Charles Darwin University

Final Examination

Family Name						
Given Name/s						
Student Number						
Teaching Period	Semester 1, 2018					

ECO503 – Economic Statistics	DURATION	
	Reading Time:	10 minutes
	Writing Time:	180 minutes

INSTRUCTIONS TO CANDIDATES

Total Marks: 50

Section A: Suggested Time: 60 mins	**Multiple Choice Questions**: Answer ALL 20 questions. Marks as indicated on paper
Section B: Suggested Time: 60 mins	**Statistics – Short Answer Questions**: Answer ANY 3 out of 5 questions. Marks as indicated on paper.
Section C: Suggested Time: 60 mins	**Economics – Short Answer Questions**: Answer ANY 3 out of 5 questions. Marks as indicated on paper.

Relax, concentrate and think your answers through. GOOD LUCK.

EXAM CONDITIONS

You may begin writing from the commencement of the examination session. The reading time indicated above is provided as a guide only.

This is a RESTRICTED OPEN BOOK examination

Any non-programmable calculator is permitted

No handwritten notes are permitted

Any hard copy, unannotated English dictionary is permitted

ADDITIONAL AUTHORISED MATERIALS	EXAMINATION MATERIALS TO BE SUPPLIED
No additional printed material is permitted	1 x 16 Page Book 1 x Scrap Paper Formula Sheet/s Statistical Table/s

THIS EXAMINATION IS PRINTED DOUBLE-SIDED.

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Section A
Multiple Choice Questions

Section B
Statistics – Short Answer Questions
Total Marks for this section: 15

This section should be answered in the Answer Booklet provided. You are required to answer any **THREE** out of **FIVE** questions. Each question is worth 5 marks.

Suggested Time allocation for Section B: 60 mins

Question 1

A retailer with 20,000 customers commissions a survey to gauge customer views on banning plastic bags, which would improve the environment. In the survey, 35% of the 800 customers interviewed said they would support a ban on plastic bags.

(a) What is the population of interest? (1 mark)
(b) What is the sample? (1 mark)
(c) What is the parameter? Do we know it's value? (1 mark)
(d) What is the statistic? Do we know it's value? (2 marks)

Question 2

Suppose that a new toy car is designed so that its lifetime (in months) is normally distributed with mean 18 months and standard deviation 4 months.

(a) The manufacturer has decided to use a marketing strategy in which the car is covered by warranty for 12 months. What is the probability that a car will stop working **before** the warranty expires?

(2 marks)

(b) Suppose that the manufacturer now decides to extend the warranty to 16 months. What is the probability that a car will continue working **after** the new warranty expires?

(3 marks)

Question 3

Consider the following sample of data:

3 7 12 14 15 15 17 20 23 24

(a) Calculate the mean, median, standard deviation and coefficient of variation for the sample. You must show your calculations.

(2 marks)

(b) If we drop the largest value from the sample, what will happen to the mean, median, standard deviation and coefficient of variation and what will be the new values?

(2 marks)

(c) Is it possible for the standard deviation to be negative? Explain, why?

(1 mark)

Question 4

Let X denote the number of pizzas delivered by Jim every night. The following table gives us the probability distribution of X.

x	2	3	4	5
p(x)	0.2	0.4	0.3	0.1

(a) Find $P(X \geq 3.5)$. (1 mark)

(b) Find the mean and the variance of X. (2 marks)

(c) Jim gets a fixed payment of $15 every night from the Pizza shop he works for. In addition, he gets $2 for every pizza he delivers. What is expected value of payment received by Jim every night? What is the variance of payment received?

(2 marks)

Question 5

The average starting salary of Bachelor of Commerce graduates in 2014 was $55,000. An Australian university claims that this average starting salary has increased since 2014. Suppose a prospective student wishes to investigate the University's claim at 1% level of significance. He/she chooses a sample of 46 graduates from the batch of 2017. The average salary in the sample was found to be $56,900. The population standard deviation of salaries is $6,782.

(a) State the null and alternative hypotheses to be tested.

(1 mark)

(b) Which test statistic should be used to test the hypothesis? Clearly state the conditions that need to be satisfied to use your test statistic.

(2 marks)

(c) Is the University's claim true? Why? Why not? Discuss.

(2 marks)

Section C
Economics – Short Answer Questions
Total Marks for this section: 15

This section should be answered in the Answer Booklet provided. You are required to answer any **THREE** out of **FIVE** questions. Each question is worth 5 marks.

Suggested Time allocation for Section C: 60 mins

Question 1

What are barriers to entry? Briefly describe the legal, economic and technical sources of barrier to entry. What kind of market structure would you expect to find if there are high barriers to entry?

[5 Marks]

Question 2

What is the difference between accounting cost and opportunity cost? Why is the concept of opportunity cost important in economics? Explain with the help of an example.

[5 Marks]

Question 3

Explain the concept of economies and diseconomies of scale with the help of a diagram.

[5 Marks]

Question 4

Consider the apartment housing market in Sydney. Explain the effect of each of the following with the help of a *diagram* on the *equilibrium market price and quantity* using a supply and demand model. Provide a brief explain of your answer.

(a) The state government clears a proposal to allow a large parkland to be used for property development.

[2 marks]

(b) An increase in the price of single unit houses

[3 Marks]

Question 5

What are the similarities and differences between a monopoly and monopolistic market structure? Which of the market structure is more common in the real world? Why? Explain your answer with the help of diagrams.

[5 Marks]

ECO503 Economic Statistics – Formula Sheet

Population mean $\mu = \frac{\sum_{i=1}^{N} x_i}{N}$

Sample mean $\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$

Range $Largest\ Observation - Smallest\ Observation$

Population variance $\sigma^2 = \frac{1}{N}\left[\sum_{i=1}^{N} x_i^2 - N\mu^2\right]$

Sample variance $s^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n} x_i^2 - n\bar{x}^2\right]$

Population standard deviation $\sigma = \sqrt{\sigma^2}$

Sample standard deviation $s = \sqrt{s^2}$

Population coefficient of variation $CV = \frac{\sigma}{\mu}$

Sample coefficient of variation $cv = \frac{s}{\bar{x}}$

Approximate sample standard deviation $s \cong \frac{Range}{4}$

Approximate sample mean (grouped data) $\bar{x} \cong \frac{\sum_{i=1}^{k} f_i m_i}{n}$

Approximate sample variance (grouped data) $s^2 \cong \frac{1}{n-1}\left[\sum_{i=1}^{k} f_i m_i^2 - \frac{\left(\sum_{i=1}^{k} f_i m_i\right)^2}{n}\right]$

Population covariance $\sigma_{xy} = \frac{\sum(x_i - \mu_x)(y_i - \mu_y)}{N}$

Sample covariance $s_{xy} = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{n-1}$

Population coefficient of correlation $\rho = \frac{\sigma_{xy}}{\sigma_x \sigma_y}$

Sample coefficient of correlation $r = \frac{s_{xy}}{s_x s_y}$

Least squares line $\hat{y} = b_0 + b_1 x, where\ b_1 = \frac{s_{xy}}{s_x^2}\ and\ b_0 = \bar{y} - b_1\bar{x}$

Coefficient of determination $R^2 = r^2$ ($r =$ coefficient of correlation)

Shortcut formulas for sample covariance

$$s_{xy} = \frac{1}{n-1}\left[\sum_{i=1}^{n} x_i y_i - \frac{\sum_{i=1}^{n} x_i \sum_{i=1}^{n} y_i}{n}\right]$$

$$s_{xy} = \frac{1}{n-1}\left[\sum_{i=1}^{n} x_i y_i - n\bar{x}\bar{y}\right]$$

Random Variables

Expected value (mean)	$E(X) = \mu = \sum_{\text{all } x} xp(x)$
Variance	$V(X) = \sigma^2 = \sum_{\text{all } x}(x-\mu)^2 p(x) = \sum_{\text{all } x} x^2 p(x) - \mu^2$
Standard deviation	$\sigma = \sqrt{\sigma^2}$
Covariance	$COV(X,Y) = \sum_{\text{all } x}\sum_{\text{all } y} xyp(x,y) - \mu_x \mu_y$
Coefficient of correlation	$\rho = \frac{\sigma_{xy}}{\sigma_x \sigma_y}$
Laws of Expected Value	1. $E(c) = c$
	2. $E(X + c) = E(X) + c$
	3. $E(cX) = cE(X)$
	4. $E(cX + d) = cE(X) + d$
Laws of Variance	1. $V(c) = 0$
	2. $V(X + c) = V(X)$
	3. $V(cX) = c^2 V(X)$
	4. $V(cX + d) = c^2 V(X)$

Laws of expected value and variance of sum of two variables

1. $E(X + Y) = E(X) + E(Y)$
2. $V(X + Y) = V(X) + V(Y) + 2COV(X,Y)$

Mean and variance of portfolio of two shares

1. $E(R_p) = w_1 E(R_1) + w_2 E(R_2)$
2. $V(R_p) = w_1^2 V(R_1) + w_2^2 V(R_2) + 2w_1 w_2 COV(R_1, R_2)$

Binomial probability $p(x) = \frac{n!}{n!(n-x)!} p^x (1-p)^{n-x}$

$E(X) = \mu = np$

$V(X) = npq, \quad \text{where } q = (1-p)$

Uniform distribution

Density function $f(x) = \frac{1}{b-a}; \quad a \leq x \leq b$

Mean $E(X) = \frac{a+b}{2}$

Variance $V(X) = \frac{(b-a)^2}{12}$

Standardised normal random variable $Z = \frac{X-\mu}{\sigma}$

Mean $E(Z) = 0$

Variance $V(Z) = 1$

Expected value of sample mean $E(\bar{X}) = \mu_{\bar{X}} = \mu$

Variance of sample mean $V(\bar{X}) = \sigma_{\bar{X}}^2 = \frac{\sigma^2}{n}$

Standard error of sample mean $\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$

Standardising sample mean $Z = \frac{\bar{X}-\mu}{\sigma/\sqrt{n}}$

Expected value of sample proportion $E(\hat{p}) = \mu_{\hat{p}} = p$

Variance of sample proportion $V(\hat{p}) = \sigma_{\hat{p}}^2 = \frac{pq}{n}, \quad q = 1-p$

Standard error of sample proportion $\sigma_{\hat{p}} = \sqrt{\frac{pq}{n}}$

Standardising sample proportion $Z = \frac{\hat{p}-p}{\sigma_{\hat{p}}}$

Confidence intervals

μ $\quad \bar{X} \pm z\alpha/2 \frac{\sigma}{\sqrt{n}}$ $\quad \bar{X} \pm t_{(\alpha/2),n-1} \frac{\sigma}{\sqrt{n}}$

p $\quad \hat{p} \pm z\alpha/2 \sqrt{\frac{\hat{p}\hat{q}}{n}}$

Required sample size $n = \left[\frac{z_{\alpha/2}\sigma}{B}\right]^2$ $n = \left[\frac{z_{\alpha/2}\sqrt{\hat{p}\hat{q}}}{B}\right]^2$

Test statistics

μ $Z = \frac{\bar{X}-\mu}{\sigma/\sqrt{n}}$ $t = \frac{\bar{X}-\mu}{s/\sqrt{n}}$

p $Z = \frac{\hat{p}-p}{\sqrt{pq/n}}$

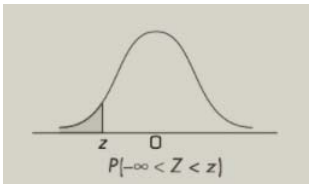
Forecasting

Mean Absolute Deviation $MAD = \frac{\sum_{t=1}^{n}|y_t - F_t|}{n}$

Sum of Squares for Forecast Error $SSFE = \sum_{t=1}^{n}(y_t - F_t)^2$

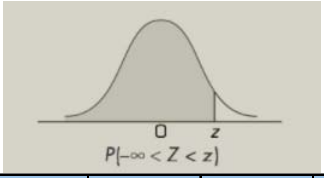
ECO503 Economic Statistics – Statistical Tables

Table 1: Standard Normal Distribution (cumulative probabilities)



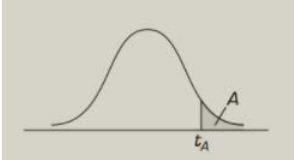
z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
-1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
-0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
-0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
-0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
-0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
-0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
-0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
-0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
-0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
-0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

Table 1: Standard Normal Distribution Continued (cumulative probabilities)



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	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

Table 2: Critical Values of the Student *t* Distribution



Degrees of freedom	$t_{0.100}$	$t_{0.050}$	$t_{0.025}$	$t_{0.010}$	$t_{0.005}$	Degrees of freedom	$t_{0.100}$	$t_{0.050}$	$t_{0.025}$	$t_{0.010}$	$t_{0.005}$
1	3.078	6.314	12.706	31.821	63.657	29	1.311	1.699	2.045	2.462	2.756
2	1.886	2.920	4.303	6.965	9.925	30	1.310	1.697	2.042	2.457	2.750
3	1.638	2.353	3.182	4.541	5.841	35	1.306	1.690	2.030	2.438	2.724
4	1.533	2.132	2.776	3.747	4.604	40	1.303	1.684	2.021	2.423	2.704
5	1.476	2.015	2.571	3.365	4.032	45	1.301	1.679	2.014	2.412	2.690
6	1.440	1.943	2.447	3.143	3.707	50	1.299	1.676	2.009	2.403	2.678
7	1.415	1.895	2.365	2.998	3.499	55	1.297	1.673	2.004	2.396	2.668
8	1.397	1.860	2.306	2.896	3.355	60	1.296	1.671	2.000	2.390	2.660
9	1.383	1.833	2.262	2.821	3.250	65	1.295	1.669	1.997	2.385	2.654
10	1.372	1.812	2.228	2.764	3.169	70	1.294	1.667	1.994	2.381	2.648
11	1.363	1.796	2.201	2.718	3.106	75	1.293	1.665	1.992	2.377	2.643
12	1.356	1.782	2.179	2.681	3.055	80	1.292	1.664	1.990	2.374	2.639
13	1.350	1.771	2.160	2.650	3.012	85	1.292	1.663	1.988	2.371	2.635
14	1.345	1.761	2.145	2.624	2.977	90	1.291	1.662	1.987	2.368	2.632
15	1.341	1.753	2.131	2.602	2.947	95	1.291	1.661	1.985	2.366	2.629
16	1.337	1.746	2.120	2.583	2.921	100	1.290	1.660	1.984	2.364	2.626
17	1.333	1.740	2.110	2.567	2.898	110	1.289	1.659	1.982	2.361	2.621
18	1.330	1.734	2.101	2.552	2.878	120	1.289	1.658	1.980	2.358	2.617
19	1.328	1.729	2.093	2.539	2.861	130	1.288	1.657	1.978	2.355	2.614
20	1.325	1.725	2.086	2.528	2.845	140	1.288	1.656	1.977	2.353	2.611
21	1.323	1.721	2.080	2.518	2.831	150	1.287	1.655	1.976	2.351	2.609
22	1.321	1.717	2.074	2.508	2.819	160	1.287	1.654	1.975	2.350	2.607
23	1.319	1.714	2.069	2.500	2.807	170	1.287	1.654	1.974	2.348	2.605
24	1.318	1.711	2.064	2.492	2.797	180	1.286	1.653	1.973	2.347	2.603
25	1.316	1.708	2.060	2.485	2.787	190	1.286	1.653	1.973	2.346	2.602
26	1.315	1.706	2.056	2.479	2.779	200	1.286	1.653	1.972	2.345	2.601
27	1.314	1.703	2.052	2.473	2.771	100000 (∞)	1.282	1.645	1.960	2.326	2.576
28	1.313	1.701	2.048	2.467	2.763						