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ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Mid-Semester Examination

Winter Semester, A.Y. 2022-2023

Course Number: IPE 4531

Full Marks : 75

Course Title: Probability and Statistics

Time : 1 Hour 30 Min

There are **3 (Three)** questions. Answer all of them. The symbols have their usual meanings. Marks of each question and corresponding CO and PO are written in the right column.

Assume reasonable values if required. Selected formulas and charts are provided at the end of the question.

- 1 a. A bolt manufacturing company has collected raw data on the weight in gram of its bolts as tabled below: 15
CO1
PO2

201	148	286
155	236	271
213	224	191
257	193	208
170	181	226

- i. Make the data into appropriate classes and then prepare a frequency table.
ii. Determine the Range, Mean, Median, and Mode from the grouped data.
iii. Draw a box and whisker plot using the above data set.
- b. Explain your understanding about level of measurement and describe any one of them with examples. 5
CO1
PO1
- c. 'Cluster sampling method is the best sampling method' – write down your opinion on this statement after briefly describing cluster sampling with an example. 5
CO1
PO1
- 2 a) In testing a certain kind of truck tire over rugged terrain, it is found that 25% of the trucks fail to complete the test run without a blowout. Of the next 15 trucks tested, find the probability that more than 1 have blowouts. 5
CO2
PO3
- b) Hospital administrators in large cities anguish about traffic in emergency rooms. At a particular hospital in a large city, the staff on hand cannot accommodate the patient traffic if there are more than 3 emergency cases in a given hour. Historical data suggest that, on the average, 2 emergencies arrive per hour.
(i) What is the probability that in a given hour the staff cannot accommodate the patient traffic? 9
CO2
PO3
(ii) What is the probability that more than 2 emergencies arrive during a 3-hour shift.
- c) MPE dept has 6 Professors and 7 Lecturers. The Head of MPE dept has decided that he will make a Three members Syllabus Review Committee by lottery. In the lottery, replacement is not allowed. Determine the probability that the committee will be composed of only Professors. 5
CO2
PO3

- d) 10% people of Bangladesh have the Covid disease. A test to detect is 92% accurate. However, the test has 5% false positive rate. Say your friend is tested negative. Then find out the probability that your friend has the disease. 6
CO2
PO3
- 3 a) The Filling Stations Association wishes to have information on the mean consumption of Octane in Gazipur per month. A random sample of 256 customers reveals a sample mean of 250 liters. The standard deviation of this sample is 25 liters. Determine the best estimate of the population mean, the reasonable range of values considering 95 percent confidence interval and then comment on its significance. 6
CO2
PO3
- b) In an industrial process, the diameter of a ball bearing is an important measurement. The buyer sets specifications for the diameter to be 3.0 ± 0.01 cm. The implication is that no part falling outside these specifications will be accepted. It is known that in the process the diameter of a ball bearing has a normal distribution with mean $\mu = 3.0$ and standard deviation $\sigma = 0.004$. Determine the percentages of Manufactured ball bearings that will be scrapped on average. 7
CO2
PO3
- c) The monthly sales of mufflers in Board Bazar area follow the normal distribution with a mean of 1,200 and a standard deviation of 225. The manufacturer would like to establish inventory levels such that there is only a 10 percent chance of running out of stock. Find out the number of mufflers the manufacturer should keep at its inventory. 6
CO2
PO3
- d) The average grade for an exam is 74, and the standard deviation is 7. If 15% of the class is given A grade (highest grade) and 10% of the students is given F (Fail) grade, and the grades are curved to follow a normal distribution, find the cut off point for F and A grades. 6
CO2
PO3

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Formulas:::

Median:

$$M_e = L + \left(\frac{N - n_p}{n_c} \right) i \quad 1 \quad = R / (1 + 3.322 \log n)$$

$$b(x; n, P) = {}^n C_x * P^x * (1 - P)^{n-x}$$

$$P(x; \mu) = (e^{-\mu}) * (\mu^x) / x!$$

$$h(x; N, n, k) = [{}^k C_x] * [{}^{N-k} C_{n-x}] / [{}^N C_n]$$



Table A.3 Areas under the Normal Curve

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
-1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
-0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
-0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
-0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
-0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
-0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
-0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
-0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
-0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
-0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

