Botswana College of Distance And Open Learning

In Collaboration With

Zimbabwe Open University

Business Statistics

Sessional Examination, 2008

Instruction to Learners

1. Answer **all** questions in Section **A** and **any two** questions in section **B.**
2. Begin each answer to a new question on a fresh page.
3. Answer all questions in **English.**
4. Total marks is 100.

Section A

[50 Marks]

Answer **all** questions in this Section.

Question 1A

[15 Marks]

1. Suppose we have two dice. A is the event that 4 shows on the first die and B is the event that 4 shows on the second die. If both dice are rolled at once, what is the probability that two 4's occur?

   1/6 x 1/6 = 1/36

   A. 1/2
   B. 2/36
   C. 8/36
   D. 1/36

2. What is the probability that two tails occur when two coins are tossed?

   (a) 1/2
   (b) 1/4
   (c) 1
   (d) 3/4

3. Which of the following is another name of a predictor variable?

   A. Response variable
   B. Dependent variable
   C. Independent variable
   D. Discrete variable

4. What is a classical probability?

   A. Is the relative frequency of each event in the sample space when each event is equally likely?
   B. Is the relative frequency of a frequency distribution based on observation?
   C. Is an estimate that an event will happen based on how often the event occurs after collecting data or running an experiment?
   D. Is an act or process of observation that leads to a single outcome that cannot be predicted with certainty?

5. Which of the following describes Type 1 error?
   A. The probability of rejecting the null hypothesis when in fact it is true. ✓
   B. The probability of rejecting the null hypothesis when it is false.
   C. The probability of accepting the null hypothesis when in fact it is false.
   D. The probability of accepting the null hypothesis when it is true.

6. Which of the following is not an example of a seasonal variation?
   (a) Sales of ice cream will be higher in summer than in winter.
   (b) Shops might expect higher sales shortly before Christmas.
   (c) The telephone network may be heavily used at certain times of the day (such as mid-morning and mid- afternoon).
   (d) Technology improvements

7. What is a qualitative data?

   A. Refers to data that is defined by numerical characteristic that can only be observed.
   B. Refers to data that is defined by a non numerical characteristic that can only be observed.
   C. Refers to data from an original elementary unit.
   D. Refers to data from readily available document.

8. Which of the following is not a characteristic of a Good estimate?

   A. Consistency
   B. Sufficiency
   C. Efficiency
   D. Bias

9. A Marketer in a Company carried out a research on new toothpaste that is to be launched in the near future. From 500 potential customers, she interviewed 190, who were given the toothpaste to use prior to the interview. Which of the following is a sample?
   A. All the 500 potential customers
   B. 190 potential customers interviewed
   C. 500
   D. 190

10. Which of the following is used to denote the null hypothesis?
   A. H_0
   B. H_0 *and* H_1
   C. H_1
   D. H_2 *and* H_1

11. What is the probability of drawing an Ace from a well-shuffled deck of 52 playing cards?
   A. 1/52
   B. 3/4
   C. 1/13
   D. 1/4

12. What is Statistical inference?

A. The act of generalising from a sample to a population with calculated degree of certainty.
B. The act of collecting and summarising data into tables and graphs.
C. The act of generalising from a population a sample with calculated degree of certainty.
D. The act of collecting and presenting data into a manageable size.

13. A Mathematics class consists of 14 woman and 16 men. Of these, 12 of the men and half of the women study Computer Science. A person is chosen at random from the class. Find the probability that the person selected is a woman.

A. 1/14
B. 14/16
C. 7/12
D. 14/30

14. Which of the following is not a measure of central tendency?

A. Mean
B. Median
C. Mode
D. Range

15. For the following data set: 72, 93, 66, 75, 40 and 32. Find the sum of the deviations from the mean.

A. 8
B. 63
C. 93
D. 0

Question 1B - Short Answers [10 Marks]

Define the following terms.

(a) Statistics [2 marks]
(b) Elementary units [2 marks]
(c) Sample [2 marks]
(d) Attribute [2 marks]
(e) Observation [2 marks]

Question 2

[25 Marks]

(a) A group of five applicants for a pair of identical jobs consists of three Men listed as M1, M2, M3 and two women, W1, W2. Let S denote the set of all possible outcomes for the employer's selection. Let A denote the subset of outcomes corresponding to the selection of two men and B the subset corresponding to the selection of at least one woman. List the outcomes in:

(i) A **[4 marks]**

(ii) B′ **[4 marks]**

(v) A∩B' **[4 marks]**

(b) If a random variable has the normal distribution with $\mu = 10$ and $s = 5$, what is the probability that it will take on a value on the interval from 12 to 15? **[4 marks]**

(c) Using statistical tables, find the standard - normal curve area:

(i) to the left of $z = 0.94$ **[3 marks]**

(ii) to the right of $z = -0.65$ **[3 marks]**

(iii) between $z = 0.87$ and $z = 1.28$ **[3 marks]**

Section B

[50 Marks]

There are four questions in this section, answer **only two** questions.

Question 3

[25 marks]

(a) Muriel, a surveyor, must determine, based on a random sample of size $n = 35$ readings, whether the height of a certain hill is 724 feet, as recorded. The test is conducted using the 0.05 level of significance and, from a previous survey it is known that the standard deviation is $\sigma = 21$ feet. What will she decide if she gets $x = 732$ feet? (**Perform the hypothesis testing).** **[8 marks]**

(b) If a bank receives on the average $\lambda = 6$ bad checks per day,

(i) What is the probability that it will receive four bad checks on any given day? **[3 marks]**

(ii) What is the probability that it will receive five bad checks on any given day? **[3 marks]**

(iii) Find the mean. **[1 marks]**

$P(x) = {}^{N}C_{N-x}\, p^{x} q^{N-x}$

(c) The data is on the number of years worked for the company.

Number of Years	Number of workers
1-5	120
6-10	60
11-15	74
16-20	10
21-25	8

(i) Calculate the Mean. **[2 marks]**
(ii) Calculate the Median. **[4 marks]**
(iii) Calculate the Modal years worked. **[4 marks]**

Question 4 **[25 marks]**

The following table gives the price and quantity sold in the market for some commodities

Commodities	Price per unit in pula		Quantity sold in the market (000kg)	
	2000	2006	2000	2006
A	20	25	150	200
B	30	32	100	75
C	35	20	80	100
D	20	25	70	75
E	50	60	100	120

(a) Compute Simple Aggregate Index Number for the year 2006 using 2000 as base year. **[5 marks]**

(b) Compute Paasche Price index number for the year 2006 using 2000 as base year. **[5 marks]**

(c) Compute Laspeyeres Price index number for the year 2006 using 2000 as base year. **[5 marks]**

(d) Find also the price index numbers for the year 2000 using 2006 as base year. **[10 marks]**

Question 5 **[25 Marks]**

A. As part of his class project, a Business Studies student took a random sample of 50 college students and recorded how many hours a week they spend on the Internet. The Sample reveals an average of 6.9 hours.

(i) Calculate at the 90% Confidence Interval for average Internet usage among college students. Assume that the standard deviation of Internet usage for college students is known to be 4.5 hours per week. **[6 marks]**

(ii) The Internet usage for about 90% of college falls in the interval in (a) above. **True** or **False**? **[2 marks]**

(iii) Do we need to assume that weekly Internet usage for college students has a normal distribution? Explain your answer. **[3 marks]**

(iv) In this problem, we assume that the standard deviation of Internet usage is known to be 4.5 hours per week. Is it reasonable to assume that the actual value of this standard deviation is known to us? Please explain your answer. **[4 marks]**

B. Assume that a margin of error of ± 0.03 is made at 95% confidence level. Furthermore assume that the standard deviation is 15. Determine an approximate sample size, which is likely to yield that margin of error. **[6 marks]**

C. Define a point estimate and interval estimate. **[4 marks]**

Question 6

[25 Marks]

(a) A certain plot of land is in the shape of a rectangle whose length is 3 times its width. If the length is increased by 30 metres and the width is increased by 20 metres, the area of the plot is doubled.
Find the original measurements of the plot. **[8 marks]**

(b) When a man died, he bequeathed his wealth of P400 000 to be equally divided among his many wives. But two of his wives committed suicide due to uncontrollable grief. As a result, each of his surviving wives got P10 000 more than they were initially entitled to have.

(i) How many wives did this man have? **[6 marks]**
(ii) How much money did each of his wives get? **[7 marks]**
(iii) Write down four (4) limitations of Decision Trees. **[4 marks]**

15

1 40

60

15 10

15 10

15 10

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Sessional Examination, 2009

Instructions to Learners:

1. Answer **all** questions in Section **A** and **any two** questions in Section **B.**
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3. Total marks = 100.

Section A

[50 Marks]

Answer **all** questions in this section.

Question 1

[15 Marks]

1. Which of the following best describes two mutually exclusive events?

   A. If the occurrence of an event precludes the occurrence of another event.
   B. If the occurrence of an event is dependent on the occurrence of another event.
   C. If events can happen at the same time.
   D. All of the above.

2. A bag contains 15 red marbles and 10 blue marbles. An experiment is made by drawing one marble at a time. If a red marble is picked at random without replacement, what is the probability that the next pick produces a red marble also?

   A. $\frac{3}{5}$
   B. $\frac{7}{12}$
   C. 1
   D. $\frac{10}{14}$

3. Which of the following conditions will not be satisfied by a binomial experiment?

   A. There are n identical trials. In other words the given experiment is repeated n times. All these repetitions are performed under identical conditions.
   B. Each trial has two and only two outcomes. These outcomes are usually called a *success* and a *failure*.
   C. The probability of a success is denoted by p and that of failure by q, and $p + q = 1$. The probabilities of p and q remain constant for each trial.
   D. The trials are dependent, that is, the outcome of one trial affects the outcome of another trial.

4. Which of the following are types of alternative hypotheses?

   A. Upper one-tail test
   B. Lower one-tail test
   C. Two-tail test
   D. All of the above

5. Which of the following is normally used to denote the null hypothesis?

   A. H_0
   B. H_0 *and* H_1
   C. H_1
   D. H_4 *and* H_A

Use the data set $x_i = 7, 3, 7, 11, 2$ to answer questions 6, 7, 8 and 9.

6. What is the mean of the above data?
   A. 6
   B. 7
   C. 0
   D. 11

$30/5 = 6$

7. What is the variance of the above data?

   A. 11
   B. 13
   C. 2
   D. None of the above

8. Compute $\sum(x_i - \bar{x})$

   A. 11
   B. 5
   C. 0
   D. None of the above

9. Compute $\sum|x_i - \bar{x}|$

   A. 2
   B. 13
   C. 14
   D. 0

10. What is the probability of getting an odd number less than 5 when a dice is tossed?

    A. 0.10
    B. 0.25
    C. 0.33
    D. 0.50

11. Which of the following is **not** a measure of Central Location:

A. Mean
B. Standard Deviation
C. Mode
D. Median

12. Given that P defines probability in the equation $P(-2.11 < z < x) = 0.8596$. What is the value of x?

A. 2.11
B. 1.16
C. 0
D. None of the above

-2.11
-2.1
-0.01 0.4826

13. For an event A, which one of the following is false in probability theory?
A. $0 \leq P(A) \leq 1$
B. If an event A cannot occur, then P(A)=0
C. If an event A is certain to occur, then P(A)=1
D. The sum of the probabilities of all possible outcomes of a random experiment equals 0.

14. Consider a random process of drawing cards from a card deck. Let A = event of selecting a spade. Then, P (*spade*)=
A. $^1/_6$
B. **1**
C. $^1/_4$
D. $^1/_3$

15. Which of the following distributions can best describe the occurrence of accidents at the Game City Traffic Circle?

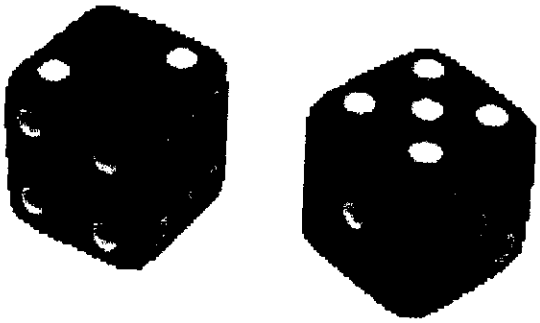
A. Binomial distribution
B. Normal distribution
C. Poisson distribution
D. Chi square distribution

Question 2 [35 Marks]

(a) Distinguish between discrete and continuous data, giving an example of each. (4 marks)

(b) Explain the terms "measures of central tendency" and "measures of dispersion" giving one example of each type. (4 marks)

(c) An experiment is performed using two dice shown below.



(i) Write down the complete sample space of the two dice. (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) A company notices that their profits for a day depend directly on number of operating hours per day. Below is a table showing the profit (in P 000 s) and the number of operation hours for 6 consecutive days.

Day	Profit (P 000's)	Number of Hours of operation
1	72	8
2	61	6
3	89	9
4	58	5
5	42	4
6	51	4.5

Portray the above information in a scatter-graph. (4 marks)

(e) Write short notes on each of the following sampling methods.

(i) Simple Random Sampling. (3 marks)
(ii) Stratified Random Sampling. (3 marks)
(iii) Systematic Random Sampling. (3 marks)

Section B [50 Marks]

Answer any **two** questions in this section.

Question 3 [25 Marks]

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

Month	Sales (P1000)	Month	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 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 4

(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 a:

(i) male under the age of 30 (2 marks)
(ii) female (1 mark)
(iii) female over the age of 30 (2 marks)
(iv) male over the age of 21 (2 marks)
(v) person less than 21 (2 marks)
(vi) female between 21 and 30 years (2 marks)
(vii) male or female (2 marks)
(viii) male given that this person is over 30 years (2 marks)
(ix) female on condition that she is below 21 (2 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 5

[25 marks]

(a) It takes on average, 70 minutes with a standard deviation of 10 minutes to assemble a particular microcomputer. Assume that assembly time is normally distributed. What is the probability that a given microcomputer will:

(i) take between 70 and 80 minutes to be assembled? (5 marks)

(ii) be assembled within 62 minutes? (5 marks)

(iii) take between 56 and 72 minutes to be assembled? (5 marks)

(b) Telephone calls arrive at the rate of 48 per hour at the reservation desk for Air Botswana.

(i) Find the probability of receiving 3 calls at a 5-minute interval. (5 marks)

(ii) Find the probability of receiving 10 calls in 15 minutes. (5 marks)

Question 6 [25 marks]

(a) Produce a pie chart showing the percentage market share of the Botswana passenger car market held by each of Botswana's car dealing companies.

Dealer	2005 Sales (Units)
Toyota	51 653
Nissan	20 793
Volkswagen	39 757
Delta	20 949
Ford	18 631
Peugeot	15 431
BMW	15 431
Hyundai	14 731
Total 2005 Sales	~~197 701~~ 197376

(10 marks)

(b) Employee bonuses earned by workers at a furniture factory in Gaborone in July 2008 (in Pula) were:

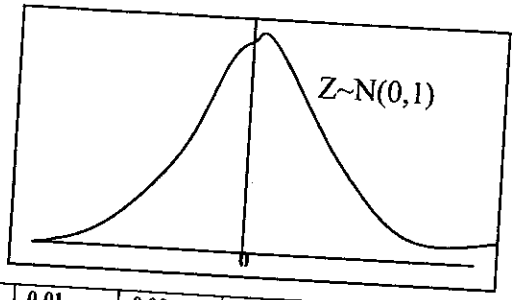
470	310	420	330	580	510
510	300	430	720	580	370

Use the data to compute the following measures (give your answer to 2 decimal places).

(i) Mean (3 marks)
(ii) Mode (1 mark)
(iii) Median (2 marks)
(iv) Variance (7 marks)
(v) Standard Deviation (2 marks)

End of Sessional Paper

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	0.12026	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	03729	03749	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	0.49956	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
2.6	0.49653	0.49664	0.49674	0.49683	0.49693	0.49702	0.49711	0.49720	0.49728	0.49736
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	0.39938	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

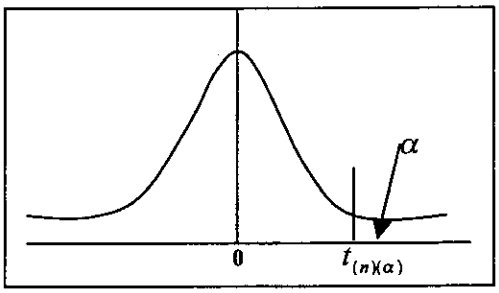
Z-tables

Only page

The *t* distribution

This table gives the value of $t_{(n)(\alpha)}$ where *n* is the degrees of freedom, i.e.

$\square = P[t \geq t_{(n)(\alpha)}]$



α	0.100	0.050	0.025	0.010	0.005	0.0025
df						
1	3.078	6.314	12.706	31.821	63.657	127.322
2	1.886	2.920	4.303	6.965	9.925	14.089
3	1.638	2.353	3.182	4.541	5.841	7.453
4	1.533	2.132	2.776	3.747	4.604	5.598
5	1.476	2.015	2.571	3.365	4.032	4.773
6	1.440	1.943	2.447	3.143	3.707	4.317
7	1.415	1.895	2.365	2.998	3.499	4.029
8	1.397	1.860	2.306	2.896	3.355	3.833
9	1.383	1.833	2.262	2.821	3.250	3.690
10	1.372	1.812	2.228	2.764	3.169	3.581
11	1.363	1.796	2.201	2.718	3.106	3.497
12	1.356	1.782	2.179	2.681	3.055	3.428
13	1.350	1.771	2.160	2.650	3.012	3.372
14	1.345	1.761	2.145	2.624	2.977	3.326
15	1.341	1.753	2.131	2.602	2.947	3.286
16	1.337	1.746	2.120	2.583	2.921	3.252
17	1.333	1.740	2.110	2.567	2.898	3.222
18	1.330	1.734	2.101	2.552	2.878	3.197
19	1.328	1.729	2.093	2.539	2.861	3.174
20	1.325	1.725	2.086	2.528	2.845	3.153
21	1.323	1.721	2.080	2.518	2.831	3.135
22	1.321	1.717	2.074	2.508	2.819	3.119
23	1.319	1.714	2.069	2.500	2.807	3.104
24	1.318	1.711	2.064	2.492	2.797	3.091
25	1.316	1.708	2.060	2.485	2.787	3.078
26	1.315	1.706	2.056	2.479	2.779	3.067
27	1.314	1.703	2.052	2.473	2.771	3.057
28	1.313	1.701	2.048	2.467	2.763	3.047
29	1.311	1.699	2.045	2.462	2.756	3.038
30	1.310	1.697	2.042	2.457	2.750	3.030
31	1.309	1.696	2.040	2.453	2.744	3.022
32	1.309	1.694	2.037	2.449	2.738	3.015
33	1.308	1.692	2.035	2.445	2.733	3.008
34	1.308	1.691	2.032	2.441	2.728	3.002
35	1.306	1.690	2.030	2.438	2.724	2.996
36	1.306	1.688	2.028	2.434	2.719	2.990
37	1.305	1.687	2.026	2.431	2.715	2.985
38	1.304	1.686	2.024	2.429	2.712	2.980
39	1.304	1.685	2.023	2.426	2.708	2.976

40	1.303	1.684	2.021	2.423	2.704	2.971
45	1.301	1.679	2.014	2.412	2.690	2.952
50	1.299	1.676	2.009	2.403	2.678	2.937
60	1.296	1.671	2.000	2.390	2.660	2.915
70	1.294	1.667	1.994	2.381	2.648	2.899
80	1.292	1.664	1.990	2.374	2.639	2.887
90	1.291	1.662	1.987	2.369	2.632	2.878
100	1.290	1.660	1.984	2.364	2.626	2.871
110	1.289	1.659	1.982	2.361	2.621	2.865
120	1.289	1.658	1.980	2.358	2.617	2.860
140	1.288	1.656	1.977	2.353	2.611	2.852
160	1.287	1.654	1.975	2.350	2.607	2.847
180	1.286	1.653	1.973	2.347	2.603	2.842
200	1.286	1.653	1.972	2.345	2.601	2.839
∞	1.282	1.645	1.960	2.327	2.576	2.807

Botswana College of Distance And Open Learning

In Collaboration With

Zimbabwe Open University

Business Statistics

Supplementary Examination, 2009

Instructions to Learners

1. Answer **all** questions in Section **A** and **any two** questions in Section **B.**
2. Begin each answer to a new question on a fresh page.
3. Total marks = 100.

Section A: Answer all questions [15 marks]

A. Multiple choices

1. Which of the following does not satisfy a binomial experiment?

   A. There are n identical trails
   B. Each trial has one possible outcome.
   C. The probabilities p and q are constant.
   D. All the trials are independent.

   $p(x) = \binom{n}{x} p^x q^{(n-x)}$??

2. Which of the following is not a source of primary data?

   A. Data collected from magazines.
   B. Customer opinions through direct interview.
   C. Questionnaire results of a survey by the user.
   D. Observation outcomes on sample use

3. In an experiment, two dice are rolled. What is the probability that a sum of 5 is displayed by the two dice?

   (A) 1/9
   B. 3/9
   C. 5/12
   B. 7/9

4. Which of the following is an example of a continuous variable?

   A. The number of workers in a business.
   B. The number of people attending a business meeting.
   C. Shoe size of a school boy picked randomly
   (D) The height of a new skyscraper block of offices.

5. Which of the following describes Type 1 error?

   (A.) The probability of rejecting the null hypothesis when in fact it is true.
   B. The probability of rejecting the null hypothesis when it is falls
   C. The probability of accepting the null hypothesis when in fact it is falls
   D. The probability of accepting the null hypothesis when it is true.

6. Which component of a time series is associated with the level of economic activity (business cycles)?

   A. Seasonal variation
   (B.) Cyclical variation
   C. Irregular variation
   D. Trend variation

7. What is qualitative data?

   A. Refers to data that is defined by numerical characteristics that can only be observed.
   B. Refers to data that is defined by non numerical characteristics that can only be observed.
   C. Refers to data from original elementary units.
   D. Refers to data from readily available documents.

8. Which of the following is not a characteristic of a good estimate?

   A. Consistency
   B. Sufficiency
   C. Efficiency
   D. Biasness

9. Decision trees have limitations. Which of the following is not a limitation of a decision tree?

   A. Decision trees calculations become cumbersome in complex situations.
   B. Decision trees assume that decision makers have perfect information.
   C. Decision trees cannot handle large amount of money.
   D. The decision trees analysis suggest that rational choices are preferable.

10. Which of the following is used to denote the null hypothesis?

    A. Ho
    B. Ho and H1
    C. H1
    D. H2 and H1

11. What is the probability of drawing an Ace from a well shuffled deck of 52 playing cards?

    A. 1/52
    B. 3/4
    C. 1/13
    D. 1/4

12. What is the probability of drawing a heart or spade from a pack of 52 cards when one card is drawn?

    A. 13/52
    B. 1/13
    C. 8/52
    D. 26/52

13. A mathematics class consists of 14 women and 16 men. Of these, 12 of the men and half of the women study Computer Science. A person is chosen at random from the class. Find the probability that the person selected is a woman.

A. 1/14
B. 14/16
C. 7/12
D. 14/30

14. Which of the following is not a measure of central tendency?

A. The Average
B. The Median
C. The Mode
D. The Range

15. For the following data set: 72, 93, 66, 75, 40 and 32. Find the sum of the deviations from the mean.

A. 8
B. 63
C. 93
D. 0

B. Short answer questions [10 Marks]

(a) Distinguish between population size and sample size. (4 marks)

(b) Write down **two** properties of arithmetic mean. (4 marks)

(c) Define a sample space. (2 marks)

Question 2 [25 Marks]

(a) Find the mean and the standard deviation of the following distribution, giving the amounts of time that 80 college students devoted to leisure activities during a typical school week.

Hours	Frequency
10-14	8
15-19	28
20-24	27
25-29	12
30-34	4
35-39	1
Total	80

(2*5 marks)

(b) A survey classified a large number of adults according to whether they were diagnosed as needing eye glasses to correct their reading vision and whether they use eye glasses when reading. The proportion falling into the four resulting categories are given in the table.

Needs eye glasses	Uses eye glasses for reading	
	Yes	No
Yes	0.44	0.14
No	0.02	0.40

If a single adult is selected from the large group, find the probabilities of the events defined below:

(i) The adult needs glasses. (5 marks)
(ii) The adult needs glasses but does not use them. (5 marks)
(iii) The adult uses glasses whether the glasses are needed or not. (5 marks)

Section B

There are four questions in this section. Answer TWO questions ONLY.

Question 3 [20 Marks]

(i) Explain the **two** components of a time series. (2 marks)

Consider the following time series data set.

Quarter	1987	1988	1989
1	54	59	63
2	55	59	65
3	56	60	67
4	55	60	69

(ii) Demonstrate the 4-year moving average method. (4 marks)
(iii) Calculate the four seasonal indexes for the four quarters. (8 marks)
(iv) Find the seasonal index adjustment factor. (3 marks)
(v) Compute the adjusted seasonal indexes. (8 marks)

Question 4

(a) Results from a survey of 15 unskilled workers whose daily wages in Pula (X) and monthly rent payments in Pula (Y) are given as follows;

Daily wages of unskilled workers(X) against their monthly rentals (Y) both in pula.

Y	120	130	135	138	142	149	155	158	160	169	170	175	182	190	195
X	34	37	39	42	41	45	40	52	50	62	68	65	70	68	75

SOURCE: Business statistics

(i) Using the data of unskilled workers given above, estimate the regression coefficients. (2*3 marks)

(ii) Predict values of Y for a worker earning a daily wage of X = P34, P37 and P50. (3*2 marks)

(b) A textile producer has established that a spinning machine stops randomly due to thread breakages at an average rate of 4 stoppages per hour.

(i) What is the probability that in a given hour, 3 stoppages will occur on this spinning machine? 3 marks)

(ii) Find the probability that at least 1 stoppage will occur in any given hour. (3 marks)

(c) A ball is dropped from the top of a building which is 1250 ft tall. The distance d(t) of a ball from the ground after t seconds is given by $d(t)= 1250-16t^2$.

(i) Obtain the distance of a ball from the ground after 5 seconds. (3 marks)
(ii) Obtain the time taken to hit the ground. (4 marks)

Question 5

(a) Suppose that your friend gave you the key to his new car to take his calculator, but he forgot to give you further details. In the parking lot there are 60 cars. They are 12 Hondas (2 Red, 8 Silver, 2 Blue), 13 Fords (7 Black, 5 Blue, 1 Yellow), 1 Black Audi, 21 Toyotas (10 Red, 2 Silver, 1 Blue, 4 Yellow, 4 Black) and 13 Nissans (5 Red, 2 Silver, 6 Blue). Let H be the event that a car is Honda. Similarly define the events R be the event that a car is red, S is the event that a car is Silver and F be the event that a car is Ford. Calculate the following.

(i) If you know the car is Silver, what is the probability that it is a Honda? (3 marks)
(ii) Are H and S independent? Justify. (4 marks)
(iii) Find P(S u H) (4 marks)
(iv) Suppose you remember that your friend's new car is Red, with this knowledge, what is the chance that it is a Toyota? (4 marks)

(b) Given that σ =2.5 and μ=10, calculate the coefficient of variation. (2 marks)

(c) For the following data, calculate the s and $\bar{x}$, and hence the coefficient of variation:
Data set: 13 10 21 42

(3 +3+2 marks)

Question 6

(a) Consider the following quarterly demand levels for electricity (in 1000 megawatts) in Gaborone from 1988 to 1991.

Quarter	1988	1989	1990	1991
Jan-March	21	42	60	12
Apr-June	35	54	91	14
July-Sept	39	82	136	28
Oct-Dec	78	114	160	40

(i) Find the least squares trend line for electricity demand using the sequential numbering method. (11 marks)

(ii) Find the seasonal index for each quarter. (8 marks)

(iii) Estimate the demand for electricity for Quarter 3 and Quarter 4 in 1992. (6 marks)

----------Good Luck!!----------

Botswana College of Distance And Open Learning

In Collaboration With

Zimbabwe Open University

Business Statistics

Sessional Examination, 2008

Instruction to Learners

1. Answer **all** questions in Section **A** and **any two** questions in section **B.**
2. Begin each answer to a new question on a fresh page.
3. Answer all questions in **English.**
4. Total marks is 100.

BOTSWANA COLLEGE OF DISTANCE AND OPEN LEARNING

In collaboration with

ZIMBABWE OPEN UNIVERSITY

DIPLOMA IN BUSINESS MANAGEMENT

BUSINESS STATISTICS
(D-BS 01)

SESSIONAL EXAMINATION

TIME: 3 HOURS

MARKS: 100

Instructions to candidates:

1. This examination contains two sections (A and B). Answer **all** questions in Section **A** and **any two** questions in section **B.**
2. Answer questions only in the answer booklet provided and begin each answer to a new question on a fresh page.
3. Write legibly in grammatical English.
4. Use examples where possible to support your explanations.
5. Simple calculators are allowed.

SECTION A Answer all questions in this section. 50 MARKS

Question 1 (Multiple Choice) 15 Marks

1. In an experiment, two die are rolled. What is the probability that a sum of 10 is displayed by the two die?
   - **A.** $\frac{1}{10}$
   - **B.** $\frac{1}{12}$
   - **C.** $\frac{2}{6}$
   - **D.** $\frac{1}{100}$

2. What is the area under a normal probability distribution curve?
   - **A.** 1
   - **B.** 2
   - **C.** 0
   - **D.** 4

3. In Hypothesis Testing, how best do you describe Type I error?
   - **A.** This is the probability of rejecting the null hypothesis when in fact it is true.
   - **B.** This is the probability of accepting the null hypothesis when in fact it is false.
   - **C.** This is the probability that one parameter is greater than the other.
   - **D.** None of the above.

4. Which of the following are the two types of hypotheses?

   A. Null and Void.

   B. Null and Alternative.

   C. Null and Space

   D. None of the above

5. A manufacturer claims that his market share is 60%.
   What is the Null Hypothesis for the above problem?

   A. $H_0 : \pi = 0.6$

   B. $H_0 : \pi < 0.6$

   C. $H_0 : \pi > 0.6$

   D. $H_0 : \pi \neq 0.6$

6. Which of the following will yield an equal value as ${}^{7}C_{2} = ?$

   A. $\frac{7!\,5!}{2!}$

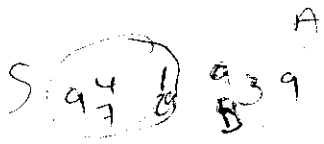
   B. $\frac{7!}{5!}$

   C. $\frac{7!}{2!}$

   D. None of the above

If $S = \{1, 2, 4, 7, 9\}$ and $A = \{1, a, 2, 3, 9, b\}$, then answer questions ~~29~~ 7 and ~~30~~ 8

7. Which of the following sets represents $S \cup A = ?$
   - **A.** {1, 2, 3, 4, 7, 9, a, b}
   - **B.** {1, 2, 9}
   - **C.** {a, b}
   - **D.** None of the above



8. Which of the following sets represents $S \cap A = ?$
   - **A.** {1, 2, 9}
   - **B.** {1, 2, 3, 4, 7, 9, a, b}
   - **C.** {b,9}
   - **D.** {a, 1, 2}

9. Which of the following is the z-transformation formula for a random variable X, which is normally distributed with mean = μ and standard deviation = δ ?
   - **A.** $Z = \dfrac{X + \mu}{\sigma}$
   - **B.** $Z = \dfrac{X - \mu}{\sigma}$
   - **C.** $Z = \dfrac{\mu - X}{\sigma}$
   - **D.** $Z = \dfrac{\mu - \sigma}{X}$

10. Which of the following does not satisfy a binomial experiment?
    - A. There are n identical trails
    - B. Each trial has one possible outcome.
    - C. The probabilities p and q are constant.
    - D. All the trials are independent.

11. The Binomial Probability Distribution function is given by:

A. $P(x) = \dfrac{n!\ p^{n-x}\ q^{x}}{x!(n-x)!}$

B. $P(x) = \dfrac{n!\ p^{x}\ q^{n-x}}{x!(x-n)!}$

C. $P(x) = \dfrac{n!\ p^{x}\ q^{n-x}}{x!(n-x)!}$

D. $P(x) = \dfrac{x!\ p^{x}\ q^{n-x}}{n!(n-x)!}$

12. In an examination a student is asked to answer three questions from an examination paper containing eight questions. How many different selections are possible?

A. 24
B. 56
C. 64
D. 336

13. If 350 units of share A were purchased in 1999 and the investor currently holds 300 units in 2009. What is the quantity relative change in the shareholding level of share A from 1999 to 2009?

A. 85.7
B. 300
C. 350
D. 100

14. If p_1 is the current price and p_0 is the base price, what is the formula for relative price?

A. Relative price = $\dfrac{\text{Po}}{\text{P1}} \times 100\%$

B. Price relative = $\dfrac{p_1}{p_0} x100\%$

C. $Price\ relative = p_0 \times p_1 \times 100\%$

D. $Price\ relative = \frac{p_0}{100} \times \frac{p_1}{100}$

(The answers above to read as relative price not price relative)

15. One of the properties of the Poisson distribution is that:

A. It is discrete.
B. It is associated with the variance.
C. It is associated with a sample size.
D. It neither deals with rare or unique events.

QUESTION 2

(35 marks)

SHORT ANSWER QUESTIONS

a. Write brief explanatory notes on:
   i. Problems of index number construction **(5 marks)**
   ii. Simple Price and Simple Quantity index **(5 marks)**

b. A random sample of 100 households has been selected in order to establish a price index for housing utilities.

The following average figures have been obtained:

	Prices (Pula/Unit)		*Quantities*	
	2000	*2008*	*2000*	*2008*
Electricity	1.97	2.09	62	68
Gas	7.90	8.60	9	10
Water	0.29	0.31	296	298
Telephone	2.40	2.50	55	58

Using 2000 as the base year:

i. Calculate the Laspeyeres price index. **(5 marks)**

ii. Calculate the Laspeyeres quantity index. **(5 marks)**

iii. Calculate the Paasche price index. **(5 marks)**

iv. Calculate the Paasche quantity index. **(5 marks)**

v. Calculate the Fishers Quantity and Price Indexes and comment. **(5 marks)**

Section B **(50 marks)**

ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION 3

The following table gives the weights, to the nearest kilogram, of randomly-selected male university students.

63	68	60	67	81	73	91	75	88	96
71	78	73	82	84	92	74	81	73	83
80	86	97	99						

1816 75.67 1915 = 79.79
19.1 24
73-3

i. Using class intervals of size 10kg, construct a frequency distribution of the above data. **(5 marks)**

(USE the notation: 60-<70, 70-<80, 80-<90 for consistency)

ii. Using the grouped data, calculate the following quantities:

a. Mean **(5 marks)**

iii.

b. Median **(5 marks)**

c. Mode **(5 marks)**

d. Variance **(5 marks)**

QUESTION 4

a. A trade union claims that the average hourly rate paid to domestic cleaners throughout the country is only P2.85. Assume that the House Wives League wishes to test this claim. They conducted a survey amongst a sample of 250 domestic cleaners throughout the country. The sample mean hourly rate was found to be P3.03. Assume that the population standard deviation of hourly rates paid to domestic cleaners is P1.00.

   Test the hypothesis at 5% significance level that the average hourly rate paid to domestic cleaners throughout the country is more than P2.85 **(15 marks)**

b. A sample of size 34 gave a mean of 32.06 and a standard deviation of 6.67 during some analysis. Develop a 94.75% confidence interval of the population mean. **(10 marks)**

QUESTION 5

The following table shows quarterly time series mining data for XYZ Pvt. Ltd. Company. The figures are in thousands of tones and are for the years 2000, 2001 and 2002.

Year	Q1	Q2	Q3	Q4
2000	7	6	7	10
2001	7	9	10	4
2002	10	12	11	9

a. Perform a four-year moving average method on this data. **(10 marks)**

b. Calculate the seasonal indices for the 3 years. **(4 marks)**

c. Using the zero-sum coding method, find the linear trend line (T) for the quarterly sales for XYZ Pvt. Ltd. Company. **(8 marks)**

d. Predict the sales figures for the first quarter of 2003. **(3 marks)**

QUESTION 6

a. There is an 80% chance that a trainee in a company training programme will complete the programme successfully. What is the probability that in a group of 4 trainees chosen at random:

i. Exactly 4 will complete the programme successfully? **[5 marks]**

ii. At most one trainee will be successful? **[5 marks]**

iii. At least 1 trainee will be successful? **[5 marks]**

b. A manufacturer claims that the average life of batteries produced by his firm is at least 30 months. You disagree, contending that the average life of the batteries is less than 30 months. A random sample of 81 batteries has a mean of 28.7 months and a standard deviation of 8 months.

Perform the appropriate hypothesis test. Use a significance level of 5%.

(10 marks)

Simple Linear Regression Analysis

$$y = a + bx$$

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

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

Grouped Data

$$Mean = \bar{x} = \frac{\sum f_i x_i}{n}$$

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

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

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

Probability Distributions

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

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

$$Z = \frac{x - \mu}{\sigma} \text{ Normal}$$

Index Numbers

$$LPI = \frac{\sum P_n Q_0}{\sum P_0 Q_0}$$

$$LQI = \frac{\sum P_0 Q_n}{\sum P_0 Q_0}$$

$$PPI = \frac{\sum P_n Q_n}{\sum P_0 Q_n}$$

$$PQI = \frac{\sum P_n Q_n}{\sum P_n Q_0}$$

$$FPI = \sqrt{LPI x PPI}$$

$$FQI = \sqrt{LQI x PQI}$$

Hypothesis Testing

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

$$Z_{calc} = \frac{(\bar{x}_1 - x_2) - (\bar{\mu}_1 - \mu_2)}{\sqrt{\frac{s_1^{\,2}}{n_1} + \frac{s_2^{\,2}}{n_2}}}$$

Bayes Formula

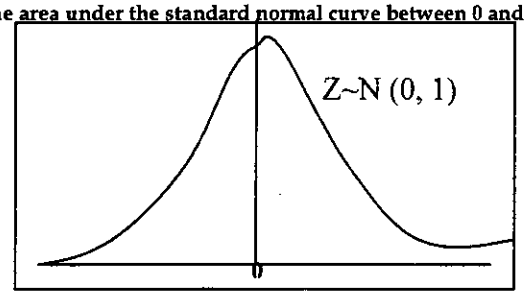
$$P(A/B) = \frac{P(A \cap B)}{P(B)}$$

APPENDIX A:

The value of e = 2.718 (the exponential value of e)

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	0.12026	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	03729	03749	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	0.49956	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	0.39938	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

BOTSWANA COLLEGE OF DISTANCE AND OPEN LEARNING

In collaboration with

ZIMBABWE OPEN UNIVERSITY

DIPLOMA IN BUSINESS MANAGEMENT

BUSINESS STATISTICS
(BS 101)

SESSIONAL EXAMINATION
November-2011

TIME: 3 HOURS MARKS: 100

Instructions to candidates:

1. Answer **ALL** questions in **Section A** and **Section B**
2. Answer **ANY TWO (2)** questions in **Section C**
3. Begin each answer to a new question on a fresh page.
4. Answer all questions legibly in grammatical **English.**
5. Answer questions in the answer booklet provided.

SECTION: A. Answer ALL questions in this Section.

Question. 1 (20 Marks)

1. Last year a small statistical consulting company paid each of its five statistical clerks BWP22,000, two statistical analysts BWP50,000 each, and the senior statistician/owner BWP270,000. The number of employees earning less than the mean salary is:

A. 0
B. 4
C. 7
D. 6

2. The heights in centimeters of 5 students are: 165, 175, 176, 159, and 170. The sample median and sample mean are respectively:

A. 170, 169
B. 170, 170
C. 169, 170
D. 176, 169

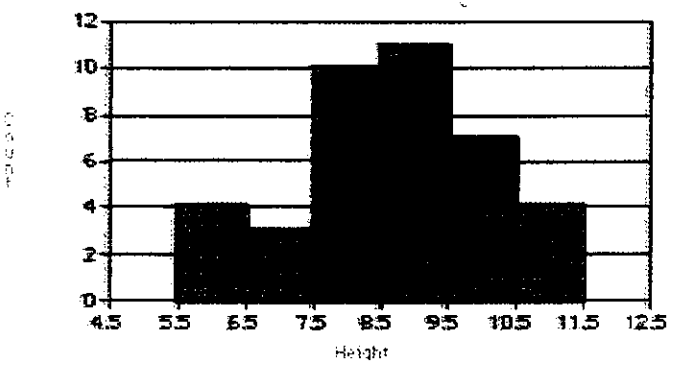
3. A die is rolled; find the probability of getting a 3.

A. 1/6
B. ½
C. 0
D. 1

4. In an experiment to determine if antibiotics increase the final dressed weight of cattle, the following were measured on each animal in the study: *Sex, initial weight, weight gain, grade of meat* where grade is recorded as (A, B, or C). The scale of measurement of these variable are:

A. Nominal, ratio, interval, nominal
B. Nominal, ratio, ratio, nominal
C. Nominal, ratio, ratio, ordinal
D. Ordinal, ratio, ratio, ordinal

5. A histogram of the heights of 39 plants is as follows:



The 75th percentile of the height distribution is approximately:

A. 9.4
B. 9.7
C. 7.7
D. 7.5

6. A die is rolled and a coin is tossed, the probability that the die shows an odd number and the coin shows a head is:

A. 1/3
B. ¼
C. ½
D. 0

7. A binomial experiment is one which satisfies all of the following except:

A. There are n identical trails.

B. Each trial has two and only two outcomes called a *success* and a *failure*.

C. $p + q = 1$.

D. The outcome of one trial affects the outcome of another trail.

8. Which of the following is NOT applicable to a Poisson distribution?

   A. It is used to compute the probability of rare events.

   B. Every event is independent of every other event.

   C. It is parameterized by the sample size and the probability that an event will occur.

   D. The theoretical range for the number of events that could occur is 0,1,2,3, ...

9. Find the value of 6! / (2! * 4!)

   A. 20

   B. 15
   C. 1
   D. 0

10. Let x be the random variable that represents the length of time. It has a mean of 50 and a standard deviation of 15. In normal distribution, the probability that x is between 50 and 70 or P(50< x < 70) is equivalent to:

    A. P(-1.33 < z < 1.33)
    B. P(0< z < 1.33)
    C. P(1.33 < z < 0)
    D. P(z < 1.33)

11. The area under a normal probability distribution curve is equal to:

    A. 1
    B. 2
    C. 0
    D. 4

12. Statistical Inference is:

    A. The act of generalizing from a sample to a population with calculated degree of certainty.
    B. The occurrence of events in experiments.
    C. The act of generalizing from a population to a sample with calculated degree of certainty.
    D. All of the above.

Given the following frequency distribution, answer the questions 13, 14 and 15:

Class interval	Frequency
1-20	20
21-40	15
41-60	24
61-80	5

13. The modal class is:

A. 21-40
B. 61-80
C. 41-60
D. 1-20

14. The median class is:
A. 1-20
B. 21-40
C. 41-60
D. 61-80

15. The lower class boundary for the third class is:
A. 40.5
B. 41.5
C. 41.0
D. 50.5

16. A study found a correlation of r = −0.61 between the sex of a worker and his or her income. You conclude that:
A. Women earn more than men on average.
B. Women earn less than men on average.
C. This is not reasonable because *r* makes no sense here.
D. The correlation of −0.61 is not meaningful here because the relationship between sex and income is likely nonlinear.

17. In Hypothesis Testing, how best do we describe Type I error?

- **A.** This is the probability of rejecting the null hypothesis when in fact it is true.
- **B.** This is the probability of accepting the null hypothesis when in fact it is false.
- **C.** This is the probability that one parameter is greater than the other.
- **D.** None of the above.

18. Two types of estimation are:

- **A.** point and interval
- **B.** point and probability
- **C.** interval and range
- **D.** None of the above

19. The summary statistics of a simple linear regression model are:

$\sum X = 57$

$\sum Y = 92$

$\sum XY = 550$

$\sum X^2 = 433$

$\sum Y^2 = 650$

$n = 10$

$$b = \frac{10\,550 - 57 \times 92}{10\,433 - 57^2}$$

$$\frac{5500 - 5244}{4330 - 3249} = \frac{256}{1081} = 0.236$$

The value of b in the regression equation $y = a + bx$ is approximately:

- **A.** 0.236
- **B.** 2.36
- **C.** 236.0
- **D.** 92

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

20. The following are types of alternatives hypotheses:

- **A.** Upper one-tail test
- **B.** Lower one-tail test
- **C.** Two-tail test
- **D.** A, B, C.

SECTION: B

(30 Marks)

Cerebral Vascular Accident (CVA) – otherwise known as 'stroke', is an interruption of the flow of blood to the brain that is caused either by blockage or by rupture of an artery. An occupational therapist working at a nursing home recorded the number of weeks each of 30 patients, selected from a random sample of CVA patients, underwent occupational therapy. The data are:

8	21	6	9	4	15	10	9	7	9	6	17	8	9	9
2	8	8	3	10	16	13	5	3	2	1	9	4	13	7

a. Using the raw data, determine the range. **(1 mark)**

b. Construct a frequency distribution with a lowest class limit of 1 week and a class width of 5 weeks. **(4 marks)**

c. Using the grouped data, determine the mean, median and mode. **(15 marks).**

d. Construct the "less than" and "greater than" OGIVE curves and estimate the middle quartile. **(5 marks)**

e. Determine the standard deviation. **(5 marks)**

Section: C. Answer two questions from this section. (50 Marks)

QUESTION 1:

(25 Marks)

Town MILKYVILLE is an important milk-production town in Namibia. Some people believe that because of transportation costs, the cost of milk increases with the distance of cities from MILKYVILLE. Suppose the milk prices in eight cities are as follows:

Cost of milk (per litre) (PULA)	Distance from MILKYVILLE (km)
8.60	480
9.50	1200
14.80	2600
8.90	850
7.00	620
6.50	140
8.20	500
7.40	250

a. Identify the independent and dependent variables. **(2 marks)**

b. Portray the data in the form of a scatter plot. **(5 marks)**

c. Determine the Pearson's correlation coefficient corresponding to the data. **(5 marks)**

d. Determine the linear regression equation **(8 marks)**

i. Use the linear regression equation to estimate the cost of a litre of milk in a town which lies 3000 km away from MILKYVILLE. **(3 marks)**

ii. Is the value attained in (i) reliable? Explain. **(2 marks)**

QUESTION. 2: (25 Marks))

a. The number of minutes of continuous spray yielded by cans of a certain brand of (ozone friendly) deodorant spray is normally distributed with a mean of 260 seconds and a standard deviation of 15 seconds.

i. What is the probability that a can selected at random will yield a continuous spray of duration between 245 and 275 seconds? **[5 marks]**

ii. Find the probability that a can selected at random will yield a continuous spray of duration at least 275 seconds. **[5 marks]**

iii. The probability of 0.0987 that a randomly selected can of this spray will yield a continuous spray equal to or less that what number of seconds? **[5 marks)**

b. The manager of a discount department store has determined that 90% of the persons entering the store make a purchase. In a random sample of 25 persons entering the store, find the probability that:

i. All 25 will make a purchase. **[5 marks]**

ii. 23 or less will make a purchase. **[5 marks]**

QUESTION: 3. (25 Marks)

a. A company consists of 86 male employees, 41 of who smoke. Of the 67 females employed, 28 smoke. If someone is randomly chosen from the company, determine the following probabilities.

i. The person is a male smoker **(2 marks)** 69 Smok.
ii. The person is a female non-smoker **(2 marks)** 153 Total
iii. The person is either a male smoker or a female non-smoker **(3 marks)**
iv. The person is a smoker given that the person is a female **(3 marks)** 84 Wom

c. The annual salaries of 500 employees in a large company are approximately normally distributed with a mean of P50, 000 and a standard deviation of P20, 000.

i. What percent of people earn less than P40, 000? **(5 marks)**

ii. What percent of people earn between P45, 000 and P65, 000? **(5 marks)**

iii. How many people earn more than P70, 000? **(5 marks)**

QUESTION: 4. (25 Marks))

The Heart Produce Company sells and delivers food produce to restaurants and catering services within a 100-km radius of its warehouse. The food supply business is competitive, and the ability to deliver orders promptly is a factor in getting new customers and keeping old ones. The manager of the company wants to be certain enough drivers and vehicles are available to deliver orders promptly and they have adequate inventory in stock. Therefore, the manager wants to be able to forecast the number of orders that will occur during the next month (i.e., to forecast the demand for deliveries).

From records of delivery orders, management has accumulated the following data for the past 12 months, from which it wants to compute three- and five-month moving averages.

Month	Orders	Month	Orders
January	120	July	75
February	90	August	130
March	100	September	110
April	75	October	90
May	110	November	100
June	75	December	80

i. Perform the three- and five-month moving averages method for the given data. **(12 marks)**

ii. Comment of the effect of the three and five-month moving average values with regards to the actual data. Show the effect by plotting, on the same graph, the three lines (actual, three-month and five-month). **(12 marks)**

List of Formulae

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 $Q_1 = O_{q3} + \frac{c(\frac{3n}{4} - f(<))}{f_{q3}}$ Variance $= \frac{\sum_{i=1}^{n} f_i (x_i - \bar{x})^2}{n-1}$

Index Numbers

Laspeyres Price Index

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

Laspeyres Quantity Index

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

Paasche Price Index

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

Paasche Quantity Index

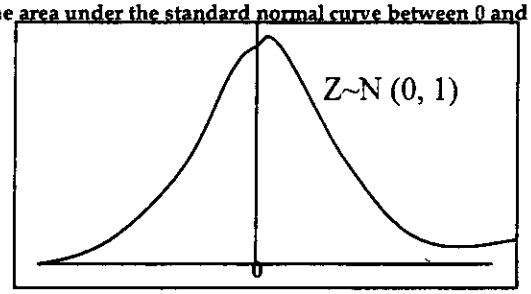
$$PQI = \frac{\sum P_n Q_n}{\sum P_n Q_0} * 100\%$$

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

$Fishers\text{Pr}iceIndex = \sqrt{LPI * PPI}$ $FishersQuantityIndex = \sqrt{LQI * PQI}$

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	0.12026	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	03729	03749	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	0.49956	0.48983	0.49010	0.49036	0.49061	0.49086	0.49111	0.49134	0.49158
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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	0.39938	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

0.0987

BOTSWANA COLLEGE OF DISTANCE AND OPEN LEARNING

DIPLOMA IN BUSINESS MANAGEMENT

BUSINESS STATISTICS

BS 101

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 – Multiple Choice Questions [15 Marks]

Answer ALL questions. Each question carries ONE (1) mark.

Choose the best alternative answer.

1. Which of the following divides a group of data into four subgroups?
   A. Quartiles
   B. Percentiles
   C. Standard deviation
   D. Median

2. If the standard deviation of a population is 9, the population variance is_____.
   A. 3
   B. 9
   C. 21.35
   D. 81

3. The middle value of an ordered array of numbers is the _____.
   A. Mean
   B. Median
   C. Mode
   D. Midpoint

4. The sum of the deviations about the mean are always_____.
   A. The range
   B. The standard deviation total
   C. Zero
   D. Positive

5. Given that the standard deviation is 6.7 and mean is 12, _____ is the coefficient of variation.
   A. 55.8%
   B. 0.8%
   C. 54.8%
   D. 80.4%

6. Which of the following statements is/are true?
   I. Categorical variables are the same as qualitative variables.
   II. Categorical variables are the same as quantitative variables.
   III. Quantitative variables can be continuous variables.
   A. I Only
   B. II Only
   C. III Only
   D. I and III Only

7. A coin is tossed three times. _____ is the probability that it lands on heads *exactly* one time?
   A. 0.125
   B. 0.250
   C. 0.333
   D. 0.375

8. An auto analyst is conducting a satisfaction survey, sampling from a list of 10,000 new car buyers. The list includes 2,500 Ford buyers, 2,500 GM buyers, 2,500 Honda buyers, and 2,500 Toyota buyers. The analyst selects a sample of 400 car buyers, by randomly sampling 100 buyers of each brand.

   Is this an example of a simple random sample?
   A. Yes, because each buyer in the sample was randomly selected
   B. Yes, because each buyer in the sample had an equal chance of being selected
   C. Yes, because car buyers of every brand were equal represented in the sample
   D. No, because every possible 400 buyer sample did not have an equal chance of being selected

9. A sample consists of four observations: {1, 3, 5, 7}. The standard deviation is _____.
   A. 2
   B. 2.58
   C. 6
   D. 6.67

10. A card is drawn randomly from a deck of ordinary playing cards. You win $10 if the card is a spade or an ace. _____ is the probability that you will win the game.
    A. 1/13
    B. 13/52
    C. 4/13
    D. 17/52

11. The stem plot below shows the number of hot dogs eaten by contestants in a recent hot dog eating contest.

80	1
70	
60	4 7
50	2 2 6
40	0 2 5 7 9 9
30	5 7 9
20	7 9
10	1

Which of the following statements are true?
I. The range is 70.
II. The median is 46.
III. The mean is 47.

A. I Only
B. II Only
C. III Only
D. I and II

12. Which of the following would be a reason to use a one-sample t-test instead of a one-sample z-test?
I. The standard deviation of the population is unknown.
II. The null hypothesis involves a continuous variable.
III. The sample size is large (greater than 40).
A. I Only
B. II Only
C. III Only
D. I and III

13. The number of adults living in homes on a randomly selected city block is described by the following probability distribution.

Number of adults, x	1	2	3	4 or more
Probability, P(x)	0.25	0.50	0.15	???

What is the probability that 4 or more adults reside at a randomly selected home?
A. 0.10
B. 0.15
C. 0.25
D. 0.50

14. The median of 10 scores is 30. If the smallest score is decreased by 5, the median will be _____.
A. 25
B. 30
C. 35
D. 32.5

15. The Sample statistics is defined as _____.
A. A random variable which is calculated from observations in sample.
B. A random variable which is calculated from the population.
C. A random variable whose mean is the population.
D. A random variable which is also a parameter of the population

SECTION B: Answer ALL questions in this Section. [35 Marks]

QUESTION 1

The following data shows marks obtained by a sample of Diploma in Business Management students in Business Statistics sessional examination:

68	52	49	56	69	74	41	59	79	81
42	57	60	88	87	47	65	55	68	65
50	78	61	90	85	65	66	72	63	95

(a) Group the data into classes; 40 – 49, 50 – 59, 60 – 69, etc, until all values have been accounted for. **(4 marks)**

(b) Change the apparent limits to real limits. **(3 marks)**

(c). Using the grouped data, calculate the following:

(i) Mean **(4 marks)**

(ii) Median **(5 marks)**

(iii) Mode **(5 marks)**

(iv) Upper quartile of the data **(4 marks)**

Question 2 **[10 Marks]**

(a). **(6 Marks)**

From the following information related to the enrolment of students for various programmes at BOCODOL in the year 2011, you are required to prepare a Pie Chart and shows your workings.

Name of Program	No. of students enroled
MSC	50
B Com	200
BBE	175
DHRM	425

(b). Explain the following Statistical Data at least with one example.

(i). Qualitative data **(2 marks)**

(ii). Quantitative data **(2 marks)**

SECTION C. Answer any TWO questions from this section. **[50 Marks]**

Question 1

A company is planning the launch of a new product. It estimates the probability of good market Conditions to be 80%. If market conditions are good the probability of a successful launch is 75%, if market conditions are poor the probability of a successful launch is 50%.

(a) Find the probability that the launch is successful. **(5 marks)**

(b) If the product launch is unsuccessful what is the probability that the market conditions were poor? **(5 marks)**

The estimated returns from the new product launch are:

Market conditions are good and the product launch is successful £55 million
Market conditions are good and the product launch is unsuccessful – £13 million
Market conditions are poor and the product launch is successful £37 million
Market conditions are poor and the product launch is unsuccessful – £19 million

(c) What is the expected profit from the new product launch? **(4 marks)**

(d) Once a month a merchandiser replenishes the stock of a particular product brand in 10 stores for which he is responsible. Experience has shown that there is one in five chances that a given store will have run out of stock before the merchandiser's monthly visit.
What is the probability that on a given monthly round, the merchandiser will find:

(i) Exactly 1 store is out of stock? **(3 marks)**

(ii) Less than 2 stores are out of stock? **(3 marks)**

(iii) More than 2 stores will be out of stock? **(3 marks)**

(iv) What is the mean number of stores out of stock each month? **(2 marks)**

Question 2

A random sample of 100 households has been selected in order to establish a price index for housing utilities.

The following average figures have been obtained:

	Prices (Pula/Unit)		*Quantities*	
	2000	*2008*	*2000*	*2008*
Electricity	1.97	2.09	62	68
Gas	7.90	8.60	9	10
Water	0.29	0.31	296	298
Telephone	2.40	2.50	55	58

Using 2000 as the base year,

i. Calculate the Laspeyeres price index. **(5 marks)**

ii. Calculate the Laspeyeres quantity index. **(5 marks)**

iii. Calculate the Paasche price index. **(5 marks)**

iv. Calculate the Paasche quantity index. **(5 marks)**

v. Explain the basic index concept. Also list the three types of index numbers. **(5 marks)**

Question 3

The following table below shows the sales figures for each quarter of 2009, 2010 and 2011

Period	Q 1	Q 2	Q 3	Q 4
2009	216	220	224	220
2010	236	236	240	240
2011	252	260	268	276

From the above table:

(i) Demonstrate the 4-period moving average method **(6 marks)**

(ii) Calculate the four seasonal indices for the four quarters **(7 marks)**

(iii) Find the seasonal indices adjustment factor **(5 marks)**

(iv) Compute the adjusted seasonal indices **(8 marks)**

END OF PAPER

Simple Linear Regression Analysis

$$y = a + bx$$

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

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

Grouped Data

$$Mean = \bar{x} = \frac{\sum f_i x_i}{n}$$

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

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

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

Probability Distributions

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

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

$$Z = \frac{x - \mu}{\sigma} \text{ Normal}$$

Index Numbers

$$LPI = \frac{\sum P_n Q_0}{\sum P_0 Q_0}$$

$$LQI = \frac{\sum P_0 Q_n}{\sum P_0 Q_0}$$

$$PPI = \frac{\sum P_n Q_n}{\sum P_0 Q_n}$$

$$PQI = \frac{\sum P_n Q_n}{\sum P_n Q_0}$$

$$FPI = \sqrt{LPIxPPI}$$

$$FQI = \sqrt{LQIxPQI}$$

Hypothesis Testing

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

$$Z_{calc} = \frac{(\bar{x}_1 - x_2) - (\bar{\mu}_1 - \mu_2)}{\sqrt{\frac{s_1^{\,2}}{n_1} + \frac{s_2^{\,2}}{n_2}}}$$

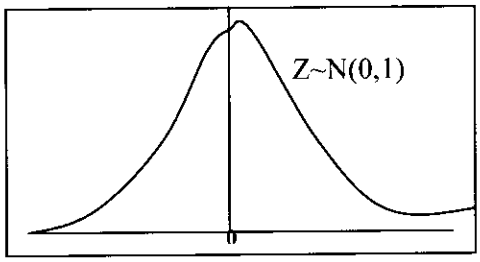
Bayes Formula

$$P(A/B) = \frac{P(A \cap B)}{P(B)}$$

APPENDIX A:

The value of e = 2.718 (the exponential value of e)

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	0.12026	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	03729	03749	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	0.49956	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	0.39938	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

BOTSWANA COLLEGE OF DISTANCE AND OPEN LEARNING

DIPLOMA IN BUSINESS MANAGEMENT

BUSINESS STATISTICS
BS 101

Sessional Examination

Time: 3 Hours **Marks: 100**

Instruction to candidates:

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SECTION: A **[20 MARKS]**

Multiple Choice questions. Answer ALL questions in this section.

1. The mean of 11, 17.5, 9.5 and 58 is 24. Suppose every value is reduced by 3, the new mean is:

   A. 21

   B. 24

   C. 27

   D. Value does not change.

2. The geometric mean of 12, 7 and 10 is:

   A. 9.435

   B. 14.5

   C. 12

   D. None of the above

3. The harmonic mean of 12, 7, 8 and 10 is:

   A. 9.25

   B. 9.5

   C. 8.87

   D. 5

4. Given that the arithmetic mean is 5.75 and the harmonic mean is 3.87, the geometric mean is:

   A. 5.75

   B. 3.28

   C. 4.71

   D. 4.68

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

5. The median is:
   - **A.** 12
   - **B.** 28
   - **C.** 17
   - **D.** 11

6. The range is:
   - **A.** 1
   - **B.** 12
   - **C.** 11
   - **D.** 19

7. The mode of the data set 0.51kg 800g 0.80kg 10kg 10.5kg 15kg is
   - **A.** 15kg
   - **B.** 0.80kg
   - **C.** 0.51kg
   - **D.** None of the above

8. All but one of the following are measures of dispersion:
   - **A.** Mean
   - **B.** Variance
   - **C.** Range
   - **D.** Standard Deviation

9. 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 10 and 11

10. The Inter Quartile Range for the data set is:

A. 80
B. 13
C. 93
D. 35

11. The semi Inter Quartile Range is:

A. *13*

B. *17.5*

C. *40*

D. None of the above

12. The variance of a data set containing 20 numbers is 900. The standard deviation is:
A. 1800
B. 30
C. 35
D. 45

Consider the following pairs and answer questions 13 and 14:
i. Distance travelled and Time taken
ii. Tax paid and income earned
iii. Sales and Profits
iv. Age (year) and machine reliability

13. 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

14. 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

15. 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

16. In an examination a student is asked to answer three questions from an examination paper containing eight questions. How many different selections are possible?
    A. 24
    B. 56
    C. 64
    D. 336

Use the following simple linear regression analysis data to answer questions 17 and 18: $\sum xy = 50000$, $\sum x = 0$, $\sum x^2 = 2500$, $\sum y = 2400$, $n = 12$

17. In the linear equation $y = a + bx$, the value of b is:
    A. 3
    B. 20
    C. 12
    D. 14

18. In the linear equation $y = a + bx$, the value of a is:
    A. 12
    B. 21
    C. 200
    D. 0

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

20. If x_i are data elements with mean $\bar{x}$, then one of the following is true:

A. $\sum (x_i - \bar{x}) = 0$

B. $\sum |x_i - \bar{x}| = 0$

C. $\sum |x_i + \bar{x}| = 0$

D. $\sum (x_i - \bar{x})^2 = 0$

SECTION: B **[30 MARKS]**

Answer ALL questions in this section

1. A property developer analyzed the amount of office space available in 40 office blocks in the Commerce Park of Gaborone in November 2004.
The complete frequency distribution showing absolute frequencies is given in the following table.

Office Space ($1000\ m^2$)	Total
115-<130	5
130-<145	7
145-<160	6
160-<175	12
175-<190	8
190-<205	2

a. Calculate the relative frequencies for each class **(5 marks)**

b. Show the office space information using a histogram. **(5 marks)**

c. Construct, in a single diagram, the *less than ogive* and the *more than ogive* of the office space available in Gaborone Commerce Park office blocks. **(10 marks)**

d. Calculate the mean. **(5 marks)**

2. The lifetime of 30 electric light bulbs in hours is given in the following table.

702	680	705	699	701	697
698	684	695	682	721	708
724	695	716	730	689	700
694	710	697	676	732	676
699	714	707	697	710	682

From the above table, prepare a grouped frequency table with intervals width of 10 hours. Use 670 -< 680, 680 -< 690, etc. **(5 marks)**

SECTION: C **[50 MARKS]**

Answer any TWO questions in this section.

Question. 1

a. Distinguish between discrete and continuous data, giving an example for each. **(3 marks)**

b. Explain the terms "measures of central location" and "measures of dispersion" giving one example for each type. **(3 marks)**

c. A company notices that their profits for a day depend directly on the number of operating hours per day. Below is a table showing the profit (in P 000 s) and the number of operation hours for 6 consecutive days.

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

i. Portray the above information in a scatter-graph. **(5 marks)**

ii. Determine the co-efficient of correlation and interpret its value. **(5 marks)**

iii. Calculate the linear regression equation to predict the profit on a day when the company opens at 8 am and closes at 10 pm. **(7 marks)**

iv. Is this value reliable? Explain. **(2 marks)**

Question. 2

a. Calculate the four-quarterly moving average trend of the following time series:

	Quarters			
Year	**1**	**2**	**3**	**4**
1988	28	31	40	27
1989	32	38	49	38

(6 marks)

Using the *zero-sum* method, calculate the trend line. **(7 marks)**

b. A random sample of 100 households has been selected in order to establish a price index for housing utilities.

The following average figures have been obtained:

	Prices (Pula/Unit)		*Quantities*	
	2000	*2008*	*2000*	*2008*
Electricity	1.97	2.09	62	68
Gas	7.90	8.60	9	10
Water	0.29	0.31	296	298
Telephone	2.40	2.50	55	58

Using 2000 as the base year,

i. Calculate the Laspeyeres price index. **(3 marks)**
ii. Calculate the Laspeyeres quantity index. **(3 marks)**
iii. Calculate the Paasche price index. **(3 marks)**
iv. Calculate the Paasche quantity index. **(3 marks)**

Question. 3

a. Determine the missing values for the following probabilities involving the standard normal distribution.

i. $P(0 \leq z \leq ?) = 0.4015$ **(2 marks)**

ii. $P(? \leq z \leq 0) = 0.4803$ **(2 marks)**

b. Employees of an organization are classified according to age and income as shown in the table below.

	INCOME		
Age	**Low (L)**	**Middle (M)**	**High (H)**
< 30	20	25	15
30 – 39	18	22	10
40^{+}	11	7	9
Total	49	54	34

Required:

What is the probability that an employee selected at random will be:

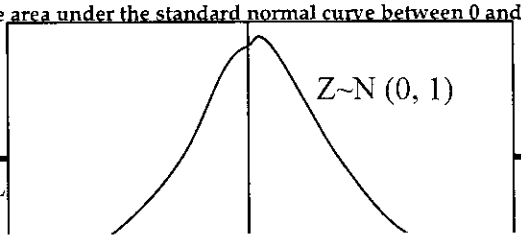
i. < 30 years of age? **(2 marks)**
ii. Either in the middle income or high income? **(3 marks)**
iii. < 30 or 40^{+}? **(4 marks)**
iv. In the low income or in the 30-39 age group? **(4 marks)**
v. In the middle income on condition that he/she is 40^{+}? **(4 marks)**
vi. 40^{+} on condition that he/she is in the middle income? **(4 marks)**

End of paper

List of Formulae

$P(A/B) = \frac{P(A \cap B)}{P(B)}$	$P(A \cup B) = P(A) + P(B) - P(A \cap$	$P(A \cup B) = P(A) + P$
${}^{n}C_{r} = \frac{n!}{r!(n-r)!}$	${}^{n}P_{r} = \frac{n!}{(n-r)!}$	$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$
$s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$	$MAD = \frac{\sum_{i=1}^{n} \lvert x_i - \bar{x} \rvert}{n}$	$\bar{x} = \frac{\sum_{i=1}^{n} f_i x_i}{n} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum f_i}$
$Median = O_{me} + \frac{c(\frac{n}{2} - f(<))}{f_{me}}$	$Mode = O_{mo} + \frac{c(f_m - f_{m-1})}{2f_m - f_{m-1} - f_{m+1}}$	$Q_1 = O_{q1} + \frac{c(\frac{n}{4} - f(<))}{f_{q1}}$
$Q_1 = O_{q3} + \frac{c(\frac{3n}{4} - f(<))}{f_{q3}}$	$\text{Variance} = \frac{\sum_{i=1}^{n} f_i (x_i - \bar{x})^2}{n-1}$	$LPI = \frac{\sum P_n Q_0}{\sum P_0 Q_0} * 100\%$
$LQI = \frac{\sum P_0 Q_n}{\sum P_0 Q_0} * 100\%$	$PPI = \frac{\sum P_n Q_n}{\sum P_0 Q_n} * 100\%$	$PQI = \frac{\sum P_n Q_n}{\sum P_n Q_0} * 100\%$
$FPI = \sqrt{LPI * PPI}$	$FQI = \sqrt{LQI * PQI}$	${}^{n}C_{r} = \frac{n!}{r!(n-r)!}$
${}^{n}P_{r} = \frac{n!}{(n-r)!}$	$b = \frac{n\sum XY - \sum X \sum Y}{n\sum X^2 - (\sum X)^2}$	$a = \frac{\sum Y - b\sum X}{n}$
$P(x) = \frac{e^{-a} a^{x}}{x!}$	$z = \frac{x - \mu}{\sigma}$	$P(x) = \frac{n! * p^{x} q^{n-x}}{x! * (n-x)!}$

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	0.12026	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	03729	03749	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	0.49956	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	0.39938	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

BOTSWANA COLLEGE OF DISTANCE AND OPEN LEARNING

DIPLOMA IN BUSINESS MANAGEMENT

BUSINESS STATISTICS
BS121

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.

SETION A – Multiple Choice Questions. **[25 MARKS]**
Answer ALL questions. Each question carries 1 mark.
Choose the best alternative answer.

1. Qualitative data are _____.
   - **A.** Non-numeric
   - **B.** Numeric
   - **C.** Can be both
   - **D.** None of the above

2. The value of ${}^{10}C_4$ is _____.
   - **A.** 40
   - **B.** 210
   - **C.** 151200
   - **D.** None of the above

3. The value of ${}^{10}P_4$ is _____.
   - **A.** 5040
   - **B.** 400
   - **C.** 350
   - **D.** None of the above.

4. If ${}^{10}C_8 = {}^{4}P_x$ then _____.
   - **A.** $15(4-x)! = 8$
   - **B.** $x! = 15(4-x)!$
   - **C.** $15(x-4)! = 8$
   - **D.** $15(4+x)! = 8!$

5. For a given data set of observations $x_1, x_2, x_3, \ldots\ldots x_n$, the Geometric Mean (GM) is given by —.
   - **A.** $GM = \sqrt[n]{x_1 * x_2 * x_3 * \ldots\ldots * x_n}$
   - **B.** $GM = \sqrt[n]{\frac{1}{x_1} * \frac{1}{x_2} * \frac{1}{x_3} * \ldots\ldots * \frac{1}{x_n}}$
   - **C.** $GM = \sqrt[n]{x_1 + x_2 + x_3 + \ldots\ldots + x_n}$

D. $GM = \sqrt{x_1 * x_2 * x_3 * .....x_n}$

6. If a cyclist travels 50 km/hour over a 5 km stretch of road, and 30 km/hour over another hilly 5 km stretch of road, then the harmonic mean (average) over the 10 km distance is_____.

A. 80 km/hour
B. 40 km/hour
C. 37.5 km/hour
D. None of the above

7. _____ is not a measure used to describe dispersion.

A. Range
B. Median
C. Variance
D. Quartile

8. Statistics is a branch of _____.

A. Applied physics
B. Applied mathematics
C. Applied commerce
D. Dramatics

9. In Simple Linear Regression Analysis, the correlation coefficient, $r = -1$, implies _____.

A. Perfect positive
B. Perfect negative
C. No correlation
D. Limited correlation

10. Only one of the following statements about a continuous random variable is **incorrect.**

A. It can take only whole numbers on a scale of measurement
B. It can take on any value in an interval
C. It continues to grow every time
D. None of the above

11. All but one of the following are types of non-probability sampling procedures.

A. Stratified sampling
B. Convenience sampling
C. Judgment sampling
D. Quota sampling

12. If P_0 *and* Q_0 are base price and quantity respectively and P_1 *and* Q_1 are the current price and quantity respectively, then the Laspeyeres Price Index is given by _____.

A. $LPI = \frac{\sum P_1 Q_1}{\sum P_0 Q_1}$

B. $LPI = \frac{\sum P_0 Q_0}{\sum P_1 Q_0}$

C. $LPI = \frac{\sum P_1 Q_0}{\sum P_0 Q_0}$

D. $LPI = \frac{\sum P_0 Q_1}{\sum P_1 Q_1}$

13. In Simple Linear Regression Analysis, the correlation coefficient (r) value of 0 indicates_____.

A. No linear relation
B. Weak positive linear relation
C. Weak negative linear relation
D. None of the above

14. Seasonal indices are _____.

A. Used to measure the regular patterns of seasonal fluctuations
B. Used to measure the irregular patterns of seasonal fluctuations
C. Used to measure the average fluctuations between seasons
D. Used to measure both the irregular and regular patterns of seasonal fluctuations

15. Only one of the following is a cause of long term trend forces.

A. School holiday
B. Population growth
C. Natural disasters
D. Monetary policy

16. _____ is unaffected by extreme scores.

A. Mean
B. Median
C. Mode
D. Range

17. A storeowner kept a tally of the sizes of suits purchased in her store. Which measure of central tendency should the storeowner use to describe the average suit sold?

A. Mean
B. Median
C. Mode
D. None

18. One of the following statements is true about the probability P(A) of an event A happening or not

A. $P(A) = 1$

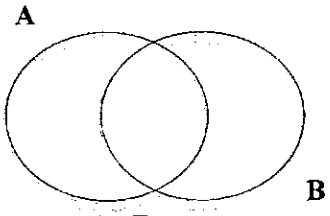
B. $P(A) = 0$
C. $0 \leq P(A) \leq 1$
D. None of the above

19. Which of the following is NOT an assumption of the Binomial distribution?
A. All trials must be identical
B. All trials must be independent
C. Each trial must be classified as a success or failure
D. The probability of success is equal to 0.5 in all trials

20. The trend component is easy to identify by using _____.
A. Moving averages
B. Exponential smoothing
C. Regression analysis
D. The Delphi approach

21. Marginal probability is _____.
A. The probability of one event A occurring given information about the occurrence of another event B
B. The probability of only a single event A occurring
C. The probability of both event A and event B occurring simultaneously on a given trial of a random experiment
D. None of the above

22. Using the Venn diagram below, find the value of $A \cup (A \cap B)$



A. B
B. A
C. $A \cup B$
D. $A \cap B$

23. A probability distribution is _____.
A. Discrete probability distribution
B. Continuous probability distribution
C. A set of valid success outcomes for which probabilities can be derived
D. A list of all the possible outcomes of a random variable and their associated probabilities of occurrence.

24. A Poisson process is a _____.

A. Binomial process
B. Continuous process
C. Discrete process
D. None of the above

25. In a Poisson probability process, $P(x \geq 5)$ is the same as _____.

A. $1 - P(x \leq 5)$
B. $1 - P(x \leq 4)$
C. $1 - P(x = 5)$
D. $1 - P(x = 4)$

SECTION B **[25 MARKS]**
Answer ALL questions in this Section.

Question 1

a. Discuss the difference between primary and secondary data. **(4 marks)**

b. Define the following data types.
   a. Nominal **(2 marks)**
   b. Ordinal **(2 marks)**

c. Use the data below to produce an ordered stem-and-leaf diagram: **(6 marks)**

81	110	85	95	96	100	45	95
130	75	80	70	80	101	120	112
125	73	107	40	72	118	150	74

Question 2

a. A group of 200 Chief Executive Officers (CEO) is tested for personality type. The following table gives the results of this survey:

Gender	Type X	Type Y

Male M	90	54
Female F	30	26

If the CEO is selected randomly from this group, calculate P (F and Type Y). **(3 marks)**

b. Given a Poisson random variable X, where the average number of successes occurring in a specified interval is 1.8, calculate P (X=0). 0.1653 **(3 marks)**

c. In a large supermarket, the monthly demand for a particular variety of breakfast cereal is normally distributed with a mean of 900 boxes and a standard deviation of 200 boxes. What is the probability that in any month, the demand will be more than 1000 boxes? **(5 marks)**

SECTION C **[50 MARKS)]**

Answer any TWO questions in this Section.

QUESTION 1

The Human Resources Manager of a a certain company has recorded the number of leave days for their 30 employees. The data are:

8	21	6	9	4	15	10	9	7	9	6	17	8	9	9
2	8	8	3	10	16	13	5	3	2	1	9	4	13	7

a. Calculate the range of the data. **(1 mark)**

b. Construct a frequency distribution with a lowest class limit of 1 day and a class width of 5 days. **(2 marks)**

c. Using the grouped data, determine the mean, median and mode. **(10 marks)**

d. Construct the "less than" and "greater than" OGIVE curves and estimate the middle quartile. **(5 marks)**

e. Determine the standard deviation. **(7 marks)**

QUESTION 2

Data for amount of coal used (x) in thousands of tons and electricity generated (y) in thousands of KW for a certain electricity generation plant are recorded as follows.

Coal (000 tons)	Electricity (000 KW)
8.60	480
9.50	1200
14.80	2600
8.90	850
7.00	620
6.50	140
8.20	500
7.40	250

a. Identify the independent and dependent variables. **(2 marks)**
b. Portray the data in the form of a scatter plot. **(5 marks)**
c. Determine the Pearson's correlation coefficient corresponding to the data. **(5 marks)**
d. Determine the linear regression equation **(7 marks)**
   i. Use the linear regression equation to estimate the amount of electricity generated if 3 000 tons of coal are used. **(3 marks)**
   ii. Is the value attained in (i) reliable? Explain. **(3 marks)**

QUESTION 3

a. State whether each of the following statements corresponds to **QUANTITATIVE** or **QUALITATIVE** data. If you identify the variable as QUANTITATIVE, further indicate whether it would be **DISCRETE** or **CONTINUOUS.**

   i. Mary's travel time from her home to the Faculty. **(1 marks)**
   ii. Your status as either educated or not educated. **(1 mark)**
   iii. The number of students on campus who belong to a certain political party. **(1 mark)**
   iv. Whether or not you own a car or not. **(1 mark)**

b. Consider the following information on the prices and annual quantities consumed per family:

	Price		Quantity	
Product	**1999**	**2002**	**1999**	**2002**
A	0.52	0.64	200	180
B	0.12	0.18	300	200

C	1.19	1.28	100	200

1999=100

Compute the Fishers Price Index. **(10 marks)**

c. 20% of the registered voters in a local government belong to Party A. If 15 voters are selected at random, what is the probability that:

i. Exactly 3 **(3 marks)**
ii. Less than 2 **(4 marks)**
iii. More than 3 **(4 marks)**

are members of Party A?

d. Calculate the mean, variance and standard deviation of this process. **(3 marks)**

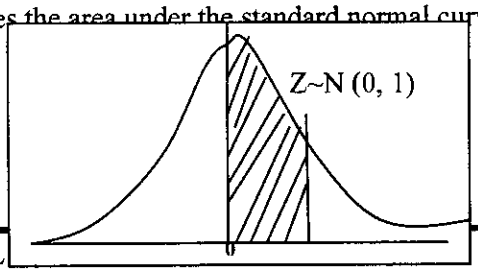
END OF PAPER

FORMULAS

$P(A/B) = \frac{P(A \cap B)}{P(B)}$	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$	$P(A \cup B) = P(A) + P(B)$
${}^nC_r = \frac{n!}{r!(n-r)!}$	${}^nP_r = \frac{n!}{(n-r)!}$	$Z = \frac{X - \mu}{\sigma}$
$P(x) = \frac{n!.\,p^x\,.q^{n-x}}{n!(n-x)!}$	$P(x) = \frac{e^{-a}.a^x}{x!}$	$b = \frac{n\sum XY - \sum X \sum Y}{n\sum X^2 - (\sum X)^2}$
$a = \frac{\sum Y - b\sum X}{n}$	$r = \frac{n\sum XY - \sum X \sum Y}{\sqrt{[n\sum X^2 - (\sum X)^2][n\sum Y^2 - (\sum Y)^2}}$	

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	0.12026	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
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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	03729	03749	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	0.49956	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
2.6	0.49653	0.49664	0.49674	0.49683	0.49693	0.49702	0.49711	0.49720	0.49728	0.49736
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	0.39938	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