



FINAL EXAMINATION

COURSE : INTRODUCTION TO STATISTICS AND DATA ANALYSIS

COURSE CODE : TQM1063

DURATION : 2 HOURS

INSTRUCTIONS TO CANDIDATES :

1. This question paper consists of **FIVE (5)** questions.
2. Answer ALL questions in the Answer Booklet provided.
3. Please check to make sure that this examination pack consists of :
 - i. The Question Paper
 - ii. An Answer Booklet
 - iii. Appendix 1
 - iv. Appendix 2
4. Do not bring any material into the examination hall unless permission is given by the invigilator.
5. Scientific calculator is allowed.
6. Please write your answer using a ball-point pen.

MYKAD NO : _____

ID. NO. : _____

LECTURER : _____

SECTION : _____

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO

The question paper consists of 3 printed pages

MAR2024/D/TQM1063

Short Answer**1. (12 points)**

Table 1 presents a result of a survey conducted among a random sample of 200 cyclists regarding the cycling route preferred by them.

	Hilly path (H)	Lake path (L)	Wooded path (W)
Female (F)	45	38	27
Male (M)	26	52	12

Table 1

- a. Suppose a cyclist is randomly selected, find the probability that the cyclist
 - i. is a female and prefers lake path. (1 point)
 - ii. is a male or prefers wooded path. (2 points)
 - iii. prefers hilly path given she is a female. (3 points)
- b. Determine whether “Male” and “Lake path” mutually exclusive events. (2 points)
- c. Illustrate the information in Table 1 into a probability tree. (4 points)

2. (9 points)

Through observation it has been determined that the probability for a given number of people waiting in line at a particular checkout counter of a supermarket is as shown in Table 2.

Number of people waiting, X	0	1	2	3	4
Probability, P(X)	0.10	0.15	k	0.24	0.31

Table 2

- a. Find the value of k . (2 points)
 - b. Find the probability of at least 2 people waiting in line. (2 points)
 - c. Determine the mean of the probability distribution. (2 points)
 - d. Determine the variance of the probability distribution. (3 points)
- 3. (12 points)**
- a. Determine the following probabilities for the standard normal distribution.
 - i. $P(-1.86 \leq Z \leq 0)$. (1 point)
 - ii. $P(0 \leq Z \leq 2.34)$. (1 point)

CONFIDENTIAL

- b. The vitamin B content (in mg) in a randomly selected carton of orange juice is modeled as a normal distribution with a mean of 32 mg and a standard deviation of 2 mg. Calculate the probability that the vitamin B content for a randomly chosen carton is
- i. less than 36 mg. (3 points)
 - ii. more than 34.5 mg. (3 points)
 - iii. between 27.5 mg and 37 mg. (4 points)

4. (4 points)

A researcher wants to estimate the time taken to bake a cookie for new culinary students. A sample of 30 students showed that the mean time taken by them is 6 hours with standard deviation of 3 hours.

- a. Find the point estimate of the population mean. (1 point)
- b. Calculate a 95% confidence interval of the population mean. (3 points)

5. (13 points)

- a. State the null and alternative hypothesis for the following statements. Hence, determine whether it is a left-tailed, right-tailed, or two-tailed test.
 - i. A social media company claims that the average number of shares for posts related to a particular campaign is greater than 200. (2 points)
 - ii. The average serving speed of a tennis player is believed to be different from 120 mph. (2 points)
- b. In a recent study, a researcher claimed that the mean of people spend on screen time per day is less than 6.9 hours. To investigate this claim, he conducted a survey of 50 individuals and recorded their daily screen times. The sample mean was found to be 7.08 hours with a standard deviation of 1.2 hours. At 5% significance level, test the researcher's claim.
 - i. State the null and alternative hypothesis. (2 points)
 - ii. State the type of the test. (1 point)
 - iii. Find the critical value. (1 point)
 - iv. Calculate the statistical test. (3 points)
 - v. State the decision. (1 point)
 - vi. State the conclusion. (1 point)

END OF QUESTION PAPER

APPENDIX 1

Probability Theory and Probability Distribution

i. Addition rule: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

ii. Multiplication rule:

$$P(A \cap B) = P(B) \cdot P(A | B)$$

$$P(A \cap B) = P(A) \cdot P(B) \text{ if and only if } A \text{ and } B \text{ are independent events}$$

iii. Conditional probability: $P(A | B) = \frac{P(A \cap B)}{P(B)}$

iv. Mean for a probability distribution: $\mu = E(x) = \sum x \cdot p(x)$

v. Variance for a probability distribution: $Var(x) = \sum x^2 P(x) - [E(x)]^2$

Normal Distribution

i. Standardized score: $z = \frac{x - \mu}{\sigma}$

Estimation of mean

Margin of error for the point estimation of μ : $Z_{\alpha/2} \left(\frac{\sigma}{\sqrt{n}} \right)$

i. Confidence interval of μ for a large sample

$$\bar{x} - z \frac{\sigma}{\sqrt{n}} < \mu < \bar{x} + z \frac{\sigma}{\sqrt{n}}$$

or

$$\bar{x} - z \frac{s}{\sqrt{n}} < \mu < \bar{x} + z \frac{s}{\sqrt{n}}$$

ii. Minimum sample size needed for an interval estimate of the population mean:

$$n = \left(\frac{Z_{(\alpha/2)} \cdot \sigma}{E} \right)^2$$

Hypothesis Testing

i. z test: $z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$

APPENDIX 2

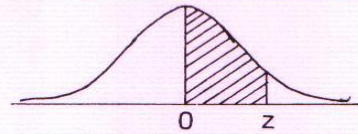
Table 4

NORMAL DISTRIBUTION

Statistical Table

The following table gives the areas under the standard normal curve from 0 to z

Eg: $P(0 \leq z \leq 1.24) = 0.3925$



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	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.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