BOTSWANA COLLEGE OF DISTANCE AND OPEN LEARNING

B COM (HR & Industrial Relations)

BUSINESS STATISTICS
BS221

SESSIONAL EXAMINATION

Time: 3 Hours   **Marks: 100**

Instructions:

1. The examination consists of TWO sections: A and B.

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   [60 MARKS]

Answer ALL Questions in this Section.

Question 1.

A doctor's office has studied the waiting times for patients who arrive at the office with a request for emergency service. The following data were collected over a 1-month period (the waiting times are in minutes):

2, 5, 10, 12, 4, 4, 5, 17, 11, 8, 9, 8, 12, 21, 6, 8, 7, 13, 18, 3

a.	Represent the above data using a stem-and-leaf diagram.	**(10 marks)**

b. For the data values, find the:

i.	minimum value,	**(2 marks)**
ii.	first quartile,	**(3 marks)**
iii.	median,	**(2 marks)**
iv.	mean	**(3 marks)**
v.	mode,	**(3 marks)**
vi.	third quartile	**(3 marks)**
vii.	maximum value	**(2 marks)**
viii.	Range	**(2 marks)**

Question 2.

A group of 5 students took tests before and after training and obtained the following scores:

Before, x	8	10	10	15	20
After, y	10	12	15	20	20

Calculate the linear regression line $\hat{y} = b_0 + b_1 x$.   **(6 marks)**

Question 3.

a. 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 are members of Party A?   **(4 marks)**

ii. Calculate the mean, variance, and standard deviation.   **(3 mark)**

b. A scientist has established that a measuring instrument in the laboratory breaks down randomly due to excessive heat at an average rate of 5 stoppages per week.

i.   Find the probability that at least 1 stoppage will occur in any given week. **(4 marks)**

ii. Calculate the mean variance and standard deviation   **(3 mark)**

Question 4.

Suppose that in a study on cancer of the lungs. If A stands for the event that a patient is a smoker and B is the event that the patient has cancer of the lungs, state the following probabilities in words.

i. $P(A^c)$ **(3 marks)**

ii. $P(A \cup B^c)$ **(3 marks)**

Question 5.

Given that the ages of students doing STA114 is normally distributed with mean 25 years and variance 5 years, convert the following statements in X to those in Z. Sketch on the normal curve clearly showing the area required. **NOTE: No probabilities required**

P (15<X<40)   **(4 marks**

SECTION B   **[40 MARKS]**

Answer any TWO questions in this section.

Question 1.

Survey results of the ages of students in the mathematics - Adult Basic Education classes are shown in this frequency table.

Age Interval (years)	Frequency

15-20	7
20-25	10
25-30	17
30-35	8
35-40	6
40-45	2

Use the chart above to do the following:

a.	Produce a frequency with continuous classes.	(6 marks)
b.	Draw a histogram.	(5 marks)
c.	Find the mean.	(3 marks)
d.	Find mode.	(3 marks)
e.	Find median.	(3 marks)

Question 2.

a. The producer of *Thieves in the Park*, a new English film, held a preview by asking viewers for their opinion. He classified the reaction as follows:

	Good	Fair	Bad	Indifferent
Young	50	10	6	2
Old	20	40	4	1

If a viewer is selected at random, find the probability that the selected viewer:

i.	Is young	(2 marks)
ii.	Feels that the film is good	(2 marks)
iii.	Is old and feels that the film is good	(2 marks)
iv.	Is not old or the feeling is indifferent	(3 marks)
v.	Is old given that he/she feels fair	(3 marks)

b. It takes on average, 70 minutes with a standard deviation of 10 minutes to assemble a particular computer.
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?	(4 marks)
ii.	Be assembled in less than 62 minutes?	(4 marks)

Question 3.

a. The average lifetime of light bulbs produced by Hime & Co. is known to be 1600 hours with a standard deviation of 132 hours. What is the probability that a randomly selected bulb has a lifetime of 1682 hours? **(6 marks)**

b. Calculate the four-quarterly moving average trend of the following time series:
(9 marks)

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

    i. What is the seasonal index for the quarter 1? **(2 marks)**
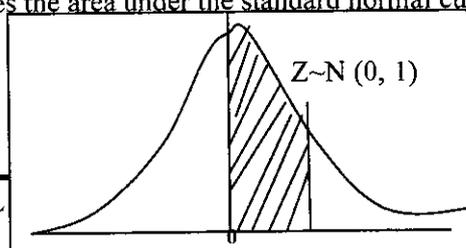   ii. Calculate the seasonal index adjustment factor. **(3 marks)**

FORMULAS

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

END OF EXAMINATION

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~N (0, 1)

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