



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY
DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL DIPLOMA

IN

QUANTITY SURVEYING / IRRIGATION ENGINEERING

SUBJECT: Statistics

PAPER NO: 575/15/S06

DURATION: 3 Hours

MARCH/APRIL 2022 EXAMINATION

REQUIREMENTS

1. Graph paper(s).
2. List of formulae (Appendix).
3. Area under the normal distribution curve (Appendix).

INSTRUCTIONS TO CANDIDATE

1. Answer any five (5) questions.
2. Show your workings.

This paper consists of 7 printed pages.

QUESTION 1

Summarised below are the values of the orders (to the nearest \$) taken by a sales representative for a wholesale firm during a particular year.

Value of order (\$)	Number of orders
10 – 19	9
20 – 29	15
30 – 39	27
40 – 49	29
50 – 59	34
60 – 69	19
70 – 79	10

- Calculate the mean. (4 marks)
- Calculate the standard deviation. (5 marks)
- Using interpolation, estimate the median and the mode. (5 marks)
- Find the Pearson's second coefficient of skewness. (3 marks)
- Calculate the coefficient of variation. (3 marks)

QUESTION 2

- The probability of a windy day is 0.3. When a golfer makes a given shot, the probability that it will land on the green is $\frac{1}{4}$ if it is a still day, and $\frac{1}{8}$ if it is a windy day. Find the probability that a shot will land on the green. (4 marks)
- A box contains ten counters. Five of the counters have the number 1 written on them, three have 2, and two have 3. A counter is drawn out, and X is the number on it. Construct a table showing the probability distribution of X . (4 marks)
- A machine has four components, and will work provided that at least three of them are functioning. If each component has probability 0.1 of breaking down before the end of the day, what is the probability that the machine will still be working at the end of the day? (4 marks)
- A company sends out letters to 2000 customers. Each letter has probability 0.002 of being incorrectly addressed. Find the probability that at least two are incorrectly addressed. (4 marks)
- A gun is fired at a target which is 1000m away. The shell travels X m towards the target, where $X \sim N(1000, 10)$. What proportion of shells land within 2m of the target? (4 marks)

QUESTION 3

The prices and quantities of four commodities were recorded for the years 2008, 2009 and 2011. The following table gives the prices in hundreds of dollars and the quantities in thousands.

Commodity	2008		2009		2011	
	Price	Quantity	Price	Quantity	Price	Quantity
1	100	1,2	105	1,25	150	2,0
2	40	2,0	50	2,5	80	4,5
3	200	5,1	210	6,0	260	7,0
4	70	3,0	78	3,2	100	5,0

Using 2008 – 2009 as the base period, calculate the price index for 2011 using.

- The Simple Aggregate method (6 marks)
- Laspeyre's method (6 marks)
- Paasche's method (4 marks)
- Fisher's ideal index method (4 marks)

QUESTION 4

The table below shows the sales made by a company over a three year period. Sales are given in hundreds.

Year	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter
2009	12	14	16	15
2010	19	21	19	20
2011	23	24	27	30

- Using a period of four quarters, find the trend values using the moving average method. (5 marks)
- Calculate the seasonal variations using the multiplicative method. (5 marks)
- Calculate the deseasonalised sales. (5 marks)
- Forecast the total sales for 2015 using least squares method. (5 marks)

QUESTION 5

- a) The following table gives the ages and masses of five people.

Age, X (years)	1	5	20	36	42
Mass, Y (kgs)	5	14	40	70	63

It is believed that the age and mass are related by the law $Y = a + bX$, where a and b are constants.

- i) Draw a scatter graph of Y on X. (4 marks)
 - ii) Use the least-squares method to find a and b , and state the law. Draw the equation on your scatter graph. (6 marks)
 - iii) Find the correlation coefficient. (5 marks)
- b) The heights and weights of ten adult men are given in the table below.

Man	A	B	C	D	E	F	G	H	I	J
Height (cm)	188	175	168	183	185	163	184	192	175	187
Weight (kg)	86	71	92	85	83	76	77	112	92	85

Rank the data and calculate Spearman's rank correlation coefficient. (5 marks)

QUESTION 6

- a) A university department regularly sets its students an examination at the end of their first semester. The marks have been found to be normally distributed with mean 67 and variance 96. One year the department is forced to lower its entrance requirements, and at the end of the first year the 30 students achieved a mean mark of 62 in the test.

Is this significant at 5 per cent to show that the standard of student attainment has fallen? (6 marks)

- b) The marks obtained nationally in an examination have a normal distribution with variance 190. The marks obtained by a sample of ten students from a particular college are listed below.

64 61 58 70 49 56 66 60 52 74

Find the sample mean mark.

Find the 95 per cent confidence interval for the mean mark of the students from the college.

Without any further calculation, comment on a claim by the college principal that the true mean mark is 68. (7 marks)

- c) The salaries, in \$00S, of 80 employees of a company are given in the following table.

3.9	1.7	2.0	2.4	2.0	1.2	2.4
3.4	1.3	1.5	3.7	2.6	1.6	3.2
1.5	2.6	3.1	3.1	3.4	2.5	2.2
2.9	2.1	1.6	1.6	1.6	2.1	2.9
2.1	1.3	3.9	3.5	4.1	2.4	4.4
3.7	2.5	1.4	4.1	2.7	2.5	4.2
2.6	2.6	2.9	2.4	2.6	4.4	3.3
1.7	1.9	2.1	1.6	3.6	3.8	3.2
3.6	3.0	3.5	3.7	2.4	1.6	1.7
3.7	2.6	2.9	2.5	2.8	3.9	2.5
2.7	3.6	2.4	3.6	3.2	3.0	2.9
3.0	3.1	3.3				

Assuming the intervals 1.0 – 1.5, 1.6 – 2.1, -----,

- Construct a frequency distribution table. (5 marks)
- From your frequency distribution table, determine the median class. (2 marks)

LIST OF FORMULAE

$$y = a + bx$$

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

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

$$r = \frac{n \sum xy - \sum x \sum y}{\sqrt{[n \sum x^2 - (\sum x)^2][n \sum y^2 - (\sum y)^2]}}$$

$$r^1 = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)}$$

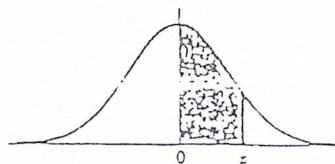
Critical values for the standard normal distribution.

[Significance for 1 tail test (2 – tail in brackets)].

	10% (20%)	5% (10%)	2.5% (5%)	2% (4%)	1% (2%)	0.5% (1%)
Z	1.282	1.645	1.960	2.054	2.326	2.576

APPENDIX 2

AREAS
under the
STANDARD
NORMAL CURVE
from 0 to z



z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3926	.3944	.3962	.3980	.3997	.4016
1.3	.4032	.4049	.4066	.4082	.4099	.4116	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

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