



6. From an assessment of two variables, it was noticed that as one event increases, the second mostly decreases. How do you label this correlation?

- a. Strong Positive
- b. Weak Positive
- c. Strong Negative
- d. Weak Negative

**Q2. Answer the following (any 3):**

**(3 x 3 marks = 9 marks)**

- a. Discuss Blind and Double-blind studies with suitable examples.
- b. Find the Quartile and Inter-quartile range for the following dataset:

<b>Data point</b>	30	40	10	20	60	50
<b>Frequency</b>	11	2	9	18	12	8

- c. Graphically represent the following data using an appropriate chart:

The figures for total population, male and female population of a community at decade intervals since 1990 are given below.

<b>Year</b>	<b>Total Population</b>	<b>Male</b>	<b>Female</b>
1990	45,532	24,043	21,489
2000	49,056	25,076	23,980
2010	43,185	22,198	20,987
2020	40,667	20,990	19,677

- d. The length of human pregnancies from conception to birth approximates a normal distribution with a mean of 262 days and a standard deviation of 11 days. What proportion of all pregnancies will last between 240 and 270 days (roughly between 8 and 9 months)?

## SECTION II

**Q3.** Hypertension is the most important risk factor for chronic disease burden in India. Global Burden of Diseases study reported that hypertension led to 1.63 million deaths in India in 2016 as compared to 0.78 million in 1990 (+108%). A novel study is required to update these values as of 2020. (10)

- a. Design a research study using multi-stage cluster sampling method. Justify each step of your design.
- b. Discuss any other parameters of interest that can be studied for further insight into this issue.

**Q4.** In an attempt to create fermented milk with enhanced antioxidant content, experiments were conducted with green tea extract. The effect of the green tea extract on viability of the inoculum was also studied. Viability (%) of the bacterial inoculum was recorded as shown. Data obtained followed Gaussian distribution:

36 37 38 38 39 39 40 40 40 40 41 41 41 41 41 41 42 42 42 42 42 42 42 42 43 43 43 43 43 43 43 43 44 44 44 44 44 44 45 45 45 45 45 45 45 45 45 45 46 46 46 46 46 46 46 46 46 46 47 47 47 47 47 47 47 47 47 48 48 48 48 48 48 48 48 48 49 49 49 49 49 49 49 49 50 50 50 50 50 50 50 51 51 51 51 51 52 52 53 53 54 55. (10)

- a. Determine the probability of the extract reducing bacterial viability below 26%.
- b. What is the bacterial viability if 80% of the organized data pertains to fermentation at pH 5?

**Q5.** The effect of heat processing on protein content of a meat sample was studied. Data was collected at 10 temperature sets.

- Determine if the two parameters are correlated (establish X and Y axes correctly).
- Find the least square regression line for the data. (10)

<b>Temperature (°C)</b>	40	45	50	55	60	65	70	75	80	85
<b>Protein Content (mg/g)</b>	95	92	82	79	71	61	52	43	31	26

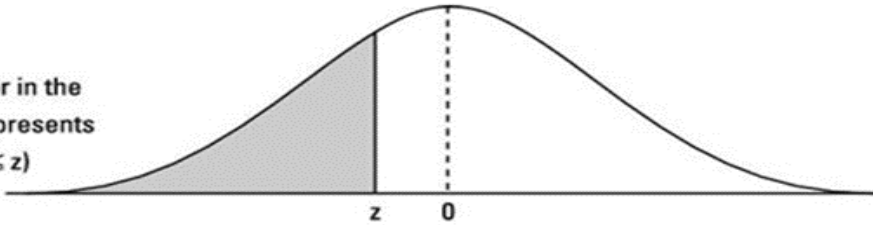
**Q6.** Remdesivir is one of the five antiviral drugs approved by the Central Drugs Standard Control Organization (CDSCO), India, for treatment of Covid-positive patients. A new drug, Covmedivir, has been created as an alternate treatment to Remdesivir. To prove Covmedivir's effectiveness over the standard drug, ten randomized double-blind studies were conducted. Effectiveness was measured as variation in concentration of viral proteins in blood serum. (10)

<b>Placebo</b>	$\bar{x}_0 = 150 \mu g/ml$	$s_0 = \pm 27$	$n_0 = 81$
<b>Remdesivir</b>	$\bar{x}_1 = 50 \mu g/ml$	$s_1 = \pm 8$	$n_1 = 83$
<b>Covmedivir</b>	$\bar{x}_2 = 39 \mu g/ml$	$s_2 = \pm 9$	$n_2 = 79$

- Using Z-test, determine if the novel treatment significantly reduced viral load in sera (confidence level of 95%).
- Using Z-test combined with P-value, at significance level of 5%, conclude whether Covmedivir or Remdesivir is a better antiviral treatment. [At  $\alpha=0.05$ ,  $z_\alpha=1.96$ ]

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## Z-Value table for correlated P-values

<div style="display: flex; align-items: center; justify-content: center;"> <div style="text-align: left; margin-right: 20px;"> <p>Number in the table represents <math>P(Z \leq z)</math></p> </div>  </div>										
z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
-3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
-3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
-3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
-0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

## Z-Value Table for Normal Distribution

[illegible]