# KAKATIYA UNIVERSITY, WARANGAL

## Department of Statistics

CBCS pattern with Semester System (wef: 2016-17)

**B.Sc (STATISTICS)**

**PRACTICAL EXAMINATION PATTERN**

**I Year, Semester-II: Practical-2**

## Probability Distributions

| Method of Solving | No. of Problems given | Student has to attempt | Marks division | | | Total Marks | Duration of Exam |
|---|---|---|---|---|---|---|---|
| | | | Problem solving | Viva | Record | | |
| Using Calculator | 4 | 2 | 2x10=20 | 10 | 10 | **50** | 2+1=3 hrs |
| Using Computer (MS-Excel) | 2 | 1 | 1x10=10 | | | | |

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**B. Sc (Statistics) I Year, Semester-II**

## Probability Distributions

**(Question Bank for Practical Examinations)**

**Note:** 1) **ONE** problem **each** is to be given from sections **A, B, C, D.**
Student has to attempt any **TWO** problems using **calculator.**
2) **TWO** problems are to be given from section-**E.**
Student has to attempt any **ONE** problem using **MS-Excel.**

## SECTION – A

1. Fit a Binomial distribution for the following data using the direct method. And calculate expected frequencies.

| X: | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| f: | 0 | 4 | 13 | 28 | 42 | 20 | 6 | 2 |

2. Fit a Binomial distribution for the data given below, using recurrence method. Also calculate expected frequencies.

| X: | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| f: | 5 | 3 | 9 | 19 | 11 | 12 | 3 | 5 | 2 |

3. Seven coins are tossed and number of heads noted. The experiment is repeated 205 times and the following data is obtained.

| No. of heads | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| Frequency | 6 | 11 | 29 | 34 | 52 | 41 | 22 | 9 | 1 |

Using the direct method, fit a Binomial distribution when (a) coin is unbiased
(b) nature of the coin is not known.

4. The following data due to Weldon shows the results of throwing 12 fair dice 4096 times; a throw of 4, 5 or 6 being called success. Fit a binomial distribution and find expected frequencies.

| Success | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | --- | 7 | 60 | 198 | 430 | 731 | 948 | 847 | 536 | 257 | 71 | 11 | ---- |

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5. The number of male and female births in 800 families in a village having four children are as follows:

| No. of male births: | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| No. of female births: | 4 | 3 | 2 | 1 | 0 |
| No. of families: | 32 | 178 | 290 | 236 | 64 |

Fit a Binomial distribution (a) assuming male and female births are equally probable (b) estimating the probabilities from the above data.

6. Fit a Poisson distribution using the direct method to the following data. Find expected frequencies.

| X: | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| f: | 142 | 156 | 69 | 27 | 5 | 1 |

7. In 1000 consecutive issues of the 'utopian seven daily chronicle' the deaths of centenarians were recorded, the number 'X' having the frequency 'f' are given in the table. Fit a Poisson distribution by direct method.

| X: | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| f: | 229 | 325 | 257 | 119 | 50 | 17 | 2 | 1 | 0 |

8. The numbers of the phone calls received at on exchange in 245 successive one minute intervals are given in the following frequency distribution. Fit a Poisson distribution by recurrence method.

| Number of calls | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| Frequency | 14 | 21 | 25 | 43 | 51 | 40 | 39 | 12 |

9. Fit a Poisson distribution by recurrence method to the following data which gives the number of dodders in a sample of clover seeds.

| No. of dodders (X): | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| Observed frequency(f): | 56 | 156 | 132 | 92 | 37 | 22 | 4 | 0 | 1 |

10. Five hundred television sets are inspected as they come off the production line and the number of defects per set is recorded below:

| No. of defects | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| No. of sets | 368 | 72 | 52 | 7 | 1 |

Estimate the average number of defects per set and expected frequencies of 0, 1, 2, 3 and 4 defects, assuming Poisson distribution.

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## SECTION – B

11. Fit a Negative Binominal distribution and calculate the expected frequencies using direct method.

| X: | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| f: | 213 | 128 | 37 | 18 | 3 | 1 |

12. The number of failures preceding $r^{th}$ success in an experiment was recorded as:

| No. of failures (X): | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Frequency (f): | 214 | 125 | 41 | 16 | 3 | 1 |

Fit a Negative Binomial distribution using recurrence relation method.

13. The number of accidents among 414 machine operators was investigated for three successive months. The following table gives the distribution of the operators according the number of accidents which happened to the same operators.

| X: | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| f: | 296 | 74 | 26 | 8 | 4 | 4 | 1 | 0 | 1 |

Fit a negative Binomial distribution using the direct method.

14. A blood bank collects B-negative blood samples only. The probability of getting B-negative blood is 'P' and it is treated as success. It takes only one bottle of blood from one person and purchases five bottles per day. The failures of 400 days before getting $5^{th}$ bottle of blood of this kind were recorded as follows.

| No. of failures | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| No. of days | 131 | 131 | 79 | 37 | 14 | 5 | 2 | 1 |

Fit a Negative binomial distribution using recurrence method.

15. In a shooting competition the no of failures of 400 candidates before $r^{th}$ success were recorded as follows:

| X: | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| f: | 213 | 127 | 44 | 12 | 3 | 1 |

Estimate 'p' and 'r'. Fit a Negative binomial distribution.

16. For the following frequency distribution, Fit a Geometric distribution using direct method.

| X: | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| f: | 1 | 3 | 9 | 15 | 21 | 26 |

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17. Given the hypothetical distribution:

| No. of cells (X): | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Frequency (f): | 213 | 128 | 37 | 18 | 3 | 1 |

Fit a geometric distribution and calculate the expected frequencies.

18. A constable inspects each car for a drunkard driver. Every morning he starts inspection until he finds a drunkard driver and then he stops inspection. The probability that a car is driven by drunkard driver is 'p' and is treated as success. The distribution of failures before he finds a drunkard drive in 100 days is given below:

| No. of failures (X): | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| No. of days (f): | 40 | 24 | 15 | 9 | 5 | 3 | 2 | 1 | 1 |

Fit a Geometric distribution to the given data using recurrence method

19. Fit a Geometric distribution using direct and recurrence methods and compare expected frequencies.

| X: | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| f: | 460 | 140 | 45 | 25 | 18 | 10 | 2 |

20. In a rifle shooting camp the numbers of chances taken by each candidate to hit the target first time successfully are recorded as given below.

| No.of chances taken: | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| No.of candidates: | 145 | 68 | 46 | 211 | 11 | 4 |

Fit a Geometric distribution.

## SECTION – C

21. Fit a normal distribution using Areas method for the following data.

| Class | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 | 50 – 60 | 60 – 70 | 70 – 80 | 80 – 90 |
|---|---|---|---|---|---|---|---|---|
| Frequency | 5 | 12 | 13 | 42 | 76 | 12 | 3 | 15 |

Also obtain the expected normal frequencies.

22. Obtain the equation of the normal curve that may be fitted to the following data:

| Class | 60 – 65 | 65 – 70 | 70 – 75 | 75 – 80 | 80 – 85 | 85 – 90 | 90 – 95 | 95 – 100 |
|---|---|---|---|---|---|---|---|---|
| Frequency | 3 | 21 | 150 | 335 | 326 | 135 | 26 | 4 |

Also obtain the expected normal frequencies.

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23. Fit a normal distribution for the following data by ordinates method. Find expected frequency of each class interval.

| C.I. | 150-160 | 160-170 | 170-180 | 180-190 | 190-200 | 200-210 | 210-220 | 220-230 | 230-240 |
|---|---|---|---|---|---|---|---|---|---|
| f | 9 | 24 | 51 | 66 | 72 | 48 | 21 | 6 | 3 |

24. Fit a normal distribution for the following data by the method of ordinates. Calculate expected frequencies.

| C.I. | 60 – 62 | 63 – 65 | 66 – 68 | 69 – 71 | 72 – 74 |
|---|---|---|---|---|---|
| f | 5 | 18 | 42 | 27 | 8 |

25. For a certain normal distribution, the first moment about 10 is 40 and fourth moment about 50 is 48, find the arithmetic mean ($\mu$) and standard deviation ($\sigma$) of the distribution. Also find (a) $P(\mu-\sigma < X < \mu+\sigma)$ (b) $P(\mu-2\sigma < X < \mu+2\sigma)$ (c) $P(\mu-3\sigma < X < \mu+3\sigma)$.

26. X is normally distributed with mean 12 and S.D 4.
Find (a) $P(X \geq 20)$ (b) $P(X \leq 20)$ (c) $P(0 \leq X \leq 12)$ (d) Find $x^1$, when $P(X > x^1) = 0.24$ (e) Find $X_0'$ and $X_1'$, when $P(X_0' < X < X_1') = 0.50$ (f) Find $X_2'$, if $P(X > X_2') = 0.25$.

27. The mean yield for one-acre plot is 662 kilos with a s.d. 32 kilos. Assuming normal distribution, how many one-acre plots in a batch of 1,000 plots would you expect to have yield (a) over 700 kilos (b) below 650 kilos, (c) What is the lowest yield of the best 100 plots?

28. The local authorities in a certain city install 10,000 electric lamps in the street of the city. If these lamps have an average life of 1,000 burning hours with a standard deviation of 200 hours, assuming normality, what number of lamps might be expected to fail (i) in the first 800 burning hours? (ii) between 800 and 1,200 burning hours? (iii) After what period of burning hours would you expect that (a) 10% of the lamps would fail? (b) 10% of the lamps would be still burning?

29. In a distribution exactly normal, 10.03% of the items are under 25 kilogram weight and 89.97% of the items are under 70 kilogram weight. What are the mean and standard deviation of the distribution?

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30. In an examination it is laid down that a student passes if he secures 30 percent or more marks. He is placed in the first, second or third division according as he secures 60% or more marks, between 45% and 60% marks and marks between 30% and 45% respectively. He gets distinction in case he secures 80% or more marks. It is noticed from the result that 10% of the students failed in the examination, whereas 5% of them obtained distinction. Calculate the percentage of students placed in the second division. (Assume normal distribution of marks).

## SECTION – D

31. 200 electrical bulbs tested and the following data is obtained. Fit an exponential distribution and draw graphs for the observed and expected frequencies.

| C.I. | 0 – 20 | 20 – 40 | 40 – 60 | 60 – 80 | 80 – 100 |
|---|---|---|---|---|---|
| f | 104 | 56 | 24 | 12 | 4 |

32. The life time (in hours) of an I.C. of television set of a certain type is tested for 200 T.V. sets and recorded in the following frequency distribution.

| Life time (in hrs) | 0 – 30 | 30 – 60 | 60 – 90 | 90 – 120 | 120 – 150 | 150 – 180 | 180 – 210 | 210 – 240 |
|---|---|---|---|---|---|---|---|---|
| Frequency | 108 | 45 | 21 | 9 | 8 | 5 | 4 | 0 |

Fit an exponential distribution and find the expected frequencies.

33. The waiting time 'X' (in minutes) at a railway booking counter is exponentially distributed. The following distribution is obtained for 200 passengers.

| Waiting time | 0 – 5 | 5 – 10 | 10 – 15 | 15 – 20 | 20 – 25 | 25 – 30 | 30 – 35 | 35 – 40 |
|---|---|---|---|---|---|---|---|---|
| No. of passengers | 79 | 48 | 29 | 18 | 11 | 7 | 4 | 4 |

Fit an exponential distribution.

34. The study of divorced cases in the western countries, the following distribution is obtained for the time interval (in years) between the day of their marriage and day of their divorce.

| No. of Years | 0-3 | 3-6 | 6-9 | 9-12 | 12-15 | 15 and above |
|---|---|---|---|---|---|---|
| No. of persons | 190 | 70 | 25 | 10 | 4 | 1 |

Fit an exponential distribution and find the expected frequencies.

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35. A private bus operator runs buses from Warangal to Nizamabad. The bus leaves as soon as 40 passengers have arrived. Assume that the passenger arrivals are independent and are at a mean rate of 'θ'. The following distribution is obtained for 200 buses.

| Time (in minutes) | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60 & above |
|---|---|---|---|---|---|---|---|
| No. of buses that have got 40 passengers | 90 | 50 | 30 | 15 | 8 | 5 | 2 |

Fit an exponential distribution.

36. In air force operation, suppose a pilot-less helicopter is flying at 1 K.M. height from the origin. It has a sophisticated machine gun which identifies the enemy crossing the border and fires at him. It can uniformly turn in between $\left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$. It was reported that 200 terrorists were killed at different places along the border as given below. Fit a Cauchy distribution.

| Distance | $-\infty$ to -25 | -25 to -19 | -19 to -13 | -13 to -7 | -7 to -1 | -1 to -5 | 5 to 11 | 11 to 17 | 17 to 23 | 23 to $+\infty$ |
|---|---|---|---|---|---|---|---|---|---|---|
| No. of terrorists killed | 2 | 1 | 2 | 4 | 41 | 137 | 7 | 2 | 1 | 3 |

37. Fit a Cauchy distribution with location parameter 1.5 and scale parameter 1.

| Interval | $-\infty$ to -15 | -15 to -12 | -12 to -9 | -9 to -6 | -6 to -3 | -3 to 0 | 0 to 3 | 3 to 6 | 6 to 9 | 9 to 12 | 12 to 15 | 15 to $\infty$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | 17 | 1 | 3 | 5 | 15 | 60 | 311 | 59 | 14 | 3 | 2 | 16 |

38. Fit a Cauchy distribution for the following data.

| Interval | $-\infty$ to -29 | -29 to -21 | -21 to -13 | -13 to -5 | -5 to 3 | 3 to 11 | 11 to 19 | 19 to 27 | 27 to 35 | 35 to $\infty$ |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | 12 | 10 | 20 | 38 | 400 | 32 | 20 | 10 | 8 | 0 |

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## SECTION – E

### Note: All problems are to be solved using MS-Excel

39. Fit a binomial distribution by direct method using MS-EXCEL.

| X: | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| f: | 0 | 4 | 13 | 28 | 42 | 20 | 6 | 2 |

40. Fit a binomial distribution by recurrence method using MS-EXCEL.

| X: | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| f: | 7 | 64 | 140 | 210 | 132 | 75 | 12 |

41. Fit a Poisson distribution for the following data by direct method using MS-EXCEL.

| No. of Deaths | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Frequency | 7 | 64 | 140 | 210 | 132 |

42. The distribution of typing mistakes committed by a typist is given below. Assuming a Poisson model find out the expected frequencies using MS-EXCEL. (Use recurrence method)

| Mistakes per page | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| No. of Pages | 142 | 156 | 69 | 27 | 5 | 1 |

43. Fit a normal distribution to the following data by areas method using MS-EXCEL.

| Class | 60 – 65 | 65 – 70 | 70 – 75 | 75 – 80 | 80 – 85 | 85 – 90 | 90 – 95 | 95 – 100 |
|---|---|---|---|---|---|---|---|---|
| Frequency | 3 | 21 | 150 | 335 | 326 | 135 | 26 | 4 |

44. Fit a normal distribution to the following data by areas method using MS-EXCEL.

| Class | 60 - 62 | 63 - 65 | 66 – 68 | 69 – 71 | 72 - 74 |
|---|---|---|---|---|---|
| Frequency | 5 | 18 | 42 | 27 | 8 |

45. Fit a normal distribution for the following data by ordinates method using MS-XCEL.

| C.I. | 150-160 | 160-170 | 170-180 | 180-190 | 190-200 | 200-210 | 210-220 | 220-230 | 230-240 |
|---|---|---|---|---|---|---|---|---|---|
| f | 9 | 24 | 51 | 66 | 72 | 48 | 21 | 6 | 3 |

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46. The I.Q. of 200 children is distributed as given below:

| I.Q.Scores | 60 - 70 | 70 - 80 | 80 - 90 | 90 - 100 | 100- 110 | 110- 120 |
|---|---|---|---|---|---|---|
| No. of Children | 2 | 9 | 23 | 40 | 50 | 42 |

Fit a Normal distribution by ordinates method using MS- EXCEL.

47. The study of divorced cases in the western countries, the following distribution is obtained for the time interval (in yeas) between the day of their marriages and the day of the divorce. Fit an exponential distribution using MS-EXCEL.

| No. of year | 0 – 2 | 2 – 4 | 4 – 6 | 6 – 8 | 8 – 10 | 10 and Above |
|---|---|---|---|---|---|---|
| No .of Persons | 126 | 48 | 17 | 6 | 2 | 1 |

48. The waiting time 'X' (in minutes) at a railway booking counter is exponentially distributed. The following distribution is obtained for 200 passengers.

| Waiting time | 0 – 5 | 5 – 10 | 10 – 15 | 15 – 20 | 20 – 25 | 25 – 30 | 30 – 35 | 35 – 40 |
|---|---|---|---|---|---|---|---|---|
| No. of passengers | 79 | 48 | 29 | 18 | 11 | 7 | 4 | 4 |

Fit an exponential distribution using MS-EXCEL.

49. Fit a Cauchy distribution for the following data using MS-EXCEL.

| Interval | -∞ to -29 | -29 to -21 | -21 to -13 | -13 to -5 | -5 to 3 | 3 to 11 | 11 to 19 | 19 to 27 | 27 to 35 | 35 to ∞ |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | 12 | 10 | 20 | 38 | 400 | 32 | 20 | 10 | 8 | 0 |

50. Fit a Cauchy distribution with location parameter 1.5 and scale parameter 1 for the following data using MS-EXCEL.

| Interval | -∞ to -15 | -15 to -12 | -12 to -9 | -9 to -6 | -6 to -3 | -3 to 0 | 0 to 3 | 3 to 6 | 6 to 9 | 9 to 12 | 12 to 15 | 15 to ∞ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | 17 | 1 | 3 | 5 | 15 | 60 | 311 | 59 | 14 | 3 | 2 | 16 |

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