

**FINAL EXAMINATION****BACHELOR OF INFORMATION TECHNOLOGY (HONOURS) IN CYBER
SECURITY****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 Pixel Play Gaming Hub, the variable X represents the number of gaming console bookings made during the evening session on a randomly selected weekend day. The probability distribution for X is given as follows: for 15 bookings, the probability is 15%; for 20 bookings, the probability is 25%; for 25 bookings, the probability is 30%; for 30 bookings, the probability is 20%; and for 35 bookings, the probability is 10%. This distribution helps Gaming Hub allocate gaming stations and staff efficiently.
- Create a probability distribution table.
(2 marks)
 - If a weekend day is selected at random, determine the probability that the number of gaming console bookings is at most 20.
(3 marks)
 - Calculate the mean and standard deviation of the number of gaming console bookings during the evening session.
(6 marks)
- b. At Sweet Cloud Dessert Cafe, it is found that 7 out of every 20 customers purchase a slice of cheesecake during their visit. For a marketing study, 18 customers are randomly selected.
- State the name of the probability distribution used for the above variable.
(1 mark)
 - Find the probability that exactly 5 of the selected customers purchase a slice of cheesecake.
(2 marks)
 - Calculate the mean and variance of the number of customers who purchase a slice of cheesecake.
(4 marks)
- c. A bakery tracks the number of customers purchasing pastries during the morning session. On average, 14 customers make a purchase every 45 minutes. For any given 45-minute interval, find the probability that the number of customers making a purchase is:
- exactly 11 customers.
(2 marks)
 - between 12 and 14 customers, inclusive
(5 marks)
- (Total: 25 marks)

QUESTION 2

- a. A music streaming platform records the number of users who complete an entire season of a newly released K-drama within the first week of its release. The random variable X , representing the number of users, is normally distributed with a mean of 4,500 users and a standard deviation of 600 users. Find the probability that, for a randomly selected K-drama release, the number of users who complete the entire season within the first week is:
- i. more than 5,200 users. (4 marks)
 - ii. between 4,000 users and 4,800 users. (7 marks)
- b. A gaming company studies the daily gaming duration (in minutes) of players participating in a ranked competition. The gaming duration follows a normal distribution with a mean of 180 minutes and a standard deviation of 36 minutes. A random sample of 80 players is selected.
- i. Calculate the standard deviation of the sampling distribution. (3 marks)
 - ii. Find the probability that the sample mean gaming duration less than 185.6 minutes. (4 marks)
 - iii. Find the probability that the sample mean gaming duration lies between 175 minutes and 182.7 minutes. (7 marks)
- (Total: 25 marks)

QUESTION 3

- a. A university researcher is interested in estimating the average number of hours students spend creating content for social media platforms such as TikTok, Instagram, and YouTube each week. A random sample of 64 students who actively create content revealed a mean content creation time of 14.8 hours per week with a sample standard deviation of 4.5 hours.
- i. Determine the best point estimate of the population mean weekly content creation time among student content creators.
(2 marks)
 - ii. Construct a 90% confidence interval for the population mean weekly content creation time.
(6 marks)
 - iii. The researcher wishes to estimate the population mean weekly content creation time with a margin of error not exceeding 1 hour at a 95% confidence level. Determine the minimum sample size required.
(4 marks)
- b. As part of a study on the "Travel & Healing Era" trend among university students, a survey was conducted to investigate students' leisure travel habits. Out of 450 students surveyed, 288 students reported that they had travelled for leisure purposes (such as staycations, road trips, island vacations, or short getaways) at least twice during the past 12 months.
- i. Calculate the best point estimate of the population proportion of students who travelled for leisure at least twice during the past 12 months.
(2 marks)
 - ii. Construct a 99% confidence interval for the true proportion of students who travelled for leisure at least twice during the past 12 months. Interpret the interval obtained.
(7 marks)
 - iii. The researcher wishes to estimate the population proportion with a 90% confidence level and a maximum margin of error of 4%. 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. A food delivery company wants to test whether the average delivery time for orders during peak hours is greater than 35 minutes.
(2 marks)
 - ii. A movie streaming platform wants to test whether the average number of hours subscribers spend watching content per week is less than 12 hours after introducing a new recommendation algorithm.
(2 marks)
- b. A dessert cafe claims that customers spend an average of RM25 per visit. The cafe owner believes that customers now spend more than RM25 after introducing a premium dessert menu. A random sample of 36 customers shows a mean spending of RM28.40 with a population standard deviation of RM7.20. Using a significance level of $\alpha = 0.05$, test whether the average spending per customer has increased.
- i. State the null and alternative hypothesis.
(2 marks)
 - ii. Determine the critical value for $\alpha = 0.05$.
(2 marks)
 - iii. Compute the test statistics.
(3 marks)
 - iv. State the decision and conclusion for the above study.
(4 marks)
- c. A music streaming platform claims that less 7% of its users listen to playlists generated by artificial intelligence (AI). A random sample of 400 users found that 20 users regularly listen to AI-generated playlists. Using a significance level of $\alpha = 0.01$, conduct a hypothesis test to determine whether the proportion of users who listen to AI-generated playlists is less than 7%.
(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. $P(X = r) = {}^n C_r p^r q^{n-r}$

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

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

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

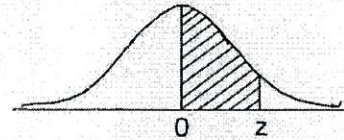
Table 6

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