

BOTSWANA COLLEGE OF DISTANCE AND OPEN LEARNING

In collaboration with

ZIMBABWE OPEN UNIVERSITY

B COM (HRM & INDUSTRIAL RELATIONS)

BUSINESS STATISTICS
BS 221

SESSIONAL EXAMINATION

TIME: 3 HOURS

MARKS: 100

Instructions:

1. The examination consists of three sections: A, B and C.
2. Begin each answer to a new question on a new page.
3. Answer questions according to instructions given in each section.
4. Write answers in the answer booklet provided.
5. Write in grammatical English.

SECTION A

[15 MARKS]

Answer ALL questions in this section.

1. Given that, the mean of 10, 18, 9 and 28 is 16.25, if each observation is decreased by 5, the new mean is:

- A. $16.25-5$
- B. 16.25×5
- C. $16.25+5$
- D. 16.25

Use the data set 17, 28, 6, 19, 1, 12 and 5 to answer questions 2 and 3

2. The median is:

- A. 12
- B. 28
- C. 17
- D. 11

3. The range is:

- A. 1
- B. 12
- C. 11
- D. 19

4. The mode of the data set 0.51kg 800g 0.80kg 10kg 10.5kg 15kg is

- A. 15 kg
- B. 0.80 kg
- C. 0.51 kg
- D. 6.27 kg

5. Of the following, which one is not a measures of dispersion?

- A. Mean

- B. Variance
 - C. Range
 - D. Standard Deviation
6. If Q_1 and Q_3 define Quartile 1 and Quartile 3 respectively, then the Inter Quartile Range is defined by:
- A. $Q_3 - Q_1$
 - B. $Q_3 + Q_1$
 - C. $\frac{Q_3 - Q_1}{2}$
 - D. $\frac{Q_3 + Q_1}{2}$

Use the data set 72, 64, 93, 44, 13, 62, 54, 25, 37, 89 to answer Questions 7 and 8

7. The Inter Quartile Range for the data set is:
- A. 80
 - B. 13
 - C. 93
 - D. 35
8. The semi Inter Quartile Range is:
- A. 13
 - B. 17.5
 - C. 40
 - D. 35
9. The variance of a data set containing 20 numbers is 900. The standard deviation is:
- A. 1800
 - B. 30
 - C. 35

D. 45

10. Given that the mean of a data set containing 10 numbers is 15 and the standard deviation is 5, the coefficient of variation (CV) is:

A. $33\frac{1}{3}\%$

B. 30%

C. $7\frac{1}{2}\%$

D. None of the above

Consider the following pairs and answer questions 11 and 12:

i. Distance travelled and Time taken

ii. Tax paid and income earned

iii. Sales and Profits

iv. Age (year) and machine reliability

11. One of the following describes the whole set of dependent variables for the given data:

A. Distance; Income earned; Profits; Machine Reliability

B. Profits; Age; Income earned; Distance

C. Age; Income earned; Sales; Time taken

D. Distance; Tax paid; Profits; Machine Reliability

12. One of the following describes the whole set of independent variables for the given data:

A. Age; Sales; Income Earned; Distance

B. Time taken; Income earned; Sales; Age

C. Distance; Income earned; Sales; Machine Reliability

D. Time taken; Tax Paid; Profits; Age

13. If P_0 , and P_n and Q_0 and Q_n are prices (for periods 0 and n) and quantities (for periods 0 and n) respectively, then the Paasche Price Index (PPI) is given by:

A.
$$PPI = \frac{\sum P_n Q_n}{\sum P_0 Q_n} * 100\%$$

B.
$$PPI = \frac{\sum P_0 Q_0}{\sum P_n Q_n} * 100\%$$

C.
$$PPI = \frac{\sum P_0 Q_0}{\sum P_0 Q_n} * 100\%$$

$$D. PPI = \frac{\sum P_0 Q_n}{\sum P_n Q_0} * 100\%$$

14. In the data set 10000, 2, 46, 23, 23, 12, 1, 35, 15, 10, 9 the number 10000 is referred to as:
- A. Range
 - B. Outrange
 - C. Outlier
 - D. None of the above

15. In the general linear regression analysis line $y = a + bx$, the parameter b is obtained by using the formula:

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

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

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

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

SECTION B

[35 MARKS]

Answer ALL questions in this section.

- a. Distinguish between discrete and continuous data, giving an example of each. **(4 marks)**
- b. Explain the terms “measures of central location” and “measures of dispersion” giving one example of each type. **(4 marks)**
- c. An experiment is performed using two die shown below.
 - i. Write down the complete sample space of the two die. **(4 marks)**
 - ii. Find the probability that the numbers displayed on the top faces of the two die as they land add up to 6. **(5 marks)**
 - iii. Calculate the probability that the difference between the numbers is 3. **(5 marks)**

- d. An electricity producing company has noticed that if the power plant runs for a certain number of hours, some electricity (in 000 s of KW) is produced. After 6 days, data was collected and presented in a table below.

KW of Electricity (000's)	Number of Hours of operation
72	8
61	6
89	9
58	5
42	4
51	4.5

Portray the above information in a scatter-graph.

(4 marks)

- e. Write a short note on each of the following sampling methods.

- i. Simple Random Sampling
- ii. Stratified Random Sampling
- iii. Systematic Random Sampling

(3 marks)

(3 marks)

(3 marks)

SECTION C

[50 MARKS]

Answer any TWO questions in this section.

Question 1

[25 MARKS]

Find the moving averages by performing the 3-period and 5-period moving average methods, for the following data:

	Sales (P1000)		Sales (P1000)
January 2006	75	July	120
February	34	August	46
March	51	September	107

April	93	October	131
May	75	November	98
June	92	December	105

(12 marks)

Which moving averages method shows more fluctuation than the other? (3 marks)

Draw line graphs comparing the actual time series to both the 3-period and the 5-period moving average values? (10 marks)

Question 2

[25 MARKS]

- a. In a group of 46 people on holiday it is established that there are:
- 10 males under the age of 21
 - 8 females under the age of 21
 - 6 males aged between 21 and 30
 - 5 females aged between 21 and 30
 - 7 males over the age of 30

Calculate the probability that, if one person is selected at random from the group this person will be:

- (i) a female over the age of 30 [3 marks]
- (ii) a male over the age of 21 [3 marks]
- (iii) a person less than 21 [3 marks]
- (iv) a female between 21 and 30 years [4 marks]
- (v) a female on condition that she is below 21 [4 marks]

- b. Once a week a merchandiser replenishes the stocks of a particular product brand in 15 stores for which she is responsible. Experience has shown that there is a one in five chance that a given store will have run out of stock before the merchandiser's weekly visit. What is the probability that, on a given weekly round, the merchandiser will find:

- (i) Exactly 1 store is out of stock? [4 marks]
- (ii) Less than 2 stores are out of stock? [4 marks]

Question 3

[25 MARKS]

Power generation at a certain power plant is from coal. The table below shows the tonnage of coal used in 2014 and the electricity generated.

Coal used in 2014 (in millions of tones)	Electricity generated (millions kilowatt hours)
5	15
9	27
12	35
11	40
15	32
18	28
19	36
30	41
25	40
27	38

- Find the straight-line regression function to estimate electricity generated (Y) from coal used (X) by the method of least squares. **(10 marks)**
- What is the value of electricity generated if the coal used is 10 million tones? **(4 marks)**
- Find the amount of coal that has been used if 50 million kilowatt hours of electricity were generated. **(4 marks)**
- Find the correlation coefficient between coal used and electricity generated and comment on the relationship of coal usage to electricity generated. **(7 marks)**

END OF EXAMINATION

List of Formulae for Business Statistics

Probability Distributions

Poisson Probability Distribution

$$P(x) = \frac{e^{-a} a^x}{x!}$$

Normal Probability Distribution

$$z = \frac{x - \mu}{\sigma}$$

Binomial Probability Distribution

$$P(x) = \frac{n! * p^x q^{n-x}}{x! * (n-x)!}$$

Simple Linear Regression Analysis

$$b = \frac{n \sum XY - \sum X \sum Y}{n \sum X^2 - (\sum X)^2}$$

$$a = \frac{\sum Y - b \sum X}{n}$$

Probability

Conditional Probability

For two events A and B, $P(A/B) = \frac{P(A \cap B)}{P(B)}$

For non-mutually exclusive events A and B

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

Combinations

$${}^n C_r = \frac{n!}{r!(n-r)!}$$

Permutations

$${}^n P_r = \frac{n!}{(n-r)!}$$

Measures of Central Tendency/Dispersion

Ungrouped Data

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

Sample Variance $s^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}$

Mean Absolute Deviation: $MAD = \frac{\sum_{i=1}^n |x_i - \bar{x}|}{n}$

Grouped Data

Mean = $\bar{x} = \frac{\sum_{i=1}^n f_i x_i}{n} = \frac{\sum_{i=1}^n f_i x_i}{\sum f_i}$

Median = $O_{me} + \frac{c(\frac{n}{2} - f(<))}{f_{me}}$

Mode = $O_{mo} + \frac{c(f_m - f_{m-1})}{2f_m - f_{m-1} - f_{m+1}}$

Lower Quartile

$Q_1 = O_{q1} + \frac{c(\frac{n}{4} - f(<))}{f_{q1}}$

Upper Quartile $Q_3 = O_{q3} + \frac{c(\frac{3n}{4} - f(<))}{f_{q3}}$

Variance = $\frac{\sum_{i=1}^n f_i (x_i - \bar{x})^2}{n-1}$

Index Numbers

Laspeyres Price Index

Laspeyres Quantity Index

$LPI = \frac{\sum P_n Q_0}{\sum P_0 Q_0} * 100\%$

$LQI = \frac{\sum P_0 Q_n}{\sum P_0 Q_0} * 100\%$

Paasche Price Index

Paasche Quantity Index

$PPI = \frac{\sum P_n Q_n}{\sum P_0 Q_n} * 100\%$

$PQI = \frac{\sum P_n Q_n}{\sum P_n Q_0} * 100\%$

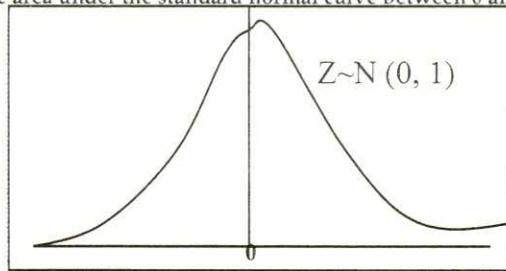
The Fishers Price Index and Fishers Quantity Index can be calculated as follows:

$Fishers Price Index = \sqrt{LPI * PPI}$

$Fishers Quantity Index = \sqrt{LQI * PQI}$

The standard normal distribution (z)

This table gives the area under the standard normal curve between 0 and z . i.e. $P[0 < Z < z]$



Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2703	0.2734	0.2764	0.2793	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3557	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4380	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4514	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4884	0.4884	0.4887	0.4890
2.3	0.48928	0.48956	0.48983	0.49010	0.49036	0.49061	0.49086	0.49111	0.49134	0.49158
2.4	0.49180	0.49202	0.49224	0.49245	0.49266	0.49286	0.49305	0.49324	0.49343	0.49361
2.5	0.49379	0.49396	0.49413	0.49430	0.49446	0.49461	0.49477	0.49492	0.49506	0.49520
2.6	0.49534	0.49547	0.49560	0.49573	0.49585	0.49598	0.49609	0.49621	0.49632	0.49643
2.7	0.49653	0.49664	0.49674	0.49683	0.49693	0.49702	0.49711	0.49720	0.49728	0.49736
2.8	0.49744	0.49752	0.49760	0.49767	0.49774	0.49781	0.49788	0.49795	0.49801	0.49807
2.9	0.49813	0.49819	0.49825	0.49831	0.49836	0.49841	0.49846	0.49851	0.49856	0.49861
3.0	0.49865	0.49869	0.49874	0.49878	0.49882	0.49886	0.49889	0.49893	0.49897	0.49900
3.1	0.49903	0.49906	0.49910	0.49913	0.49916	0.49918	0.49921	0.49924	0.49926	0.49929
3.2	0.49931	0.49934	0.49936	0.49938	0.49940	0.49942	0.49944	0.49946	0.49948	0.49950
3.3	0.49952	0.49953	0.49955	0.49957	0.49958	0.49960	0.49961	0.49962	0.49964	0.49965
3.4	0.49966	0.49968	0.49969	0.49970	0.49971	0.49972	0.49973	0.49974	0.49975	0.49976
3.5	0.49977	0.49978	0.49978	0.49979	0.49980	0.49981	0.49981	0.49982	0.49983	0.49983
3.6	0.49984	0.49985	0.49985	0.49986	0.49986	0.49987	0.49987	0.49988	0.49988	0.49989
3.7	0.49989	0.49990	0.49990	0.49990	0.49991	0.49991	0.49991	0.49992	0.49992	0.49992
3.8	0.49993	0.49993	0.49993	0.49994	0.49994	0.49994	0.49994	0.49995	0.49995	0.49995
3.9	0.49995	0.49995	0.49996	0.49996	0.49996	0.49996	0.49996	0.49996	0.49997	0.49997
4.0	0.49997	0.49997	0.49997	0.49997	0.49997	0.49997	0.49998	0.49998	0.49998	0.49998