BACHELOR OF INFORMATION TECHNOLOGY (HONS)
BACHELOR OF INFORMATION TECHNOLOGY (HONS) (INTERNET ENGINEERING AND CLOUD COMPUTING)

FINAL EXAMINATION
OCTOBER 2020

Course : EB3125 (Statistics)

Time : 9.00 am – 12.00 pm
(3 hours)

Lecturer : Nur Suaidah Binti Rosli

Date : 17 December 2020

Instructions:

Answer **ALL** questions.

Important:

1. Formula sheets are provided at the end of the question paper.
2. All workings and calculations must be shown clearly wherever applicable.

This exam paper consists of 7 printed pages
(excluding front cover).

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

1. a. The following data give the numbers of car thefts that occurred in a city during the past 12 days.

6 3 7 11 4 3 8 7 2 6 9 15

i. Find the mean, mode and median. **(6 MARKS)**

ii Calculate the variance and standard deviation. **(6 MARKS)**

b. The following table gives the grouped data on the weights of all 100 babies born at a hospital in 2019

Weight (kg)	Number of Babies
3 to less than 5	5
5 to less than 7	30
7 to less than 9	40
9 to less than 11	20
11 to less than 13	5

Find the mean and variance. **(8 MARKS)**

2. a. A box contains 20 DVDs, 4 of which are defective. If two DVDs are selected at random (without replacement) from this box, what is the probability that both are defective? **(6 MARKS)**

b. An office building has two fire detectors. The probability is .02 that any fire detector of this type will fail to go off during a fire. Find the probability that both of these fire detectors will fail to go off in case of a fire. **(4 MARKS)**

c. The following table, gives the probability distribution of the number of patients entering the emergency room during a 1-hour period at Nilai Medical Hospital.

Patients per hour	0	1	2	3	4	5	6
Probability	0.2725	0.3543	0.2303	0.0998	0.0324	0.0084	0.0023

Calculate the mean and standard deviation for this probability distribution **(10 MARKS)**

3. a. Magnetic resonance imaging (MRI) is a process that produces internal body images using a strong magnetic field. Some patients become claustrophobic and require sedation because they are required to lie within a small, enclosed space during the MRI test. Suppose that 20% of all patients undergoing MRI testing require sedation due to claustrophobia. If five patients are selected at random, find the probability that the number of patients in these five who require sedation is

i. exactly 2. **(4 MARKS)**

ii. none. **(4 MARKS)**

b. On average, 5.4 shoplifting incidents occur per week at an electronics store. Find the probability that exactly 3 such incidents will occur during a given week at this store. **(4 MARKS)**

c. A psychologist has devised a stress test for dental patients sitting in the waiting rooms. According to this test, the stress scores (on a scale of 1 to 10) for patients waiting for root canal treatments are found to be approximately normally distributed with a mean of 7.59 and a standard deviation of 0.73.

i. What percentage of such patients have a stress score lower than 6.0? **(4 MARKS)**

ii. What is the probability that a randomly selected root canal patient sitting in the waiting room has a stress score between 7.0 and 8.0? **(4 MARKS)**

4. a. The following data give the ages (in years) of all six members of a family.

55	53	28	25	21	15

i. What is the population mean? **(2 MARKS)**

ii. List all the possible samples of size five (without replacement) that can be selected from this population. Calculate the mean for each of these samples. Write the sampling distribution of a sample mean. **(8 MARKS)**

b. A sample of 1500 homes sold recently in a state gave the mean price of homes equal to \$299,720. The population standard deviation of the prices of homes in this state is \$68,650. Construct a 99% confidence interval for the mean price of all homes in this state. [Hint: $\bar{X} \pm Z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right)$] **(5 MARKS)**

c. A bank manager wants to know the mean amount of mortgage paid per month by homeowners in an area. A random sample of 120 homeowners selected from this area showed that they pay an average of \$1575 per month for their mortgages. The population standard deviation of such mortgages is \$215. Find a 97% confidence interval for the mean amount of mortgage paid per month by all homeowners in this area. [Hint: $\bar{X} \pm Z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right)$] **(5 MARKS)**

5. a. The Telephone Company provides long-distance telephone service in an area. According to the company's records, the average length of all long-distance calls placed through this company in 2009 was 12.44 minutes. The company's management wanted to check if the mean length of the current long-distance calls is different from 12.44 minutes. A sample of 150 such calls placed through this company produced a mean length of 13.71 minutes. The standard deviation of all such calls is 2.65 minutes. Using the 2% significance level, to conclude that the mean length of all current long-distance calls is different from 12.44 minutes? **(8 MARKS)**

b. A diabetic is interested in determining how the amount of aerobic exercise impacts his blood sugar. When his blood sugar reaches 170 mg/dL, he goes out for a run at a pace of 10 minutes per mile. On different days, he runs different distances and measures his blood sugar after completing his run. Note: The preferred blood sugar level is in the range of 80 to 120 mg/dL. Levels that are too low or too high are extremely dangerous. The data generated are given in the following table.

Distance (miles)	2	2	2.5	2.5	3	3	3.5	3.5	4	4	4.5	4.5
Blood sugar (mg/dL)	136	146	131	125	120	116	104	95	85	94	83	75

i. Construct a scatter diagram for these data. Does the scatter diagram exhibit a linear relationship between distance run and blood sugar level. **(6 MARKS)**

ii. Find the predictive regression equation of blood sugar level on the distance run. **(6 MARKS)**

-END OF QUESTION PAPER-

FORMULAE

UNGROUPED DATA	GROUPED DATA
Mean, $\bar{x} = \dfrac{\sum f}{n}$	Mean, $\bar{x} = \dfrac{\sum fx}{n}$
Sample Variance, $s^2 = \dfrac{\sum x^2 - \dfrac{\left(\sum x\right)^2}{n}}{n-1}$	Median, MD $= L + \left(\dfrac{\frac{n}{2} - C_f}{f}\right)C$
Standard deviation, $s = \sqrt{s^2}$	Sample Variance , $s^2 = \dfrac{\sum X_m{}^2 f - \dfrac{\left(\sum X_m f\right)^2}{n}}{n-1}$
	Standard deviation, $s = \sqrt{s^2}$

PROBABILITY	CONDITIONAL PROBABILITY
Complement Rule $P\left(\overline{A}\right) = 1 - P(A)$	P (A | B) = $\dfrac{P\left(A \cap B\right)}{P(B)}$
A and B are mutually exclusive events $P(A \cup B) = P(A) + P(B)$	If A and B are independent, then $P(A \cap B) = P(A) \cdot P(B)$
A and B are mutually non exclusive events $P\left(A \cup B\right) = P(A) + P(B) - P(A \cap B)$	If A and B are dependent, then $P(A \cap B) = P(B) \cdot P(B/A)$

BINOMIAL DISTRIBUTION	DISCRETE RANDOM VARIABLE
$P(X = x) = {}^nC_x\,(p)^x\,(q)^{n-x} = \dfrac{n!}{x!(n-x)!}\,p^x(1-p)^{n-x}$ $\mu = np\,; \qquad \sigma^2 = np(1-p)$	$E(X) = \mu = \sum X \cdot P(X)$ $V(X) = \sigma^2 = \sum\left[X^2 \cdot P(X)\right] - \mu^2$

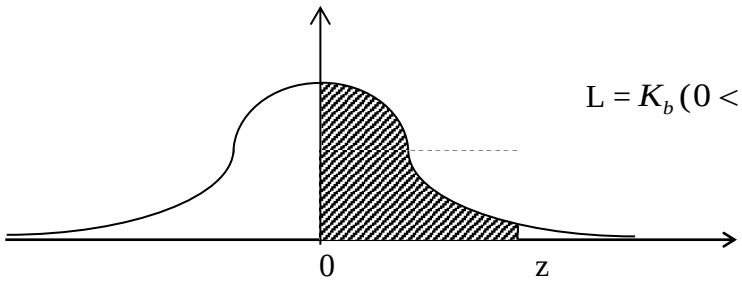
STANDARD NORMAL DISTRIBUTION	POISSON DISTRIBUTION
$z = \dfrac{x - \mu}{\sigma}$	P (X = x) = $\dfrac{e^{-\lambda}\,\lambda^x}{x!}$

EQUATION OF THE REGRESSION LINE	CORRELATION COEFFICIENT
$y' = a + bx$ $a = \dfrac{\left(\sum y\right)\left(\sum x^2\right) - \left(\sum x\right)\left(\sum xy\right)}{n\left(\sum x^2\right) - \left(\sum x\right)^2}$ $b = \dfrac{n\left(\sum xy\right) - \left(\sum x\right)\left(\sum y\right)}{n\left(\sum x^2\right) - \left(\sum x\right)^2}$	$r = \dfrac{n\left(\sum xy\right) - \left(\sum x\right)\left(\sum y\right)}{\sqrt{\left[n\left(\sum x^2\right) - \left(\sum x\right)^2\right]\left[n\left(\sum y^2\right) - \left(\sum y\right)^2\right]}}$

POPULATION MEAN	SAMPLE MEAN
$\mu = \sum X \cdot P(X)$ $\sigma^2 = \sum\left[X^2 \cdot P(X)\right] - \mu^2$ $\sigma = \sqrt{\sigma^2}$	$\mu_{\bar{x}} = \sum \overline{X} \cdot P\left(\overline{X}\right)$ $\sigma_{\bar{x}}{}^2 = \sum\left[\overline{X}^2 \cdot P\left(\overline{X}\right)\right] - \mu_{\bar{x}}{}^2$ $\sigma_{\bar{x}} = \sqrt{\sigma_{\bar{x}}{}^2}$

THE STANDARD NORMAL DISTRIBUTION TABLE

Area under the standard normal curve from 0 to z



$$L = K_b(0 < Z \le z) = \Phi(z) = \int_0^z \frac{1}{\sqrt{2\pi}} e^{\frac{-z^2}{2}}\, dz$$

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	**0.0000**	**0.0040**	**0.0080**	**0.0120**	**0.0160**	**0.0199**	**0.0239**	**0.0279**	**0.0319**	**0.0359**
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0635	0.0675	0.0714	0.0754
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	0.2088	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	0.2612	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2996	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**	**0.3461**	**0.3485**	**0.3508**	**0.3531**	**0.3554**	**0.3577**	**0.3599**	**0.3621**
1.1	0.3643	0.3665	03686	0.3708	0.3729	0.3750	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	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4516	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	0.4761	0.4767
2.0	**0.4772**	**0.4778**	**0.4783**	**0.4788**	**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	0.4998	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	0.4974	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	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	0.4996
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	0.4988	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