Quiz-1, Monsoon Semester, 2022-2023

I – MBA / I – MBA BA / I – M.Tech. (IEM) / I – JRF (IEM/MAN) Date: September 12, 2022
Subject: Research Methodology and Statistics (MSC 502) Full Marks: 20 Time: 20 minutes

Instructions:
(a) Attempt all questions.
(b) Questions are of MCQs, Fill in the blanks and True/False.

---

1. The average monthly production of a factory for the first 8 months is 2,500 units, the next 4 months 1,200 units, the average monthly production of the year will be _____

Ans: 2066.67 units (8*2500 + 4*1200)/12

2. Which one of these statistics is unaffected by outliers? _____
   a. Mean
   b. Standard deviation
   c. Interquartile range
   d. Range
   e. Mean Absolute Deviation
   f. None of the above

Ans: (c) Interquartile range

3. The 50th percentile of the following grouped data is _____

Class	Frequency
0 - 5	8
5 -10	2
10-15	6
15-20	8
20-25	5
25-30	5
30-35	0
35-40	1

Ans: 15.9375

Lower Class Limit	Upper Class Limit	f	cf
0	5	8	8
5	10	2	10
10	15	6	16
15	20	8	24
20	25	5	29
25	30	5	34
30	35	0	34
35	40	1	35

N/2 = 0.5*35 = 17.5; 50^{th} percentile class is 15-20;
Therefore, 50^{th} percentile = 15 + ((17.5-16)/8)*5 = 15.9375

4. When testing water for chemical impurities, results are often reported as bdl, i.e., below detection limit. The following are the measurements of the amount of lead in a series of water samples taken from inner city households (ppm). [5, 7, 12, bdl, 10, 8, bdl, 20, 6]. The values mentioned indicate above bdl. Which of the following is correct? _____
    a. The mean lead level in the water is about 10 ppm
    b. The mean lead level in the water is about 8 ppm
    c. The median lead level in the water is 8 ppm
    d. The median lead level in the water is 7 ppm
    e. None of the above

    Ans: (d) The median lead level in the water is 7 ppm
    Ascending order of the data set: bdl, bdl, 5, 6, 7, 8, 10, 12, 20

5. Find the missing figures: Mean = _____ (3 Median – Mode) Ans: 1/2

6. State whether the following statements are 'True' or 'False'.
    i. Geometric Mean is the appropriate average when emphasis is on the rate of change rather than the amount of change. (False)
    ii. Cumulative frequency is non-decreasing. (True)
    iii. The quartile points are equispaced. (False)
    iv. Mean and Standard Deviation have the same unit. (True)

7. The following table represents the relative frequency of accidents per day in a city.

Accidents	0	1	2	3	4 or more
Relative Frequency	0.55	0.20	0.10	0.15	0

    Which of the following statements are true?
    I. The mean and modal number of accidents are equal.
    II. The mean and median number of accidents are equal.
    III. The median and modal number of accidents are equal.
    a. I only
    b. II only
    c. III only
    d. I, II and III
    e. None of the above

Accidents (x)	Relative Frequency (f)	xf	Cumulaive refative frequency	
0	0.55	0	0.55	Median Class
1	0.2	0.2	0.75	
2	0.1	0.2	0.85	
3	0.15	0.45	1	
4 or more	0	0	1	

Mean =	0.85
Median =	0
Mode =	0

    Ans: (c) III only

8. The statistics of runs scored by four batsmen in different match series are provided in the following table. Who is the most consistent batsman of these four?

Batsman	Average	Standard deviation
K	31.2	5.21
L	46.0	6.22
M	54.4	6.35

Ans: M

Batsman	Average	Standard deviation	CV
K	31.2	5.21	0.1670
L	46	6.22	0.1352
M	54.4	6.35	**0.1167 (Minimum Value)**

9. The standard deviation of a distribution is 2. In order, that the distribution be leptokurtic, the value of the fourth moment (μ_4) should be
   a. < 48
   b. > 48
   c. > 12
   d. < 12
   e. None of the above

Ans: (b) > 48; Kurtosis = $\mu_4 / (\mu_2)^2 > 3$ for leptokurtic;
or, $\mu_4 > 3*(\mu_2)^2 = 3*4^2 = 48$

10. In a frequency distribution of a dataset, the mode was found to be lower than the mean. This shows that the distribution is
    a. Symmetric
    b. Negatively skewed
    c. Positively skewed
    d. Normal
    e. None of the above

Ans: (c) positively skewed

11. The random variable x takes on the values 1, 2, or 3 with probabilities $(1 + 3k)/3$, $(1 + 2k)/3$, and $(0.5 + 5k)/3$, respectively. Then the appropriate value of k is _____

Ans: 0.05
$(1 + 3k)/3 + (1 + 2k)/3 + (0.5 + 5k)/3 = 1$ or, $2.5 + 10k = 3$, $k = 0.05$

12. The mean and variance of binomial distribution are 2.5 and 1.25 respectively. Then P(X<2) is _____

Ans: 0.1875
Mean = np = 2.5; variance = np(1-p) = 1.25; (1-p) = 0.5; p = 0.5; n = 5
P(X<2) = P(X=0) + P(X=1) = 0.03125 + 0.15625 = 0.1875

13. Contamination is a problem in the manufacture of optical storage disks. The number of particles of contamination that occur on an optical disk has a Poisson distribution, and the average number of particles per centimeter squared of media surface is 0.1. The area of a disk under study is 100 squared centimeters. Find the probability that 12 particles occur in the area of a disk under study. Round the answer to three decimal places.

Ans: 0.095

Let X denote the number of particles in the area of a disk under study.
Because the mean number of particles is 0.1 particles per cm^2.
Therefore, $E(X)$ = 100 cm^2 × 0.1 particles/cm^2 = 10 particles
$P(X=12) = e^{-10}10^{12}/12! = 0.095$

14. An aptitude test for selecting officers in a bank was conducted on 10000 candidates, the average score is 40 and standard deviation of scores is 20. Assuming normal distribution for scores, then the number of candidates whose scores lie between 30 and 70 is _____

Ans: 6247

$P(30 < X < 70) = P(-0.5 < Z < 1.5) = 0.1915 + 0.4332 = 0.6247$
Number of candidates = 10000*0.6247 = 6247