap jualan, anda tawarkan kepada pembeli peluang untuk membeli perlanjutan jaminan. Kebarangkalian bahawa individu akan membeli perlanjutan jaminan adalah 0.38.

(i) Dapatkan μ dan σ di mana $\mu = np$ dan $\sigma^2 = npq$.
(ii) Seterusnya, dengan menggunakan penghampiran binomial kepada normal, dapat kebarangakalian 70 atau lebih akan membeli perlanjutan jaminan.

(10 markah)

S4 (a) Pembolehubah rawak X adalah bertabur binomial dengan $n = 50$ dan $p = 0.08$. Dengan menggunakan jadual taburan binomial, dapatkan

(i) $P(X \geq 7)$

(ii) $P(2 \leq X \leq 9)$

(6 markah)

(b) Sepasang suami-isteri merancang untuk mempunyai 3 orang anak sahaja. Andai kebarangkalian untuk berjaya iaitu mendapat anak lelaki adalah sama dengan mendapat anak perempuan. Cari kebarangkalian mereka mendapat

(i) semua anak perempuan

(ii) sekurang-kurangnya satu anak lelaki

(7 markah)

(c) Di suatu balai polis, purata kemalangan yang dilaporkan dalam sehari adalah 3. Cari kebarangkalian

(i) lima kemalangan di laporkan dalam sehari

(ii) kurang dari tiga kemalangan dilaporkan dalam sehari

(7 markah)

S5 (a) Pemboleh ubah rawak X, mewakili bilangan kismis dalam kotak kepingan jagung, mempunyai taburan kebarangkalian berikut:

x	4	5	6	7
$P(X = x)$	0.25	0.35	0.3	0.1

(i) Dapatkan min μ dan varians σ^2 bagi X.

(ii) Dapatkan min $\mu_{\bar{X}}$ dan varians $\sigma^2_{\bar{X}}$ bagi taburan sampel $\bar{X}$ bagi sampel rawak bagi 36 kotak kepingan jagung.

(10 markah)

(b) Katalah populasi kekuatan genggaman pekerja industri diketahui minnya 120, dan sisihan piawai, 15. Untuk sampel rawak 81 pekerja, apakah kebarangkalian bahawa min sampel kekuatan genggaman adalah antara 119 dan 125?

(10 markah)

S6 (a) Dekan fakulti ingin menganggarkan purata umur pelajar yang mendaftar. Dari kajian yang lalu, sisihan piawai adalah 2 tahun. Satu sampel 50 orang pelajar dipilih, dan didapati min adalah 23.2 tahun. Dapatkan 95% selang keyakinan bagi min populasi.

(10 markah)

(b) Sepuluh kereta dihentikan secara rawak, dan kedalaman bunga tayar depan kanan diukur. Didapati minnya adalah 0.32 inci dan sisihan piawai ialah 0.08 inci. Dapatkan 95% selang keyakinan bagi min kedalaman bunga tayar. Anggap pembolehubah ini bertabur normal.

(10 markah)

-KERTAS SOALAN TAMAT-

FINAL EXAMINATION

SEMESTER / SESSION : SEM II /2012/2013 PROGRAMME : 2 BBR
COURSE : BASIC STATISTICS COURSE CODE : BBR 33803

Formula

Descriptive Statistics

Class interval = $\dfrac{\text{highest value} - \text{lowest value}}{\text{k}}$ where $k = 1 + 3.3 \log n$

$$\bar{x} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i}, \quad M = L_M + C\left(\frac{n/2 - F}{f_m}\right), M_0 = L + c \times \left(\frac{d_b}{d_b + d_a}\right), s^2 = \frac{1}{\Sigma f - 1}\left[\sum_{i=1}^{n} f_i x_i^2 - \frac{(\Sigma f_i x_i)^2}{\Sigma f}\right]$$

Special Probability Distributions : Binomial Distributions

$P(x = r) = {}^nC_r \cdot p^r \cdot q^{n-r}, \quad q = 1 - p, \; r = 0, 1, \ldots, n, \; X \sim B(n, p)$

Special Probability Distributions : Poisson Distributions

$$P(X = r) = \frac{e^{-\mu} \cdot \mu^r}{r!} \quad r = 0, 1, \ldots, \infty, \quad X \sim P(\mu)$$

Normal Distribution

$$X \sim N(\mu, \sigma^2), \; Z \sim N(0, 1) \text{ and } Z = \frac{X - \mu}{\sigma},$$

Sampling Distributions

$$\bar{X} \sim N(\mu, \sigma^2/n), \; Z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}} \sim N(0, 1),$$

Estimations : Single Mean

$$\bar{x} - z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right) < \mu < \bar{x} + z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right)$$

$$\bar{x} - t_{\alpha/2, v}\left(\frac{s}{\sqrt{n}}\right) < \mu < \bar{x} + t_{\alpha/2, v}\left(\frac{s}{\sqrt{n}}\right)$$

Table 1

CUMULATIVE BINOMIAL PROBABILITIES

p = probability of success in a single trial; n = number of trials. The table gives the probability of obtaining r or more successes in n independent trials. i.e.

$$\sum_{x=r}^{n} \binom{n}{x} p^{x}(1-p)^{n-x}$$

When there is no entry for a particular pair of values of r and p, this indicates that the appropriate probability is less than 0.000 05. Similarly, except for the case r = 0, when the entry is exact, a tabulated value of 1.0000 represents a probability greater than 0.999 95.

	p=	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
n=2	r=0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	1	.0199	.0396	.0591	.0784	.0975	.1164	.1351	.1536	.1719
	2	.0001	.0004	.0009	.0016	.0025	.0036	.0049	.0064	.0081
n=5	r=0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	1	.0490	.0961	.1413	.1846	.2262	.2661	.3043	.3409	.3760
	2	.0010	.0038	.0085	.0148	.0226	.0319	.0425	.0544	.0674
	3		.0001	.0003	.0006	.0012	.0020	.0031	.0046	.0063
	4						.0001	.0001	.0002	.0003
n=10	r=0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	1	.0956	.1829	.2626	.3352	.4013	.4614	.5160	.5656	.6106
	2	.0043	.0162	.0345	.0582	.0861	.1176	.1517	.1879	.2254
	3	.0001	.0009	.0028	.0062	.0115	.0188	.0283	.0401	.0540
	4			.0001	.0004	.0010	.0020	.0036	.0058	.0088
	5					.0001	.0002	.0003	.0006	.0010
	6									.0001
n=20	r=0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	1	.1821	.3324	.4562	.5580	.6415	.7099	.7658	.8113	.8484
	2	.0169	.0599	.1198	.1897	.2642	.3395	.4131	.4831	.5484
	3	.0010	.0071	.0210	.0439	.0755	.1150	.1610	.2121	.2666
	4		.0006	.0027	.0074	.0159	.0290	.0471	.0706	.0993
	5			.0003	.0010	.0026	.0056	.0107	.0183	.0290
	6				.0001	.0003	.0009	.0019	.0038	.0068
	7						.0001	.0003	.0006	.0013
	8								.0001	.0002
n=50	r=0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	1	.3950	.6358	.7819	.8701	.9231	.9547	.9734	.9845	.9910
	2	.0894	.2642	.4447	.5995	.7206	.8100	.8735	.9173	.9468
	3	.0138	.0784	.1892	.3233	.4595	.5838	.6892	.7740	.8395
	4	.0016	.0178	.0628	.1391	.2396	.3527	.4673	.5747	.6697
	5	.0001	.0032	.0168	.0490	.1036	.1794	.2710	.3710	.4723
	6		.0005	.0037	.0144	.0378	.0776	.1350	.2081	.2828
	7		.0001	.0007	.0036	.0118	.0289	.0583	.1019	.1596
	8			.0001	.0008	.0032	.0094	.0220	.0438	.0768
	9				.0001	.0008	.0027	.0073	.0167	.0328
	10					.0002	.0007	.0022	.0056	.0125
	11						.0002	.0006	.0017	.0043
	12							.0001	.0005	.0013
	13								.0001	.0004
	14									.0001

Table 2

CUMULATIVE POISSON PROBABILITIES

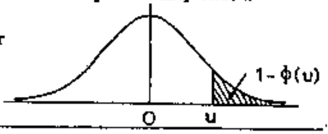
The table gives the probability that r or more random events are contained in an interval when the average number of such events per interval is m, i.e.

$$\sum_{x=r}^{\infty} e^{-m}\frac{m^{x}}{x!}$$

Where there is no entry for a particular pair of values of r and m, this indicates that the appropriate probability is less than 0.000 05. Similarly, except for the case r = 0 when the entry is exact, a tabulated value of 1.0000 represents a probability greater than 0.999 95.

m =	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
r = 0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1	.0952	.1813	.2592	.3297	.3935	.4512	.5034	.5507	.5934	.6321
2	.0047	.0175	.0369	.0616	.0902	.1219	.1558	.1912	.2275	.2642
3	.0002	.0011	.0036	.0079	.0144	.0231	.0341	.0474	.0629	.0803
4		.0001	.0003	.0008	.0018	.0034	.0058	.0091	.0135	.0190
5				.0001	.0002	.0004	.0008	.0014	.0023	.0037
6							.0001	.0002	.0003	.0006
7										.0001
m =	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**2.0**
r = 0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1	.6671	.6988	.7275	.7534	.7769	.7981	.8173	.8347	.8504	.8647
2	.3010	.3374	.3732	.4082	.4422	.4751	.5068	.5372	.5663	.5940
3	.0996	.1205	.1429	.1665	.1912	.2166	.2428	.2694	.2963	.3233
4	.0257	.0338	.0431	.0537	.0656	.0788	.0932	.1087	.1253	.1429
5	.0054	.0077	.0107	.0143	.0186	.0237	.0296	.0364	.0441	.0527
6	.0010	.0015	.0022	.0032	.0045	.0060	.0080	.0104	.0132	.0166
7	.0001	.0003	.0004	.0006	.0009	.0013	.0019	.0026	.0034	.0045
8			.0001	.0001	.0002	.0003	.0004	.0006	.0008	.0011
9							.0001	.0001	.0002	.0002
m =	**2.1**	**2.2**	**2.3**	**2.4**	**2.5**	**2.6**	**2.7**	**2.8**	**2.9**	**3.0**
r = 0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1	.8775	.8892	.8997	.9093	.9179	.9257	.9328	.9392	.9450	.9502
2	.6204	.6454	.6691	.6916	.7127	.7326	.7513	.7689	.7854	.8009
3	.3504	.3773	.4040	.4303	.4562	.4816	.5064	.5305	.5540	.5768
4	.1614	.1806	.2007	.2213	.2424	.2640	.2859	.3081	.3304	.3528
5	.0621	.0725	.0838	.0959	.1088	.1226	.1371	.1523	.1682	.1847
6	.0204	.0249	.0300	.0357	.0420	.0490	.0567	.0651	.0742	.0839
7	.0059	.0075	.0094	.0116	.0142	.0172	.0206	.0244	.0287	.0335
8	.0015	.0020	.0026	.0033	.0042	.0053	.0066	.0081	.0099	.0119
9	.0003	.0005	.0006	.0009	.0011	.0015	.0019	.0024	.0031	.0038
10	.0001	.0001	.0001	.0002	.0003	.0004	.0005	.0007	.0009	.0011
11					.0001	.0001	.0001	.0002	.0002	.0003
12									.0001	.0001

The function tabulated is $1 - \Phi(u)$ where $\Phi(u)$ is the cumulative distribution function of a standardised Normal variable u. Thus $1 - \Phi(u) = \frac{1}{\sqrt{2\pi}} \int_u^\infty e^{-u^2/2}\, du$ is the probability that a standardised Normal variable selected at random will be greater than a value of u $\left(= \frac{x-\mu}{\sigma}\right)$



$\frac{(x-\mu)}{\sigma}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641
0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
2.0	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
2.2	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
2.3	.01072	.01044	.01017	.00990	.00964	.00939	.00914	.00889	.00866	.00842
2.4	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
2.5	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00508	.00494	.00480
2.6	.00466	.00453	.00440	.00427	.00415	.00402	.00391	.00379	.00368	.00357
2.7	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00264
2.8	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
2.9	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139

Table 4

PERCENTAGE POINTS OF THE NORMAL DISTRIBUTION

α	u_α	α	u_α	α	u_α	α	u_α	α	u_α	α	u_α
.50	0.0000	.050	1.6449	.030	1.8808	.020	2.0537	.010	2.3263	.050	1.6449
.45	0.1257	.048	1.6646	.029	1.8957	.019	2.0749	.009	2.3656	.010	2.3263
.40	0.2533	.046	1.6849	.028	1.9110	.018	2.0969	.008	2.4089	.001	3.0902
.35	0.3853	.044	1.7060	.027	1.9268	.017	2.1201	.007	2.4573	.0001	3.7190
.30	0.5244	.042	1.7279	.026	1.9431	.016	2.1444	.006	2.5121	.00001	4.2649
.25	0.6745	.040	1.7507	.025	1.9600	.015	2.1701	.005	2.5758	.025	1.9600
.20	0.8416	.038	1.7744	.024	1.9774	.014	2.1973	.004	2.6521	.005	2.5758
.15	1.0364	.036	1.7991	.023	1.9954	.013	2.2262	.003	2.7478	.0005	3.2905
.10	1.2816	.034	1.8250	.022	2.0141	.012	2.2571	.002	2.8782	.00005	3.8906
.05	1.6449	.032	1.8522	.021	2.0335	.011	2.2904	.001	3.0902	.000005	4.4172

Table 7

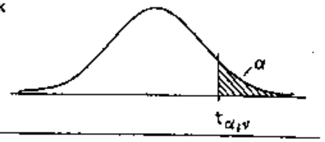
PERCENTAGE POINTS OF THE t DISTRIBUTION

The table gives the value of $t_{\alpha;\nu}$ — the 100α percentage point of the t distribution for ν degrees of freedom.

The values of t are obtained by solution of the equation:-

$$\alpha = \Gamma\{\tfrac{1}{2}(\nu+1)\}\{\Gamma(\tfrac{1}{2}\nu)\}^{-1}(\nu\pi)^{-1/2}\int_t^\infty (1 + x^2/\nu)^{-(\nu+1)/2}dx$$

Note. The tabulation is for one tail only i.e. for positive values of t. For |t| the column headings for α must be doubled.



$\alpha =$	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
$\nu =$ 1	3.078	6.314	12.706	31.821	63.657	318.31	636.62
2	1.886	2.920	4.303	6.965	9.925	22.326	31.598
3	1.638	2.353	3.182	4.541	5.841	10.213	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	1.319	1.714	2.069	2.500	2.807	3.485	3.767
24	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	1.296	1.671	2.000	2.390	2.660	3.232	3.460
120	1.289	1.658	1.980	2.358	2.617	3.160	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.090	3.291

This table is taken from Table III of Fisher & Yates: Statistical Tables for Biological, Agricultural and Medical Research, published by Oliver & Boyd Ltd., Edinburgh, and by permission of the authors and publishers and also from Table 12 of Biometrika Tables for Statisticians, Volume 1, by permission of the Biometrika Trustees.

BBR33803 BASIC STATISTICS

Q1(a) (6)

The color of the shirt – qualitative — A1
The number of hand phone the students own – quantitative, discrete — A1 A1
Rate of growth of the bacteria – quantitative, continuous — A1 A1
Types of house – qualitative — A1

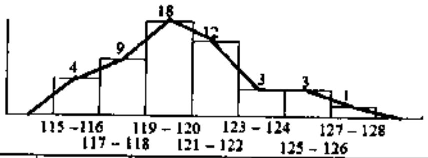
Q1(b)(i) (14)

$k = 1 + 3.3\log n = 1 + 3.3\log 50 = 6.6 \approx 7$ — M1 A1

(ii) Class interval $= \dfrac{\text{highest value} - \text{lowest value}}{k} = \dfrac{128-115}{7} = 1.86 \approx 2$ — M1 A1

Class limits	Class boundary	Frequency	Cumulative freq
			0
115 – 116	114.5 – 116.5	4	4
117 – 118	116.5 – 118.5	9	13
119 – 120	118.5 – 120.5	18	31
121 – 122	120.5 – 122.5	12	43
123 – 124	122.5 – 124.5	3	46
125 – 126	124.5 – 126.5	3	49
127 – 128	126.5 – 128.5	1	50
M1	M1M1	M1	A1

Q1(b)(iii)



M1- Bar graph
M1 -Frequency
M1 -Class limit
M1- Polygon frequency
A1 -All correct

Q2(a) (8)

Class limit	Lower boundary	x	f	f_ix_i	$f_ix_i^2$
100 – 119	99.5	109.5	4	438	47961
120 – 139	119.5	129.5	5	647.5	83851.25
140 – 159	139.5	149.5	2	299	44700.5
160 – 179	159.5	169.5	3	508.5	86190.75
180 – 199	179.5	189.5	6	1137	215481.5
Total			20	3030	478165

M1 M1M1M1
M1M1M1-Total
A1-All correct

Q2(b) (12)

(i) $\bar{x} = \dfrac{3030}{20} = 151.5$ — M1 M1 M1 A1

(ii) $s^2 = \dfrac{1}{\Sigma f - 1}\left[\sum_{i=1}^{n} f_ix_i^2 - \dfrac{(\Sigma f_ix_i)^2}{\Sigma f}\right] = \dfrac{1}{19}\left[478165 - \dfrac{(3030)^2}{20}\right]$ — M1 M1 M1 A1

$= 1006.3158$, $s = 31.722$

(iii) $M = L_M + C\left(\dfrac{n/2 - F}{f_m}\right) = 139.5 + 20\left(\dfrac{20/2 - 9}{2}\right) = 149.5$ — M1 M1 M1 A1

Q3(a) (6)

(i) P (X ≥ 7) = 0.1019 (from table binomial) — M1 M1 A1
(ii) P (2≤ X ≤ 9) = P(X≥2) – P(X≥1) = 0.9173 – 0. 0056 = 0.9117 — M1 M1 A1

Q3(b) (7)

(i) $^3C_0(0.5)^0(0.5)^3 = 0.125$

(ii) P(at least one boy) = P (X ≥ 1) = P (X=1) + P(X=2) + P (X=3) — M1 M1A1
$= {}^3C_1(0.5)^1(0.5)^2 + {}^3C_2(0.5)^2(0.5)_1 + {}^3C_3(0.5)^3(0.5)^0$
= 0.375 + 0.375 + 0.125 = 0.875 — M1 M1 M1 A1

Q3(b) (7)

(i) P(exactly five) = P (X = 5) = $e^{-3}(3)^5 / 5!$ = 0.1008 — M1 M1 A1
(ii) P (less than three) = P (X < 3) = P (X=0) + P (X=1) + P (X=2)
$= e^{-3}(3)^0/0! + e^{-3}(3)^1/1! + e^{-3}(3)^2/2!$ = 0.0498 + 0.1494 + 0.2240 = 0.4232 — M1 M1 M1 A1

Q4(a) (10)

Let X be the scores on English test, $X \sim N(70,20)$ — M1 M1 A1
(i) P(less than 50) = $P(X < 50) = P(Z < \frac{50-70}{20})$
= 1 – P (Z > – 1) = 1 – 0.1587=0.

(ii) 8413P(more than 74) = $P(X > 74) = P(Z > \frac{74-70}{20})$ — M1 M1 A1
= P (Z > 0.2) = 0.4207

(iii) P(Between 65 and 80) = $P(65 < X < 80) = P(\frac{65-70}{20} < Z < \frac{80-70}{20})$ — M1 M1M1A1
$= P(-0.25 < Z < 0.5) = 1 - P(Z > 0.25) - P(Z > 0.5)$
$= 1 - 0.4013 - 0.3085 = 0.2902$

Q4(b) (10)

(i) n=179, p=0.38 $\mu = np = 68.02, \sigma = \sqrt{npq} = \sqrt{179(0.38)(0.62)} = 6.49$ — M1 A1 M1 A1

(ii) q=0.62, nq = (179)(0.62) = 110.98 — M1 A1 B1
since np≥ 5 and nq≥5, ⇒ approx to normal distribution, $X \sim N(68.02, 6.49^2)$

$P(X \gg 70) = P(X \gg 69.5) = P(Z \gg \frac{69.5-68.02}{6.49})$ = P(Z>>0.228) = 0.4090 — M1 M1A1

Q5(a) (10)

(i) $\mu = E(X) = \Sigma x P(X = x)$ = 4(0.25)+5(0.35)+6(0.3)+7(0.1) = 5.25 — M1 M1A1-μ

Variance, $\sigma^2 = \text{Var}(X) = E(X^2) - [E(X)]^2$ — M1 M1 M1 A1-σ
$= [4^2(0.25) + 5^2(0.35) + 6^2(0.3) + 7^2(0.1)] - (5.25)^2$ = 28.45 – 5.252 = 0.8875

(ii) $\mu_{\bar{X}} = \mu = 5.25$ variance of $\bar{X}$, $\sigma^2_{\bar{X}} = \frac{\sigma^2}{n} = \frac{0.8875}{36} = 0.0247$ — A1 M1 A1

Q5(b) (10)

$\mu_{\bar{X}} = \mu = 120$ and $\sigma^2_{\bar{X}} = \sigma^2/n = 15^2/81$, $\Rightarrow \bar{X} \sim N(120, 15^2/81)$ — M1 A1 M1A1

$P(119 < \bar{X} < 125) = P\left(\dfrac{119-120}{15/\sqrt{81}} < \dfrac{\bar{X} - \mu_{\bar{X}}}{\sigma_{\bar{X}}} < \dfrac{122-120}{15/\sqrt{81}}\right)$ — M1 M2 M2 A1
$= P(-0.6 < Z < 1.2) = 1 - P(Z > 1.2) - P(Z > 0.6) = 0.6107$

Q6 (a) (10)

n = 50 (≥ 30), σ = 2 (σ known), use the standard normal distribution — M1 A1
The confidence interval is 95%, then α = 1-0.95 = 0.05
From the statistical table, $Z_{\alpha/2} = Z_{0.025} = 1.96$ — M1A1

The point estimate of μ is $\bar{x} = 23.2$ — A1- $\bar{x}$

$$\bar{x} - z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right) < \mu < \bar{x} + z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right)$$

23.2 – (1.96)(2/√50) <μ< 23.2 + (1.96)(2/√50) — M1M1
22.6 <μ< 23.8 — M1M1
So, the dean can say, with 95 % confidence, that the average age of students is between 22.6 and 23.8 years, based on 50 students. — A1

Q6(b) (10)

Since σ is unknown and s must replace it, the t distribution must be used for 95%. Hence, with 9 degrees of freedom, $t_{\alpha/2}$ = 2.262 — A1 / M1 A1 / M1 A1

$$\bar{x} - t_{\alpha/2,v}\left(\frac{s}{\sqrt{n}}\right) < \mu < \bar{x} + t_{\alpha/2,v}\left(\frac{s}{\sqrt{n}}\right)$$

0.32 – (2.2262)(0.08/√10) <μ< 0.32 + (2.2262)(0.08/√10) — M1 M1
0.32 – 0.057 <μ< 0.32 + 0.057 — M1 M1
0.26 <μ< 0.38 — A1
Therefore, one can be 95% confident that the population mean tread depth of all right front tires is between 0.26 and 0.38 inch based on 10 tires