17P458 (Pages: 2) Name…….……

Reg. No……..

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2019

(Regular/Supplementary/Improvement)

(CUCSS - PG)

(Statistics)

CC15P ST4 E04 – RELIABILITY MODELING

(2015 Admission onwards)

Time: Three Hours Maximum: 36 Weightage

Part A

Answer ***all*** questions. Each question carries 1 weightage.

1. Define structural importance of a component of a coherent system with n components.
2. Define path and minimal path of a coherent system.
3. Define lack of memory property of exponential distribution.
4. Describe IFRA property of life distribution.
5. Distinguish between Type I and Type II censoring.
6. What is the distribution function of univariate Poisson shock model.
7. Define mean residual life of a lifetime distribution.
8. Give an example showing, convolution of two DFR distributions need not be a DFR distribution.
9. Define limiting availability.
10. Define the bathtub shaped failure rate distribution.
11. State the Hollender-Proschan-Deshpande test for Exponentiality.
12. Define non-homogeneous Poisson process.

(12 x 1 = 12 Weightage)

Part B

Answer any ***eight*** questions. Each carries 2 weightage.

13. If $\varphi(x_1, \dots, x_n)$ be the structure function of a coherent system of n independent components having reliabilities $p_1, \dots, p_n$. Show that

    $\prod_{i=1}^{n} p_i \leq P(\varphi(x_1, \dots, x_n) = 1) \leq \coprod_{i=1}^{n} p_i$
14. Prove that $IFR \rightarrow IFRA$
15. Show that reliability function $h(\boldsymbol{P})$, where $\boldsymbol{P}=(p_1,\dots,p_n)$ is increasing in p_i, $i=1,2,\dots,n$
16. If F_1 and F_2 are IFRA distributions, show that the coherent system of two components is also IFRA distribution.
17. Discuss IFR and DFR property of a Weibull distribution.

18. State and prove Closure property of Life time distribution under NBU operation.
19. State and prove lack of memory property of bivariate exponential distribution.
20. Discuss the shape of reliability function.
21. Discuss the linear growth model in reliability.
22. Define reliability importance of components. Obtain the reliability importance of series and parallel system of three components with $p_1=0.6$, $p_2=0.2$, $p_3=0.4$
23. Obtain the bound for system reliability of associated components.
24. What do you understand by 'ageing' in a lifetime distribution. Give an example of distribution having IFR (DFR) properties.

(8 x 2 = 16 Weightage)

Part C

Answer any ***two*** questions. Each carries 4 weightage.

25. Compute reliability, failure rate and MRL of the Gamma distribution.
26. Explain the non-parametric estimation of Censored grouped and ungrouped data.
27. Explain the testing of homogeneous Poisson process (HPP) Vs non-homogeneous Poisson process (NHPP).
28. Establish whether the redundancy at the component level (or system level) is more better for series or parallel system.

(2 x 4 = 8 Weightage)

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