ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF BUSINESS AND TECHNOLOGY MANAGEMENT

Semester Final Examination   Summer Semester, A. Y. 2021-2022
Course No.   : Math 4461   Time   : 3 hours
Course Title : Business Statistics   Full Marks : 150

Answer **all 6 the (six)** questions. All questions carry equal marks. Marks of each question are written in the right margin and corresponding CO and PO are written within brackets.

1. a) What do mean by finite population correction factor and continuity correction factor? Describe the characteristics of different discrete probability distributions. — 10 (CO2) (PO1, PO3)

   b) Why should a person work with sample rather than population? Describe about different types of probability and non-probability sampling techniques. — 15 (CO3) (PO1)

2. a) State the limitations of different measures of central tendency and dispersion. Describe the characteristics of Z-distribution, t-distribution, and F-distribution and Chi-square distribution. — 15 (CO2) (PO1, PO3)

   b) Why do think that there is a family of uniform and normal probability distribution? Prove that-"The population mean and the mean of the sampling distribution of sampling mean are equal although the measures of dispersion are different." — 10 (CO3) (PO1)

3. Following is the number of shareholders for a selected group of large companies: — 25 (CO1) (PO1, PO2)

Company	Number of Shareholders	Company	Number of Shareholders
Southwest Airlines	154	Standard Oil	183
General Public Utilities	187	Home Depot	205
Occidental Petroleum	276	Detroit Edison	230
Middle South Utilities	143	Eastman Kodak	261
Chrysle	219	Dow Chemical	147
Standard Oil of California	274	Pennsylvania Power	160
Bethlehem Stee	170	American Electric Power	272
Long Island Lighting	153	Ohio Edison	168
RCA	256	Transamerica Corporation	172
Greyhound Corporation	161	Columbia Gas System	175
Pacific Gas & Electric	249	International Telephone	233
Niagara Mohawk Power	214	Union Electric	268
E. I. du Pont de Nemours	224	Virginia Electric and Power	172
Westinghouse Electric	205	Public Service Electric	235
Union Carbide	186	Consumers Powe	171
BankAmerica	185	Northeast Utilities	210

Requirements:

   i. Using the appropriate number of classes and class limit, construct a frequency distribution.

   ii. Determine the co-efficient of quartile deviation and estimate whether there is any outlier in the distribution of data.

   iii. Find the skewness using Pearson's estimate and comment on it.

   iv. Calculate kurtosis and interpret the results.

4. a) Describe about the central limit theorem. 05 (CO3)
                                                          (PO1)

    b) The Quality Assurance Department for Cola Inc. maintains records regarding the 08 (CO2)
        amount of cola in its Jumbo bottle. The actual amount of cola in each bottle is critical,   (PO1,
        but varies a small amount from one bottle to the next. Cola Inc. does not wish to under   PO3)
        fill the bottles, because it will have a problem with truth in labeling. On the other hand,
        it cannot overfill each bottle, because it would be giving cola away, hence reducing its
        profits. Its records indicate that the amount of cola follows the normal probability
        distribution. The mean amount per bottle is 31.2 ounces and the population standard
        deviation is 0.5 ounces. At 8 A.M. today the quality technician randomly selected 20
        bottles from the filling line. The mean amount of cola contained in the bottles is 31.38
        ounces.
            i.   Is this an unlikely result?
            ii. Is it likely the process is putting too much soda in the bottles?

    c) Coastal Insurance Company underwrites insurance for beachfront properties along the 06 (CO2)
        Virginia, North and South Carolina, and Georgia coasts. It uses the estimate that the   (PO1,
        probability of a named Category III hurricane (sustained winds of more than 110 miles   PO3)
        per hour) or higher striking a particular region of the coast (for example, St. Simons
        Island, Georgia) in any one year is 0.05. If a homeowner takes a 30-year mortgage on a
        recently purchased property in St. Simons
            i.   What is the likelihood that the owner will experience at least one hurricane
                 during the mortgage period?
            ii. What is the likelihood that the owner will experience at most two hurricane
                 during the mortgage period?

    d) The following Venn diagram shows a survey of students at Central Community college. 06 (CO2)
        Each symbol represents 10 students in a sample of 300.   (PO1,
                                                                                                 PO3)
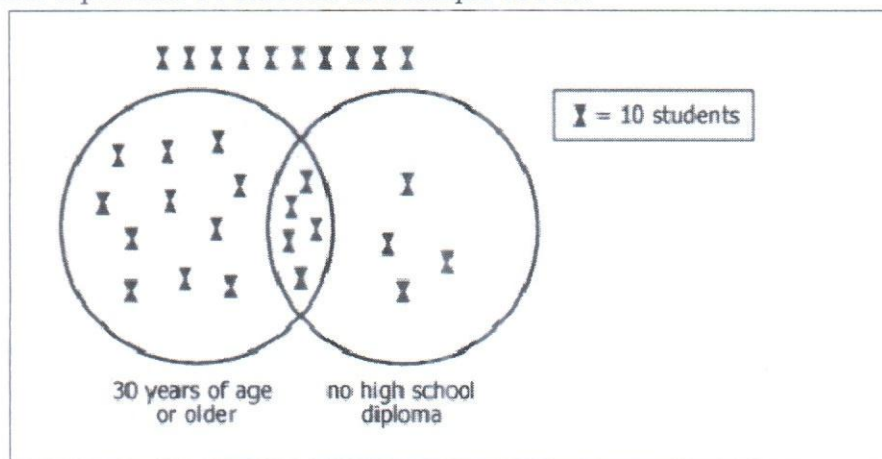
        *Diploma and graduate mean the same thing here.
        Requirements:
            i.   If one student is selected at random from the 300 surveyed, what is the
                 probability that the student will be under 30 or a high school graduate or both?
            ii. If one student is selected at random from the 300 surveyed, what is the
                 probability that the student will be both under 30 and a high school graduate?

5. a) What is P-value? How can you interpret standard deviation using empirical rule and Chebyshev theorem? 05 (CO1) (PO1, PO2)

b) A Washington D.C., "think tank" announces the typical teenager sent 50 text messages per day in 2022. To update that estimate, you phone a sample of 12 teenagers and ask them how many text messages they sent the previous day. Their responses were: 08 (CO3) (PO1)

| 51 | 175 | 47 | 49 | 44 | 54 | 145 | 203 | 21 | 59 | 42 | 100 |

At the 0.05 level, can you conclude that the mean number is greater than 50? Estimate the P-value.

c) Last month, the National Association of Theater Managers conducted a survey of 500 randomly selected adults. The survey asked their age and the number of times they saw a movie in a theater. The results are summarized in the following table: 08 (CO2) (PO1, PO3)

| Movies Per Month	Age			Total
	Less than 30 (B$_1$)	30 up to 60 (B$_2$)	60 or Older (B$_3$)	
0 (A$_1$)	15	50	10	75
1 or 2 (A$_2$)	25	100	75	200
3,4, or 5 (A$_3$)	55	60	60	175
6 or More (A$_4$)	5	15	30	50
Total=	100	225	175	500

Determine the probability of:
i. Selecting an adult who attended 2 or fewer movies per month
ii. Selecting an adult who attended 6 or more movies per month or 60 years of age or older
iii. Selecting an adult who attended 6 or more movies per month given the person is 60 years of age or older
iv. Selecting an adult who attended 6 or more movies per month and is 60 years of age or older.

d) The attendance at the Savannah Colts minor league baseball game last night was 400. A random sample of 50 of those in attendance revealed that the mean number of soft drinks consumer per person was 1.86, with a standard deviation of 0.50. Develop a 99% confidence interval for the mean number of soft drinks consumer per person. 04 (CO3) (PO1)

6. a) What is least square method? Describe about different primary scales of measurement. 12 (CO1) (PO1, PO2)

b) The credit department of Lion's Department store in Anaheim, California, reported that 30% of their sales are cash, 30% are paid with a credit card, and 40% with a debit card. Twenty percent of the cash purchases, 90% of the credit card purchases, and 60% of the debit card purchases are for more than $50. Ms. Tina Stevens just purchased a new dress that cost $120. What is the probability that she paid cash? Develop contingency table. 08 (CO2) (PO1, PO3)

c) The ABC computers wishes to set a minimum lifetime guarantee on its new power supply unit. Quality testing shows the time to failure follows an exponential distribution with a mean of 3000 hours. ABC Computers wants a warranty period such that only 1% of the power supply units fail during that period. What value should they set for the warranty period? 05 (CO2) (PO1, PO3)
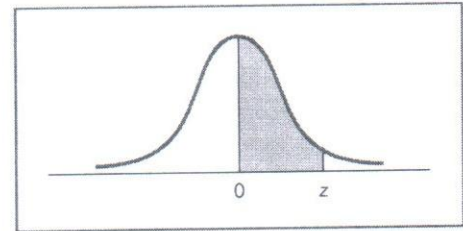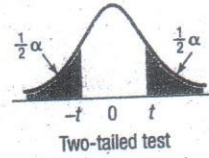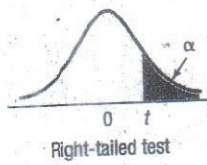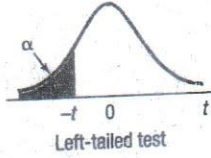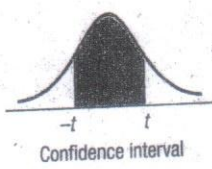
TABLE 2

Area Under the Normal Curve

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
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	.2257	.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	.2995	.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	.49865	.49869	.49874	.49878	.49882	.49886	.49889	.49893	.49897	.49900
3.1	.49903	.49906	.49910	.49913	.49916	.49918	.49921	.49924	.49926	.49929
3.2	.49931	.49934	.49936	.49938	.49940	.49942	.49944	.49946	.49948	.49950
3.3	.49952	.49953	.49955	.49957	.49958	.49960	.49961	.49962	.49964	.49965
3.4	.49966	.49968	.49969	.49970	.49971	.49972	.49973	.49974	.49975	.49976
3.5	.49977	.49978	.49978	.49979	.49980	.49981	.49981	.49982	.49983	.49983
3.6	.49984	.49985	.49985	.49986	.49986	.49987	.49987	.49988	.49988	.49989
3.7	.49989	.49990	.49990	.49990	.49991	.49991	.49992	.49992	.49992	.49992
3.8	.49993	.49993	.49993	.49994	.49994	.49994	.49994	.49995	.49995	.49995
3.9	.49995	.49995	.49996	.49996	.49996	.49996	.49996	.49996	.49997	.49997

Entry represents area under the standard normal distribution from the mean to z.

B.5 Student's t Distribution

Confidence interval

Left-tailed test

Right-tailed test

Two-tailed test

df	Confidence Intervals, c					
	80%	90%	95%	98%	99%	99.9%
	Level of Significance for One-Tailed Test, α					
	0.10	0.05	0.025	0.01	0.005	0.0005
	Level of Significance for Two-Tailed Test, α					
	0.20	0.10	0.05	0.02	0.01	0.001
1	3.078	6.314	12.706	31.821	63.657	636.619
2	1.886	2.920	4.303	6.965	9.925	31.599
3	1.638	2.353	3.182	4.541	5.841	12.924
4	1.533	2.132	2.776	3.747	4.604	8.610
5	1.476	2.015	2.571	3.365	4.032	6.869
6	1.440	1.943	2.447	3.143	3.707	5.959
7	1.415	1.895	2.365	2.998	3.499	5.408
8	1.397	1.860	2.306	2.896	3.355	5.041
9	1.383	1.833	2.262	2.821	3.250	4.781
10	1.372	1.812	2.228	2.764	3.169	4.587
11	1.363	1.796	2.201	2.718	3.106	4.437
12	1.356	1.782	2.179	2.681	3.055	4.318
13	1.350	1.771	2.160	2.650	3.012	4.221
14	1.345	1.761	2.145	2.624	2.977	4.140
15	1.341	1.753	2.131	2.602	2.947	4.073
16	1.337	1.746	2.120	2.583	2.921	4.015
17	1.333	1.740	2.110	2.567	2.898	3.965
18	1.330	1.734	2.101	2.552	2.878	3.922
19	1.328	1.729	2.093	2.539	2.861	3.883
20	1.325	1.725	2.086	2.528	2.845	3.850
21	1.323	1.721	2.080	2.518	2.831	3.819
22	1.321	1.717	2.074	2.508	2.819	3.792
23	1.319	1.714	2.069	2.500	2.807	3.768
24	1.318	1.711	2.064	2.492	2.797	3.745
25	1.316	1.708	2.060	2.485	2.787	3.725
26	1.315	1.706	2.056	2.479	2.779	3.707
27	1.314	1.703	2.052	2.473	2.771	3.690
28	1.313	1.701	2.048	2.467	2.763	3.674
29	1.311	1.699	2.045	2.462	2.756	3.659
30	1.310	1.697	2.042	2.457	2.750	3.646
31	1.309	1.696	2.040	2.453	2.744	3.633
32	1.309	1.694	2.037	2.449	2.738	3.622
33	1.308	1.692	2.035	2.445	2.733	3.611
34	1.307	1.691	2.032	2.441	2.728	3.601
35	1.306	1.690	2.030	2.438	2.724	3.591

df	Confidence Intervals, c					
	80%	90%	95%	98%	99%	99.9%
	Level of Significance for One-Tailed Test, α					
	0.10	0.05	0.025	0.01	0.005	0.0005
	Level of Significance for Two-Tailed Test, α					
	0.20	0.10	0.05	0.02	0.01	0.001
36	1.306	1.688	2.028	2.434	2.719	3.582
37	1.305	1.687	2.026	2.431	2.715	3.574
38	1.304	1.686	2.024	2.429	2.712	3.566
39	1.304	1.685	2.023	2.426	2.708	3.558
40	1.303	1.684	2.021	2.423	2.704	3.551
41	1.303	1.683	2.020	2.421	2.701	3.544
42	1.302	1.682	2.018	2.418	2.698	3.538
43	1.302	1.681	2.017	2.416	2.695	3.532
44	1.301	1.680	2.015	2.414	2.692	3.526
45	1.301	1.679	2.014	2.412	2.690	3.520
46	1.300	1.679	2.013	2.410	2.687	3.515
47	1.300	1.678	2.012	2.408	2.685	3.510
48	1.299	1.677	2.011	2.407	2.682	3.505
49	1.299	1.677	2.010	2.405	2.680	3.500
50	1.299	1.676	2.009	2.403	2.678	3.496
51	1.298	1.675	2.008	2.402	2.676	3.492
52	1.298	1.675	2.007	2.400	2.674	3.488
53	1.298	1.674	2.006	2.399	2.672	3.484
54	1.297	1.674	2.005	2.397	2.670	3.480
55	1.297	1.673	2.004	2.396	2.668	3.476
56	1.297	1.673	2.003	2.395	2.667	3.473
57	1.297	1.672	2.002	2.394	2.665	3.470
58	1.296	1.672	2.002	2.392	2.663	3.466
59	1.296	1.671	2.001	2.391	2.662	3.463
60	1.296	1.671	2.000	2.390	2.660	3.460
61	1.296	1.670	2.000	2.389	2.659	3.457
62	1.295	1.670	1.999	2.388	2.657	3.454
63	1.295	1.669	1.998	2.387	2.656	3.452
64	1.295	1.669	1.998	2.386	2.655	3.449
65	1.295	1.669	1.997	2.385	2.654	3.447
66	1.295	1.668	1.997	2.384	2.652	3.444
67	1.294	1.668	1.996	2.383	2.651	3.442
68	1.294	1.668	1.995	2.382	2.650	3.439
69	1.294	1.667	1.995	2.382	2.649	3.437
70	1.294	1.667	1.994	2.381	2.648	3.435

(continued)