



ZIMBABWE

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

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL DIPLOMA

IN

ALL CIVIL ENGINEERING DISCIPLINE MODULE COURSES

MODULE: Research Methods

**PAPER NO: 588/572/579/ 573/
569/576/574/578/575**

DURATION: 3 Hours

MAY/JUNE 2025 EXAMINATION

REQUIREMENTS

**Answer booklet, area under the standard normal distribution curve
(Appendix) and list of formulae (Appendix).**

INSTRUCTIONS TO CANDIDATE

- 1. Answer any five questions.**
- 2. Show your working.**
- 3. Do not write anything on the question paper.**
- 4. Do not tear pages from the answer booklet.**

This paper consists of 7 printed pages.

5. Do not write your name anywhere.

QUESTION 1

- (a) Define the following terms:-
- (i) Research scope (3 marks)
 - (ii) Research delimitations (3 marks)
 - (iii) Research limitations (3 marks)
- (b) Outline the steps of formulating a research hypothesis. (11 marks)

QUESTION 2

- (a) Discuss the advantages and disadvantages of using questionnaires in research. (10 marks)
- (b) Describe the following data types, giving at least one example of each type:-
- (i) nominal data (2 marks)
 - (ii) interval data (2 marks)
 - (iii) numeric data (2 marks)
 - (iv) continuous data (2 marks)
 - (v) discrete data (2 marks)

QUESTION 3

- (a) Outline any three methods of sampling data, giving their advantages and disadvantages. (15 marks)
- (b) Discuss five points that make an impressive research proposal. (5 marks)

QUESTION 4

The marks obtained by 80 students in a test are recorded in the following table.

10	39	90	40	35	40	70	65
11	70	45	85	30	40	70	65
12	78	33	32	87	34	70	65
13	33	82	73	25	30	70	65
14	91	72	80	25	40	70	65
15	51	41	40	31	30	65	60
16	65	70	35	21	70	31	58
17	60	80	40	25	42	60	63
18	60	45	30	40	30	65	65
19	71	30	40	20	15	64	72

(a) Draw the histogram for the intervals 30-39; 40-49; ... (frequency distribution table).

(b) Using the frequency distribution in (a), calculate the

- (i) Mean
- (ii) Standard deviation
- (iii) Variance
- (iv) Coefficient of variation

QUESTION 5

The probability of passing an examination is 0.7. Determine the probability of passing at least 3 out of 5 attempts.

(b) A person is known to have an average of 100 marks in a test.

(c) The probability of a person passing a test is 0.7.

(d) The probability of a person passing a test is 0.7.

(e) The probability of a person passing a test is 0.7.

The probability of a person passing a test is 0.7. Determine the probability of a person passing at least 3 out of 5 attempts.

QUESTION 4

The marks obtained by 80 students in a test are recorded as below:-

68	39	59	40	95	42	78	83
60	70	45	87	54	56	75	65
64	78	35	36	87	84	62	69
76	33	92	73	61	93	76	53
58	91	72	90	86	87	78	64
48	51	41	88	91	80	60	56
77	45	76	45	92	74	57	85
83	50	69	90	39	82	69	62
53	93	46	57	80	82	65	65
50	74	88	72	70	76	64	72

- (a) Assuming the intervals 30-39; 40-49;---- construct a frequency distribution table. (6 marks)
- (b) Using the frequency distribution in (a), calculate the
- (i) Mean (4 marks)
 - (ii) Standard deviation (5 marks)
 - (iii) Variance (2 marks)
 - (iv) Coefficient of variation (3 marks)

QUESTION 5

- (a) The probability of passing an examination is 0.65. Determine the probability that out of 8 students, at least three will pass. (5 marks)
- (b) In 30 games a team scores an average two goals per game.
Determine the probability that they will score.
- (i) two goals in their next game (3 marks)
 - (ii) at most three goals in their next game (5 marks)
- (c) Tins are packed with an average of 1.0kg of a compound and the masses

are normally distributed about the average value. The standard deviation of a sample of the contents of the tins is 12g.

Determine the percentage of tins containing

- (i) Less than 985g (3 marks)
- (ii) Between 985g and 1030g. (4 marks)

QUESTION 6

A disinfectant is tested on a liquid containing bacteria. After t minutes, the number of thousands, k of bacteria remaining is given in the table below.

t	0	5	10	15	20	25
k	100	92	81	73	65	58

- (a) Plot a scatter graph of k on t . (6 marks)
- (b) Fit the least-squares regression line of k on t on your scatter graph. (9 marks)
- (c) Find the correlation coefficient and explain its significance. (5 marks)

APPENDIX 1

List of formulae

$$1. \quad \bar{X} = \frac{\sum x}{n} \quad \text{or} \quad \frac{\sum fx}{\sum f}$$

$$2. \quad S = \sqrt{\frac{\sum x^2}{n} - \bar{X}^2} \quad \text{or} \quad \sqrt{\frac{\sum \delta x^2 - \bar{X}^2}{\sum \delta}}$$

$$3. \quad Q = \frac{Q_3 - Q_1}{2}$$

4. Regression

$$Y = a + bx$$

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

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

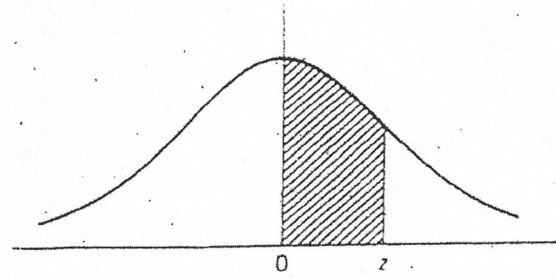
$$r = \frac{n \sum XY - (\sum X)(\sum Y)}{\sqrt{[n \sum X^2 - (\sum X)^2][n \sum Y^2 - (\sum Y)^2]}}$$

Critical values for the standard normal distribution

[Significance for 1 –tail test (2-tail in Bracket)]

	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

Table 1 Partial areas under the standardised normal curve



$z = \frac{x - \bar{x}}{s}$	0	1	2	3	4	5	6	7	8	9
0.0	0.0000	0.0040	0.0080	0.0120	0.0159	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	0.0678	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2086	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	0.2704	0.2734	0.2760	0.2794	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	0.3451	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4430	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	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	0.4762	0.4767
2.0	0.4772	0.4778	0.4783	0.4785	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	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4980	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.9	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000

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