UNIRAZAK
UNIVERSITI TUN ABDUL RAZAK

FINAL EXAMINATION
MARCH 2024

COURSE TITLE	**INTRODUCTION TO BUSINESS STATISTICS**
COURSE CODE	**RMAT1123**
DATE/DAY	**22 JUNE 2024 / SATURDAY**
TIME/DURATION	**09:00 AM - 11:00 AM / 02 Hour(s) 00 Minute(s)**

INSTRUCTIONS TO CANDIDATES :

1. Please read the instruction under each section carefully.
2. Candidates are reminded not to bring into examination hall/room any form of written materials or electronic gadget except for stationery that is permitted by the Invigilator.
3. Students who are caught breaching the Examination Rules and Regulation will be charged with an academic dishonesty and if found guilty of the offence, the maximum penalty is expulsion from the University.

(This Question Paper consists of 8 Printed Pages including front page)

*****DO NOT OPEN THE QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO*****

There are SEVEN (7) questions in this section. Answer ALL questions in the answer booklet provided. [100 MARKS]

1. There are 15 Malays, 10 Indians and x Chinese students in a Statistics class. Find the the value of x for each of the following:

   a) if the probability of choosing Malay is $\frac{1}{4}$. (5 marks)

   b) if the probability of choosing an Indian student is $\frac{1}{3}$. (5 marks)

2. A stall sells onions. The weights of onions are normally distributed with a mean of 85 grams and standard deviation 5 grams. Five onions are chosen at random, find the probability

   a) exactly three of them weigh more than 82 grams. (5 marks)

   b) at least one onion is more than 82 grams. (5 marks)

3. The table below shows the years of experience of 120 employees of Uni Razak.

Years of experience	Number of employees
$1-4$	16
$5-8$	20
$9-12$	28
$13-16$	24
$17-20$	16
$21-24$	11
$25-28$	5

Calculate

a) Mean. (5 marks)

b) Median. (5 marks)

c) Mode. (5 marks)

4. For the followings:

   a) Find the skew of this data set:

   $$2,2,3,4,5,6$$

   Calculate Pearson's Coefficient of Skewness for above sample (5 marks)

   b) Find the standard deviation of the sample data below:

   $$3 \quad 5 \quad 6 \quad 9$$

   (5 marks)

5. A certain type of ball is known to have a bounce height which is normally is normally distributed with a standard deviation of 2 cm. A random sample of 60 tennis ball is tested and the mean bounce height of the sample is 140 cm. Find

   a) a symmetrical 95% confidence interval for mean bounce height. (10 marks)

   b) a symmetrical 99% confidence interval for mean bounce height. (10 marks)

6. The weights of durian in Dusun Gombak is normally distributed with a mean of 5 kg and and a standard deviation of 0.5 kg. Given there are 100 durians in a basket find the number of durians that

   a) weigh more than 6kg. (10 marks)

   b) weigh more than 4 kg. (10 marks)

7. The masses of guavas in a farm are normally distributed with a mean μ and a standard deviation, σ. The mass of percentages of guava that less than 400 g is 15.87% and more than 500 g is 6.68%. Find the value of μ and σ. (15 marks)

*** END OF QUESTION PAPER ***

List of Formulas

1. Sample Mean: $\bar{X} = \frac{\sum x}{n}$

2. Population Mean: $\mu = \frac{\sum X}{N}$

3. *Grouped Data*

$Mean: \bar{X} = \frac{\sum fx}{\sum f}$

$Median \ = L_m + \left[\frac{\frac{n}{2} - F}{f_m}\right] c$

$Mode = L + \left[\frac{f_0 - f_1}{(f_0 - f_1) + (f_0 - f_2)}\right] \times c$

4. *Population (Ungrouped Data)*

$Mean: \mu = \frac{\sum x}{N}$

$Variance: \sigma^2 = \frac{\sum x^2}{N} - (\bar{X})^2 \ @ \ \frac{1}{N}\sum(X - \mu)^2$

$Standard\ deviation: \sigma = \sqrt{\frac{\sum x^2}{N} - (\bar{X})^2} \ @ \ \sqrt{\frac{1}{N}\sum(X - \mu)^2}$

5. *Sample (Ungrouped Data)*

$Variance: s^2 = \frac{1}{n-1}\left[\sum x^2 - \frac{(\sum x)^2}{n}\right]$

$Standard\ deviation: s = \sqrt{\frac{1}{n-1}\left[\sum x^2 - \frac{(\sum x)^2}{n}\right]}$

6. *Population (Grouped Data)*

$Mean: \mu = \frac{\sum fx}{\sum f(N)}$

$Variance: \sigma^2 = \frac{\sum fx^2}{\sum f(N)} - (\bar{X})^2$

$Standard\ deviation: \sigma = \sqrt{\frac{\sum fx^2}{\sum f(N)} - (\bar{X})^2}$.

7. *Sample (Grouped Data)*

$Variance: s^2 = \frac{1}{n-1}\left[\sum fx^2 - \frac{(\sum fx)^2}{n}\right]$

$Standard\ deviation: s = \sqrt{\frac{1}{n-1}\left[\sum fx^2 - \frac{(\sum fx)^2}{n}\right]}$

8. *Pearson's coefficient of skewness*

$$Skewness = \frac{Mean - Mode}{Standard\ deviation} \ @ \ \frac{3(Mean - Median)}{Standard\ deviation}$$

9. *Binomial*

$P(X = r) = C_r \, p^r \, q^{n-r}$

$Mean = np$

$Variance = npq$

$Standard\ deviation = \sqrt{npq}$

10. *Poisson Distribution*

$$P(X = r) = e^{-\mu} \frac{\mu^r}{r!}$$

11. *Normal Distribution*

$$z = \frac{X - \mu}{\sigma}$$

12.

$E(\bar{X}) = \mu$

$$Var(\bar{X}) = \frac{\sigma^2}{n}$$

13. *Confidence Interval for Population Mean*

(with known variance & sample size > 30)

$P(\bar{X} - E \le \mu \le \bar{X} + E)$,

$E = \pm z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$, E = marginal of error

Confidence interval will

$(\bar{X} - E, \bar{X} + E)$

14. *Confidence Interval for Population Mean*
(with unknown variance & sample size < 30)

$(\bar{X} - E \le \bar{X} \le \bar{X} + E)$

$E = \pm t_{\frac{\alpha}{2}} \frac{\hat{\sigma}}{\sqrt{n}}$

Confidence interval will

$$\left(\bar{X} - t_{\frac{\alpha}{2}} \frac{\hat{\sigma}}{\sqrt{n}}, \bar{X} + t_{\frac{\alpha}{2}} \frac{\hat{\sigma}}{\sqrt{n}}\right)$$

15.

Significance test

Population mean (Normal) with known variance

$$Test\ Statistics\ z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

Population mean (Normal) with unknown variance

$$Test\ Statistics\ z = \frac{x - \mu}{\frac{s}{\sqrt{n}}}$$

16. *Anova*

$$Test\ Statistics: \frac{{s_1}^2}{{s_2}^2}$$

$$F = \frac{estimated\ population\ variance\ between\ the\ sample}{estimated\ population\ variance\ within\ the\ sample}$$

17.

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

Test statistics: $t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$

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

$$s_{y.x} = \sqrt{\frac{\sum(Y - Y')^2}{n-2}}$$

$$Test\ statistics, t = \frac{b}{SE(b)}$$

18.

Confidence Interval of an Estimate

$$Y' \pm t_{\frac{\alpha}{2}} s_{y.x} \sqrt{\frac{1}{n} + \frac{(X - \bar{X})^2}{\sum X^2 - \left[\frac{(\sum X)^2}{n}\right]}}$$

Prediction Interval of an Estimate

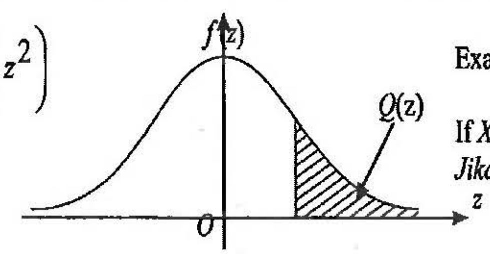
$$Y' \pm t_{\frac{\alpha}{2}} s_{y.x} \sqrt{1 + \frac{1}{n} + \frac{(X - \bar{X})^2}{\sum X^2 - \left[\frac{(\sum X)^2}{n}\right]}}$$

THE UPPER TAIL PROBABILITY Q(z) FOR THE NORMAL DISTRIBUTION N(0,1)
***KEBARANGKALIAN HUJUNG ATAS Q(z) BAGI TABURAN NORMAL* N(0, 1)**

z	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
														Minus / *Tolak*					
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641	4	8	12	16	20	24	28	32	36
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247	4	8	12	16	20	24	28	32	36
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859	4	8	12	15	19	23	27	31	35
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483	4	7	11	15	19	22	26	30	34
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121	4	7	11	15	18	22	25	29	32
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776	3	7	10	14	17	20	24	27	31
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451	3	7	10	13	16	19	23	26	29
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148	3	6	9	12	15	18	21	24	27
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867	3	5	8	11	14	16	19	22	25
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611	3	5	8	10	13	15	18	20	23
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379	2	5	7	9	12	14	16	19	21
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170	2	4	6	8	10	12	14	16	18
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985	2	4	6	7	9	11	13	15	17
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823	2	3	5	6	8	10	11	13	14
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681	1	3	4	6	7	8	10	11	13
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559	1	2	4	5	6	7	8	10	11
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455	1	2	3	4	5	6	7	8	9
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367	1	2	3	4	4	5	6	7	8
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294	1	1	2	3	4	4	5	6	6
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233	1	1	2	2	3	4	4	5	5
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183	0	1	1	2	2	3	3	4	4
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143	0	1	1	2	2	2	3	3	4
2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110	0	1	1	1	2	2	2	3	3
2.3	0.0107	0.0104	0.0102								0	1	1	1	1	2	2	2	2
				0.00990	0.00964	0.00939	0.00914				3	5	8	10	13	15	18	20	23
								0.00889	0.00866	0.00842	2	5	7	9	12	14	16	16	21
2.4	0.00820	0.00798	0.00776	0.00755	0.00734						2	4	6	8	11	13	15	17	19
						0.00714	0.00695	0.00676	0.00657	0.00639	2	4	6	7	9	11	13	15	17
2.5	0.00621	0.00604	0.00587	0.00570	0.00554	0.00539	0.00523	0.00508	0.00494	0.00480	2	3	5	6	8	9	11	12	14
2.6	0.00466	0.00453	0.00440	0.00427	0.00415	0.00402	0.00391	0.00379	0.00368	0.00357	1	2	3	5	6	7	9	9	10
2.7	0.00347	0.00336	0.00326	0.00317	0.00307	0.00298	0.00289	0.00280	0.00272	0.00264	1	2	3	4	5	6	7	8	9
2.8	0.00256	0.00248	0.00240	0.00233	0.00226	0.00219	0.00212	0.00205	0.00199	0.00193	1	1	2	3	4	4	5	6	6
2.9	0.00187	0.00181	0.00175	0.00169	0.00164	0.00159	0.00154	0.00149	0.00144	0.00139	0	1	1	2	2	3	3	4	4
3.0	0.00135	0.00131	0.00126	0.00122	0.00118	0.00114	0.00111	0.00107	0.00104	0.00100	0	1	1	2	2	2	3	3	4

$$f(z) = \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{1}{2}z^2\right)$$

$$Q(z) = \int_k^\infty f(z)\, dz$$



Example / *Contoh:*

If $X \sim N(0, 1)$, then $P(X > k) = Q(k)$
Jika $X \sim N(0, 1)$, *maka* $P(X > k) = Q(k)$