

**CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ**

Autumn Examinations 2017/18

Module Title: Statistics and Financial Maths for Business

Module Code: STAT6011

School: Business

Programme Title(s): Bachelor of Business in Business Administration – Year 1
Bachelor of Business in Business Studies – Year 1
Higher Certificate in Business Studies – Year 1

Programmes Code(s): BBADM_7_Y1
BBUSS_7_Y1
BBUSE_6_Y1

External Examiner(s): Professor Michael Wallace

Internal Examiner(s): Ms. Katie Bullen, Ms. Patricia Cogan, Dr. Mark Hartnett,
Mr. Justin McGuinness, Dr. Shane O Rourke

Instructions: Answer ALL four questions (each question carries equal marks)
Do not write, draw or underline in RED.
Show all calculations and workings in full.
Please include your class group and lecturer's name on the front cover of each answer book.

Duration: 2 HOURS

Sitting: Autumn 2018

Note to Candidates: Please check the Programme Title and the Module Title to ensure that you have received the correct examination. If in doubt please contact an Invigilator.

Question 1

- (a) A and B are two events for an experiment, if $P(A) = \frac{2}{3}$ and $P(B) = \frac{8}{15}$, are A and B mutually exclusive events? Explain your answer.

[3 marks]

- (b) Three cards are selected at random from a standard pack of cards, without replacement. What is the probability that the cards contain:

- (i) Exactly one king
- (ii) At least one king

[5 marks]

- (c) A company makes electronic gadgets. One out of every 80 of these gadgets is faulty, but the company has no way of determining which products are faulty until they are returned by the customer. Suppose the company makes €5 profit on the sale of any working product, but suffers a loss of €65 for every faulty gadget, because they have to arrange collect, repair and delivery of the faulty product.

By calculating the expected profit for each gadget, determine if the company can expect a profit in the long term?

[8 marks]

- (d) Bliss Coffee operates a chain of six coffee shops across Munster. It is investigating options to increase sales across the chain, three shops are introducing a loyalty card scheme, two shops are cutting prices and one shop is doing neither. The probability of increasing sales due to introducing a loyalty card is 0.6 and there is a probability of increasing sales by cutting prices of 0.75, doing nothing means that the probability of increasing sales is 0.16.

- (i) Construct a tree diagram to represent the information.
- (ii) Calculate the probability that the chain will increase their sales.
- (iii) Given a shop increases their sales, what is the probability that it cut prices?

[9 marks]

Question 2

(a) The drink Monster Energy delivers one thousand cans per week to a specific supermarket. Of these cans, 5% are damaged in transit to this supermarket. If 13 cans of Monster are selected at random, what is the probability that:

- (i) Exactly 3 cans are damaged?
- (ii) Exactly no cans are damaged?
- (iii) At most 2 cans are damaged?

[8 marks]

(b) The supermarket sells on average 10 cans of Monster Energy in a 30 minute period. Find the probability that the supermarket:

- (i) Sells exactly 10 cans in a 30 minute period?
- (ii) Sells 30 cans in a one hour period?

[7 marks]

(c) The average profit made by this supermarket on the sale of Monster Energy cans sold in one year is €20,000 with a standard deviation of €4000. Assuming a Normal Distribution, what is the probability that the supermarket makes a profit of:

- (i) Less than €30,000 in one year?
- (ii) Between €18,000 and €30,000 in one year?
- (iii) More than €25,000 in one year?

[10 marks]

Question 3

Over the period of a week, a department store counted the number of people who entered the store and the amount taken in sales. The data is recorded in the table below.

Day	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
No. of customers (x)	800	1200	1100	1000	1400	2200	1800
Sales, €000's (y)	12	10	9	13	16	20	32

$$\sum x = 9500, \sum y = 112, \sum xy = 168500, \sum x^2 = 14330000, \sum y^2 = 2174$$

- (a) Using the graph paper at the centre of the booklet, plot a scatter diagram for the data. **[4 marks]**
- (b) Calculate the coefficient of correlation correct to three decimal places. Comment on your answer. **[7 marks]**
- (c) Calculate the coefficient of determination correct to three decimal places. Comment on your answer. **[2 marks]**
- (d) Use the least squares method to find the regression equation, rounding the values of a and b to two decimal places. **[8 marks]**
- (e) Plot the regression line on your scatter diagram from part (a). **[2 marks]**
- (f) Using the regression equation you obtained in part (d), estimate what the sales would be if 2000 customers visited the store. **[2 marks]**

Question 4

- (a) The Bank of Eastminster offers borrowers an annual rate of interest of 4.5% where interest is compounded monthly. The Bank of West Dakota offers borrowers a *quarterly* interest rate of 1.3% compounded quarterly. Find the APR for each bank. Which bank offers better value for borrowers?

[6 marks]

- (b) Desmond saves €3,000 in a bank that offers savers a monthly interest rate of 0.15% (compounded monthly). Assuming that no additional lodgements or withdrawals are made calculate the balance in Michael's account after four years.

[5 marks]

- (c) Ophelia borrows €200,000 from a credit union to buy a house and intends to repay the loan in equal monthly repayments over 15 years due at the end of each month. The credit union charges 0.25% monthly interest (compounded monthly). Calculate the monthly repayments on the loan.

[5 marks]

- (d) Find the present value of €50,000 payable in 8 years' time if the annual interest rate is 5.5%.

[3 marks]

- (e) Emma intends to make four equal deposits into a sinking fund at the beginning of each year for the next four years. The fund will earn compound interest at 3.5% per annum. Fionn wants to ensure that there is €500,000 in the fund at the end of the four years and intends to make no withdrawals until then.

- (i) Calculate the size of each annual deposit in the sinking fund.
(ii) Calculate the total amount of interest that the fund will earn over the four years.

[6 marks]

Formulae

Probability

Conditional Probability:

$$P(B|A) = \frac{P(A,B)}{P(A)} \quad \text{OR} \quad P(B|A) = \frac{P(A \cap B)}{P(A)}$$

Expected Value:

$$E(X) = \sum_{i=1}^n x_i P(x_i)$$

Binomial Distribution:

$$P(r, n) = {}^n C_r p^r q^{n-r} \quad \text{OR} \quad P(r) = \binom{n}{r} p^r q^{n-r}$$

Poisson Distribution:

$$P(r) = \frac{\lambda^r \cdot e^{-\lambda}}{r!} \quad \text{OR} \quad P(r) = e^{-\lambda} \left[\frac{\lambda^r}{r!} \right] \quad \text{Note: } e = 2.718 \text{ approximately}$$

Standard Normal Units:

$$Z = \frac{x - \mu}{\sigma} \quad \text{OR} \quad Z = \frac{x - \bar{x}}{s}$$

Regression and Correlation

$$y' = a + bx$$

$$b = \frac{n \sum xy - \sum x \sum y}{n \sum x^2 - (\sum x)^2}$$

$$\sum y = na + b \sum x$$

$$a = \bar{y} - b\bar{x}$$

$$\sum xy = a \sum x + b \sum x^2$$

$$a = \frac{\sum y - b \sum x}{n}$$

$$\bar{y} = a + b\bar{x}$$

Coefficient of Correlation:

$$r = \frac{n \sum xy - \sum x \sum y}{\sqrt{n \sum x^2 - (\sum x)^2} \cdot \sqrt{n \sum y^2 - (\sum y)^2}} \quad \text{OR} \quad \frac{n \sum xy - \sum x \sum y}{\sqrt{(n \sum x^2 - (\sum x)^2) \cdot (n \sum y^2 - (\sum y)^2)}}$$

Formulae continued

Financial Maths

Compound Interest:

$$A = P(1 + i)^n$$

Present Value:

$$P = \frac{A}{(1 + i)^n}$$

APR:

$$APR = (1 + i)^n - 1$$

Annuity Formulae: (Payment Interval = Interest Period)

A = Amount (Future Value)

P = Present Value

$$A = R \left[\frac{(1 + i)^n - 1}{i} \right]$$

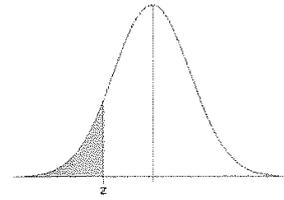
$$P = R \left[\frac{1 - (1 + i)^{-n}}{i} \right]$$

Annuity Due Formulae:

$$A = R(1 + i) \left[\frac{(1 + i)^n - 1}{i} \right]$$

$$P = R(1 + i) \left[\frac{1 - (1 + i)^{-n}}{i} \right]$$

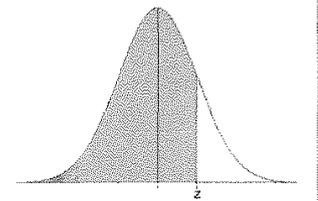
Standard Normal Cumulative Probability Table



Cumulative probabilities for **NEGATIVE** z-values are shown in the following table:

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-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

Standard Normal Cumulative Probability Table



Cumulative probabilities for POSITIVE z-values are shown in the following table:

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
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998