

Time: 3 Hours

Marks: 75

Q.I Choose the appropriate option

20 Marks

Q. No Description

- 1 The arithmetic mean of the following distribution of number of accidents  $x$  on week working days is –  
X = 2, 4, 6, 8, 10  
Frequency = 5, 4, 3, 2, 4, 1  
a. 4.666  
b. 6.666  
c. 7.666  
d. 5.666
2. The sum of the frequency of class and all classes below it in a frequency distribution is ---  
a. Frequency distribution curve  
b. Histogram  
c. Cumulative frequency distribution  
d. Cumulative frequency of a class
3. For the data 10,5,3,8,6,9,7 the median value is ---  
a. 3  
b. 5  
c. 6  
d. 7
4. With respect to the question number 3 the range of the data is ----  
a. 3  
b. 5  
c. 6  
d. 7
5. If variance of the data is 36 what is the standard deviation?  
a. 3  
b. 4  
c. 5  
d. 6
6. The values of coefficient of correlation are --  
a. equal to 1  
b. can be either -1 or +1  
c. can be any value between -1 to +1  
d. must be -1

7. The relationship between  $x$  and  $y$  is given by the following regression equation  
 $Y = 0.018x$   
The above equation implies that:
- for each unit increase in value of  $x$  the value of  $y$  varies by 1%
  - on average it takes  $1.8x$  to increase  $y$  value by 1%
  - For each unit increase in  $Y$ , the  $X$  increases by 1.8%
  - For each unit increase in  $X$ , the  $Y$  increases by exactly 0.018
8. Mean drug content of powder in a capsule product is observed to be 105 mg with standard deviation of 8 mg. What is the percentage of capsules with the content of the drug below 105 mg. Assume that the drug content of capsule is normally distributed.
- 20
  - 40
  - 50
  - 60
9. If the mean of Poisson distribution is 9 then its variance is equal to ---
- 3
  - 6
  - 9
  - 81
10. Binomial distribution is applicable to ----
- Dichotomous data
  - Continuous data
  - Ordinal data
  - Discrete data
11. Area under curve for Normal distribution is ---
- 1
  - 1.5
  - 2
  - $\infty$
12. To conclude if a drug is effective in reducing body mass index, a clinical trial was conducted by administering the drug to 10 individuals with high body mass index. Considering the data is normally distributed, which of the following tests is suitable?
- One tail paired t test
  - Two tail paired t test
  - Two tail unpaired t test
  - One tail unpaired t test
13. The calculated t value = 2.59 and the critical t value is 1.54 at  $\alpha = 0.01$ . In such case which of the following statement is true?
- Null hypothesis is accepted
  - The mean values of the two sets are significantly different at  $P < 0.01$
  - The mean values of the two sets are significantly different at  $P > 0.01$
  - The mean values of the two sets are equal at  $P < 0.01$

14. In histogram the width of the bar is proportional to
- Frequency
  - Number of classes
  - Class interval
  - Cumulative frequency
15. In case of same slope, the contour lines are---
- Widely spaced from each other
  - Spaced very close to each other
  - Parallel to each other
  - Intersecting each other
16. Mann Whitney U test is applied for
- Unpaired data following Normal Distribution
  - Unpaired data following Non-Normal Distribution
  - Paired data following Normal Distribution
  - Paired data following Non-Normal Distribution
17. Cohort Studies generally look at which of the following?
- Determining the sensitivity and specificity of diagnostic methods
  - Identifying patient characteristics or risk factors associated with a disease or outcome
  - Variations among the clinical manifestations of patients with a disease
  - The impact of blinding or masking a study population
18. Which of the following software requires writing of script
- Excel
  - SPSS
  - R Online
  - Design of Experiments
19. What is the appropriate statistical test for a factorial design?
- the Modes t
  - ANOVA
  - t-test
  - chi-square
20. Select the correct probability sampling method from the list below
- Judgment
  - Quota
  - Simple random
  - Convenience

**Q.II Answer the following (ANY TWO)**

**20 Marks**

A. i) Metabolite levels in (mcg/ ml) of a drug in young adult and elderly volunteers in urine are given below. Assume that the data is normally distributed. Apply suitable statistical test and state if there is difference in the levels of the metabolite in young and elderly populations. (5)

Young	9.6	8.5	9.8	12.2	9.8	11.7	8.7
Elderly	12.3	16	17.8	20.1	18.5	14	20.6

ii. Haemoglobin levels (% g) in school kids fed with three different diets was studied with 11 students in each category of diet. The results are as follows. Fill in the blank spaces and calculate the least significant difference and state if the levels of haemoglobin are different with respect to the diet. (5)

Variation	Degrees of Freedom	Sum of Squares	Mean Sum of squares	F value
Between the groups	-----	32.81	-----	----
Within the groups	-----	-----	-----	
Total	-----	62.57		

B. I) Write a short note on factorial design (5)

ii) In an experiment investigating breakdown of aspirin in a pharmaceutical product stored at 25°C, the following data is obtained. Calculate linear regression equation and coefficient of correlation for the same. Calculate the concentration of aspirin at zero min (5)

Time (Min)	18	35	51	68	85	101
Conc of Aspirin remaining (mg)	603.6	601.1	597.9	594.3	591.4	587.3

C. i) Write a note on different methods of graphical presentation of data (5)

ii) A tablet manufacturer produces paracetamol tablets with a label claim of 500 mg. Assume that the data is normally distributed with the mean of 502 mg and variance of 50 mg<sup>2</sup>. Find – (5)

- What proportion of the tablets contain less than 500 mg of the drug?
- What proportion of the tablets contains drug less than 490 mg and more than 510 mg of paracetamol?

QIII Answer the following (**any seven**)

35 Marks

- A. Give a detailed account of blocking and confounding system
- B. Enlist steps in hypothesis testing. Write a note on Type I and Type II errors.
- C. i. In a certain area the local authority wants immunization coverage to be 90% with precision within 5% at 95 % confidence interval ( $z = 1.96$ ). Calculate the sample size  
 ii. What do you mean by research? Enlist different types of research with suitable examples.
- D. Discuss different methods of sampling
- E. Concentration in mcg/ml of therapeutic agent in saliva at defined intervals after attachment of a drug polymeric film to the outer surface of the tooth is given below. It is hypothesized that the release of the drug into the oral cavity is constant over four days. Using Friedman test, state if the hypothesis is true. ( $\chi^2_{critical} = 7.60$ )

Patient Number	Time after attachment			
	Day 1	Day 2	Day 3	Day 4
1	25.45	23.47	20.77	20.87
2	39.57	35.78	34.99	34.90
3	15.42	13.21	12.24	10.16
4	7.19	5.99	5.93	6.06
5	58.23	49.27	42.58	44.53
6	25.60	23.64	21.58	21.89

- F. Three different kinds of food regimen are tested on three groups of rats for 5 weeks. The objective is to check the difference in mean weight (in grams) of the rats per week. Apply one-way ANOVA using a 0.05 significance level to the following data:

Food Regimen I	Food Regimen II	Food Regimen III
8	4	8
12	6	7
15	7	11

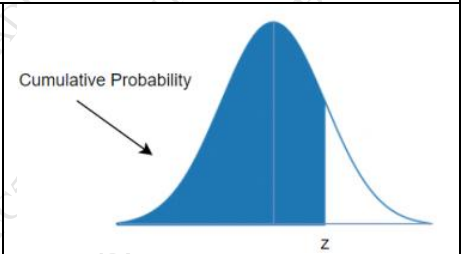
- G. Write short notes on
  - a. Report writing in research
  - b. Cohort Studies
- H. i. In the manufacture of glassware, bubbles can occur in the glass which reduces the status of the glassware to that of a 'second'. If, on average, one in every 1000 items produced has a bubble, calculate the probability that exactly 6 items in a batch of 3000 are seconds.  
 ii. Explain the terms contour plots and surface response plots.
- I. It is hypothesized that the replacement of Talc by a hydrophilic excipient like lactose improves the dissolution, hence the two tablet formulations were prepared and the time taken (mins) for dissolution of 50% of the drug is noted. The results are as follows. Apply Mann Whitney Test and state if the hypothesis is true.  $U_{critical} = 3$

Formulation with Talc	50	42	39	45	52	57
Formulation with Lactose	32	35	42	34	30	

<b>t Table</b>									<b>F table (5% significance)</b>					
cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	V2					
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	V1	1	2	3	4	5
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02						
df														
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	1	39.86	49.50	53.59	55.83	57.24
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	2	8.53	9.00	9.16	9.24	9.29
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	3	5.54	5.46	5.39	5.34	5.31
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4	4.54	4.32	4.19	4.11	4.05
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	5	4.06	3.78	3.62	3.52	3.45
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	6	3.78	3.46	3.29	3.18	3.11
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	7	3.59	3.26	3.07	2.96	2.88
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	8	3.46	3.11	2.92	2.81	2.73
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	9	3.36	3.01	2.81	2.69	2.61
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764						
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	10	3.29	2.92	2.73	2.61	2.52
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	11	3.23	2.86	2.66	2.54	2.45
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	12	3.18	2.81	2.61	2.48	2.39
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	13	3.14	2.76	2.56	2.43	2.35
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	14	3.10	2.73	2.52	2.39	2.31
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583						
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	15	3.07	2.70	2.49	2.36	2.27
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	16	3.05	2.67	2.46	2.33	2.24
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	17	3.03	2.64	2.44	2.31	2.22
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	18	3.01	2.62	2.42	2.29	2.20
									19	2.99	2.61	2.40	2.27	2.18

Standard normal distribution table

	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952



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