BIRLA INSTITUTE OF TECNOLOGY AND SCIENCE, PILANI
PILANI CAMPUS

Second Semester 2022 – 2023

Course No.: **PHA G546** Course Title: **Pharmaceutical Biostatistics**

Mid-Sem Exam

Max. Marks: **30** Duration: **90 min** **Closed Book** Date: **15/03/2023**

Instructions:

1. Write correct question number in the answer sheet.
2. Do not solve questions using pencil.

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1. A study was conducted to compare the mean body mass index (BMI) of males doing regular weightlifting and those claiming to be involved in multisport activity. Based on the data given below is there sufficient evidence for the researchers to claim that weightlifting group has higher mean BMI than multisport group? Test the hypothesis at α=0.05. [10]

Multisport group BMI values	**Weightlifting group BMI values**
22.14	21.23
25.23	27.65
19.2	21.28
18.45	25.68
19.83	20.34
20.41	23.76
24.13	23.85
21.16	20.54
18.42	20.21
20.63	20.76

2. Short answer questions: [2+3=5]
   (i) Explain the difference between ratio scale and interval scale data.
   (ii) Why we have different formula for calculating population and sample variance?

3. A researcher is interested in finding the effect of smoking on human reproduction. He has drawn a sample of 12 mothers who are non-smokers and a sample of 11 mothers who are smokers randomly and independently from their respective sub-populations (assume that the whole population of mothers is divided into two sub-population: smokers and non-smokers). The levels of cadmium (ng/g of the tissue) in the placenta of both the sample groups are determined. The data obtained is given below. Determine the 95% confidence interval for difference between cadmium levels in the placenta of smoking and non-smoking mothers. [8]

Sample Group	Cadmium Levels in Placenta of the subjects (ng/g of tissue)											
Non-Smoking Mothers	10	8	13	25	12	10	12	16	24	9	25	12
Smoking Mothers	30	15	24	30	18	21	26	28	26	24	20	-

4. The weights of a certain population of young adult females are approximately normally distributed with a mean of 132 pounds and a standard deviation of 15. Find the probability that a subject selected at random from this population will weigh: [7]
   (a) More than 155 pounds
   (b) 100 pounds or less
   (c) Between 105 and 145 pounds

Table IV.2 Cumulative Normal Distribution: Cumulative Area Under the Normal Distribution (Less Than or Equal to Z)

Z	Area	Z	Area	Z	Area	Z	Area
−3.25	0.0006	−1.50	0.0668	0.25	0.5987	2.00	0.9772
−3.20	0.0007	−1.45	0.0735	0.30	0.6179	2.05	0.9798
−3.15	0.0008	−1.40	0.0808	0.35	0.6368	2.10	0.9821
−3.10	0.0010	−1.35	0.0885	0.40	0.6554	2.15	0.9842
−3.05	0.0011	−1.30	0.0968	0.45	0.6736	2.20	0.9861
−3.00	0.0013	−1.25	0.1056	0.50	0.6915	2.25	0.9878
−2.95	0.0016	−1.20	0.1151	0.55	0.7088	2.30	0.9893
−2.90	0.0019	−1.15	0.1251	0.60	0.7257	2.35	0.9906
−2.85	0.0022	−1.10	0.1357	0.65	0.7422	2.40	0.9918
−2.80	0.0026	−1.05	0.1469	0.70	0.7580	2.45	0.9929
−2.75	0.0030	−1.00	0.1587	0.75	0.7734	2.50	0.9938
−2.70	0.0035	−0.95	0.1711	0.80	0.7881	2.55	0.9946
−2.65	0.0040	−0.90	0.1841	0.85	0.8023	2.60	0.9953
−2.60	0.0047	−0.85	0.1977	0.90	0.8159	2.65	0.9960
−2.55	0.0054	−0.80	0.2119	0.95	0.8289	2.70	0.9965
−2.50	0.0062	−0.75	0.2266	1.00	0.8413	2.75	0.9970
−2.45	0.0071	−0.70	0.2420	1.05	0.8531	2.80	0.9974
−2.40	0.0082	−0.65	0.2578	1.10	0.8643	2.85	0.9978
−2.35	0.0094	−0.60	0.2743	1.15	0.8749	2.90	0.9981
−2.30	0.0107	−0.55	0.2912	1.20	0.8849	2.95	0.9984
−2.25	0.0122	−0.50	0.3085	1.25	0.8944	3.00	0.9987
−2.20	0.0139	−0.45	0.3264	1.30	0.9032	3.25	0.9994
−2.15	0.0158	−0.40	0.3446	1.35	0.9115		
−2.10	0.0179	−0.35	0.3632	1.40	0.9192		
−2.05	0.0202	−0.30	0.3821	1.45	0.9265		
−2.00	0.0228	−0.25	0.4013	1.50	0.9332		
−1.95	0.0256	−0.20	0.4207	1.55	0.9394		
−1.90	0.0287	−0.15	0.4404	1.60	0.9452		
−1.85	0.0322	−0.10	0.4602	1.65	0.9505		
−1.80	0.0359	−0.05	0.4801	1.70	0.9554		
−1.75	0.0401	0	0.5000	1.75	0.9599		
−1.70	0.0446	0.05	0.5199	1.80	0.9641		
−1.65	0.0495	0.10	0.5398	1.85	0.9678		
−1.60	0.0548	0.15	0.5596	1.90	0.9713		
−1.55	0.0606	0.20	0.5793	1.95	0.9744		

Z	Area
1.282	0.90
1.645	0.95
1.960	0.975
2.326	0.99
2.576	0.995
3.090	0.999

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	**0.50**	**0.25**	**0.20**	**0.15**	**0.10**	**0.05**	**0.025**	**0.01**	**0.005**	**0.001**	**0.0005**
two-tails	**1.00**	**0.50**	**0.40**	**0.30**	**0.20**	**0.10**	**0.05**	**0.02**	**0.01**	**0.002**	**0.001**
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	0.000	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291