

**FINAL EXAMINATION**

**BACHELOR OF INFORMATION TECHNOLOGY (HONOURS) IN COMPUTER
APPLICATION DEVELOPMENT**

**BACHELOR OF INFORMATION TECHNOLOGY (HONOURS) IN CYBER
SECURITY**

BACHELOR IN INFORMATION TECHNOLOGY (HONOURS) (DATA ANALYTICS)

BACHELOR IN COMPUTER SCIENCE (HONOURS)

**COURSE : STATISTICS AND PROBABILITY/
STATISTICS**

COURSE CODE : STA2133/STA2103

DURATION : 3 HOURS

INSTRUCTIONS TO CANDIDATES:

1. This question paper consists of **FOUR (4)** 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(1) and 1(2)
 - iv. Appendix 2
4. Do not bring any material into the examination hall. Electronic calculator is allowed.
5. Please write your answer using permanent ink.

MYKAD/ PASSPORT NO. : _____
ID. NO. : _____
LECTURER : _____
SECTION : _____

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

This question paper consists of 5 printed pages including the front page

QUESTION 1

- a. At HealthFirst Clinic, the variable Y represents the number of patients registering at the outpatient counter between 8.00 a.m. and 10.00 a.m. on a randomly selected weekday. The probability distribution for Y is given as follows: for 10 patients, the probability is 12%; for 15 patients, the probability is 18%; for 20 patients, the probability is 30%; for 25 patients, the probability is 25%; and for 30 patients, the probability is 15%. This distribution helps the clinic plan staffing and reduce patient waiting time.
- Create a probability distribution table.
(2 marks)
 - If a weekday is chosen at random, find the probability that at most 20 patients register during this time period.
(3 marks)
 - Calculate the mean and standard deviation of the number of patients registering at the outpatient counter.
(6 marks)
- b. At BrightTech Electronics Factory, quality inspectors found that 7 out of every 20 products produced are defective. For inspection, 18 products are randomly selected.
- State the name of the probability distribution used for the above variable.
(1 mark)
 - Determine the probability that exactly 10 of the selected products are defective.
(2 marks)
 - Calculate the mean and variance of the number of defective products.
(4 marks)
- c. At an airport security checkpoint, the average number of passengers passing through per 10 minutes is 14. For any given 10 minutes, find the probability that the number of passengers passing through is:
- exactly 7 passengers.
(2 marks)
 - between 9 and 12 passengers, inclusive.
(5 marks)

(Total: 25 marks)

QUESTION 2

- a. A Music Streaming Platform monitors the number of songs streamed during the first hour after a new album is released. The random variable X , representing the number of songs streamed, is normally distributed with a mean of 45 songs and a standard deviation of 6 songs. Find the probability that, for a randomly selected album release, the number of songs streamed in the first hour is:
- i. less than 55 songs. (4 marks)
 - ii. between 41 to 49 songs. (7 marks)
- b. In a fitness tracking study, the number of calories burned per day by users of FitTrack (a popular fitness app) follows a normal distribution with a mean of 450 kcal and a standard deviation of 60 kcal. A random sample of 30 users is selected.
- i. Calculate the standard deviation of the sampling distribution. (3 marks)
 - ii. Find the probability that the sample mean calories burned is more than 473.6 kcal. (4 marks)
 - iii. Find the probability that the sample mean calories burned lies between 465.2 kcal and 487.6 kcal. (7 marks)
- (Total: 25 marks)

QUESTION 3

- a. An educational technology company aims to estimate the average number of hours students spend using an online learning platform per week. A random sample of 55 students is selected, yielding a sample mean usage time of 36 hours per week and a sample standard deviation of 12 hours.
- Determine the best point estimate of the population mean number of hours spent on the platform per week.
(2 marks)
 - Construct a 90% confidence interval for the population mean number of hours spent on the platform per week.
(6 marks)
 - The company wishes to estimate the population mean weekly usage time with a margin of error not exceeding 5 hours at a 99% confidence level. Determine the minimum required sample size.
(4 marks)
- b. A health awareness survey was conducted to determine students' exercise habits. A random sample of 500 university students was selected. Among them, 325 students reported that they exercise at least three times per week. The study aims to estimate the proportion of students who maintain regular physical activity.
- Calculate the best point estimate of the population proportion of students who exercise at least three times per week.
(2 marks)
 - Construct a 95% confidence interval for the true proportion of students who exercise at least three times per week. Interpret the interval obtained.
(7 marks)
 - The researcher wishes to determine the required sample size to estimate the population proportion with a 99% confidence level and a maximum margin of error of 5%. Determine the minimum sample size required.
(4 marks)

(Total: 25 marks)

QUESTION 4

- a. Write the null and alternative hypothesis for each of the following statements.
- i. An online learning platform wants to test whether the average time students spend on a course is at least 2 hours per day after introducing gamified learning features.
(2 marks)
 - ii. An ice cream shop wants to test whether the average number of ice creams sold per day has increased from 43 after introducing a new flavor.
(2 marks)
- b. A mental wellness app wants to determine if its new meditation reminder feature increases the average number of meditation sessions completed per week by its users. Previously, users completed an average of 2.8 sessions per week. After implementing the feature, a random sample of 25 users shows a mean of 3.4 sessions per week, with a standard deviation of 1.0. At a 10% significance level, can we conclude that the new feature increases the average number of weekly meditation sessions?
- i. State the null and alternative hypothesis.
(2 marks)
 - ii. Find the critical value for $\alpha = 0.10$.
(2 marks)
 - iii. Compute the test statistics.
(3 marks)
 - iv. State the decision and conclusion for the above study.
(4 marks)
- c. A coffee shop claimed that more than 8% of its takeaway drinks were spilled during delivery. A random sample of 200 drinks showed that 35 drinks were spilled. At a significance level of $\alpha = 0.10$, conduct a hypothesis test to determine whether the proportion of spilled drinks is more than 8%.
(10 marks)
- (Total: 25 marks)

(TOTAL: 100 MARKS)**END OF QUESTION PAPER**

APPENDIX 1(1)

Discrete Probability Distribution

1. Discrete random variable

a. $\mu = \sum xP(x)$

b. $\sigma^2 = \sum x^2 P(x) - \mu^2$

2. Binomial Distribution

a. $P(X = r) = {}^nC_r p^r q^{n-r}$

b. $\mu = np$

c. $\sigma^2 = npq$

3. Poisson Distribution

a. $P(X = k) = \frac{\lambda^k e^{-\lambda}}{k!}$

b. $\mu = \sigma^2 = \lambda$

Normal Distribution

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

Sampling Distribution

1. Mean of
- $\bar{x}$
- :
- $\mu_{\bar{x}} = \mu$

2. Standard deviation of
- $\bar{x}$
- :
- $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

3. z value for
- $\bar{x}$
- :
- $z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$

Estimation of mean

- Margin of error for the point estimation of μ : $\pm z \frac{\sigma}{\sqrt{n}}$
- Confidence interval μ for a large sample

$$\mu = \bar{x} \pm z \frac{\sigma}{\sqrt{n}} \quad \text{or} \quad \mu = \bar{x} \pm z \frac{s}{\sqrt{n}}$$

3. Minimum sample size required of the population mean:

$$n = \left(\frac{z\sigma}{E} \right)^2$$

APPENDIX 1 (2)

Estimation of proportion

1. Margin of error for the point estimation of p : $\pm z \sqrt{\frac{p \hat{q}}{n}}$

2. Confidence interval p for a large sample

$$\hat{p} \pm Z \sqrt{\frac{\hat{p} \hat{q}}{n}}$$

3. Minimum sample size required of the population proportion:

$$n = \frac{Z^2 pq}{E^2}$$

Hypothesis testing

1. Test statistics for mean = $\frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$

2. Test statistics for proportion = $\frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}}$

APPENDIX 2

Table

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