13-01-2020 Monday

**Q1.** Plot the Survival Function (S.F.), Quantiles, Hazard Function (H.F.) and Mean Residual Life (M.R.L.), for the following parametric models for different values of parameters:

1. Exponential Distribution.
2. Gamma Distribution.
3. Weibull Distribution.
4. Normal Distribution.
5. Lognormal Distribution.
6. Logistic Distribution.
7. Pareto Distribution.

20-01-2020 Monday

**Q2.** Let with pdf:

1. Find the SF at 25, 60, 75 days.
2. Find the median residual life time at 25, 50, 75 days.
3. Find the mean residual life time at 25, 50, 75 days.

**Q3.** Let the Survival Time (T);

1. Find the mean and median survival time.
2. Find the hazard function of T.
3. Find the average remaining life time after. How that is compared to the mean survival time?

04-05-2020 Tuesday

**Q4.** Suppose that the time for developing of a tumour in rats exposed to a carcinogen follows a Weibull distribution with and. (Time is in units?)

1. What is the average time to tumour development?
2. Find the hazard rate of tumour development at 10 days, 20 days and 30 days. Find the median time to the tumour development.

(Unit of hazard rate?)

11-02-2020 Tuesday

**Q5.** The following table gives quality rating of service stations by 5 professional raters:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **RATERS** | **SERVICE STATIONS** | | | | | | | | | |
| **↓** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| **A** | 99 | 70 | 90 | 99 | 65 | 86 | 75 | 70 | 85 | 92 |
| **B** | 96 | 65 | 80 | 95 | 70 | 88 | 70 | 51 | 84 | 91 |
| **C** | 95 | 60 | 48 | 87 | 48 | 75 | 71 | 93 | 80 | 93 |
| **D** | 98 | 65 | 70 | 95 | 67 | 82 | 73 | 94 | 86 | 80 |
| **E** | 97 | 65 | 62 | 99 | 60 | 80 | 76 | 92 | 90 | 89 |

Table 1 Quality rating of service stations by 5 professional raters

Analyse the data and discuss whether there is any significant difference between raters and between service stations.

18-02-2020 Tuesday

**Q6.** A chemist wishes to test the effect of 4 chemical agents on the strength of a particular type of cloth because there might be variability from one bolt to another. The chemist decides to use a Randomized Block Design (RBD) with the \_\_\_\_ of cloth considered as blocks. The chemist selects 5 bolts and applies all 4 chemicals in random order to each bolt. The resulting tensile strength is as follows. Analyse the data from this experiment using and draw appropriate conclusion.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | **Bolts** | | | | |
| **1** | **2** | **3** | **4** | **5** |
| **Chemical agents** | **A** | 73 | 68 | 74 | 71 | 67 |
| **B** | 73 | 67 | 75 | 72 | 70 |
| **C** | 75 | 68 | 78 | 73 | 68 |
| **D** | 73 | 71 | 75 | 75 | 69 |

Table 2

**Q7.** A set of data involving 4 tropical feed stuffs: A, B, C, and D are tried on 20 chicks given below. All the 20 chicks are treated alike in all respects except the feeding treatments and each feeding treatment is given to 5 chicks. Analyse the data given below:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Feed** | **Gain in Weight** | | | | | **Total(Ti)** |
| **A** | 55 | 49 | 42 | 21 | 52 | **219** |
| **B** | 61 | 112 | 30 | 89 | 63 | **355** |
| **C** | 42 | 87 | 51 | 95 | 92 | **367** |
| **D** | 169 | 137 | 169 | 85 | 154 | **714** |

17-04-2020 Friday

**Q8.** An LSD was used to compare5 varieties of oats. The yields (in kg per plot) are given in the adjoining table, where the letters A, B, C, D and E refer to varieties. Test for the differences between variety effects.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| D 7.2 | F 5.5 | A 3.7 | C 6.8 | B 7.3 |
| A 3.6 | C 4.7 | E 4.7 | B 5.5 | D 6.8 |
| E 7.2 | D 5.6 | D 7.2 | A 6.8 | C 7.8 |
| B 6.9 | A 5.3 | C 7.0 | D 8.0 | E 7.7 |
| C 8.2 | D 8.1 | B 7.6 | E 8.8 | A 7.1 |

**Q9.** The plan below is an LS experiment to test the efficiency of methods of testing with sulphur in order to control stem rust of wheat. The key to treatments is given with plan shown in the following table:

Note: Key to the treatments:

|  |  |
| --- | --- |
| A | Dusted before rinse |
| B | Dusted after rinse |
| C | Dusted once each week |
| D | Drifting once each week |
| E | Not dusted at all |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| B | D | E | A | C |
| C | A | B | E | D |
| D | C | A | B | E |
| E | B | C | D | A |
| A | E | D | C | B |

All applications were 30 lb to the acre at each treatment. Drifting means that the sulphur was allowed to settle over the plant from above. The plot yields in Brussels per acre are given below where the figures in the tale correspond to the position of the plots and the treatments in the plan.

Analyse the experiment.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | **ROW TOTALS** |
| 1 | 4.9 | 6.4 | 3.3 | 9.5 | 11.8 | **35.9** |
| 2 | 9.3 | 4 | 6.2 | 5.1 | 5.4 | **30** |
| 3 | 7.6 | 15.4 | 6.5 | 6 | 4.6 | **40.1** |
| 4 | 5.3 | 7.6 | 13.2 | 8.6 | 4.9 | **39.6** |
| 5 | 9.3 | 6.3 | 11.8 | 15.9 | 7.6 | **50.9** |
| **COLUMN TOTALS** | **36.4** | **39.7** | **41** | **45.1** | **34.3** | **196.5** |

22-04-2020 Wednesday

**Q10.** The following table gives data on time to HIV development for a sample of individuals with another STD but free of HIV at time zero.

|  |  |  |
| --- | --- | --- |
| Year | No. of HIV | No. of lost to follow up |
| 0-2 | 2 | 3 |
| 2-4 | 1 | 2 |
| 4-6 | 4 | 8 |
| 6-8 | 3 | 10 |
| 8-10 | 2 | 21 |
| 10-12 | 2 | 21 |
| 12-14 | 3 | 21 |

Find the Life Table estimate of the survival function of time to HIV at years 2, 4, 6, 8, 10, 12 and 14. Find the variance of the estimated survival function.

**Q11.** Consider the following survival times

3, 4, 5+, 6, 6+, 8+, 11, 14, 15, 16+

1. Find the Kaplan-Meir estimate of the survival function and its variance.
2. Use the above Kaplan-Meir estimate to estimate the cumulative hazard function and its variance.
3. Find the Nelson-Aalen estimate of the cumulative hazard function and its variance.
4. Find an estimate of the survival function and its variance using the Nelson-Aalen estimate of cumulative hazard function found above.

The time in days to development of a tumor for rats exposed to a carcinogen follows a Weibull distribution with α=2 and λ=0.001. (a)What is the probability a rat will be tumor free at 30 days? 45 days? 60 days? Answer: Let X denote the time in days to development of a tumor for rats exposed to a carcinogen, and X has Weibull distribution with α=2 and λ=0.001. So the p.d.f. of X is f(x) = 21000∙ 𝑥 ∙ exp{−11000∙ 𝑥2}. P{X>t} = ∫21000∙ 𝑥 ∙ exp{−11000∙ 𝑥2}∞?dx= −exp{−11000∙ 𝑥2}|?∞= exp{−11000∙ ?2}∴p{X>30} = exp{ −1 1000 ∙ 30 2 } = 0.407 ; p{X>45} = exp{ −1 1000 ∙ 45 2 } = 0.132 p{X>60} = exp{ −1 1000 ∙ 60 2 } = 0.027

