

Answer any Five Questions
All Questions Carry Equal Marks

- 1.a) Explain the properties of the binomial distribution.
- b) The probability of A hitting a target is $\frac{1}{2}$ and the probability that B hits is $\frac{1}{4}$. If each fire once, what is the probability that the target is hit i) twice ii) only by A iii) only by B iv) not at all? [7+8]
- 2.a) Show that the expected value and standard deviation of an exponential distribution are equal.
- b) A product is claimed to be 90% free of defects. What is the expected value and standard deviation of the number of defects in a sample of 40? [8+7]
3. Derive an expression for the unreliability of the model shown in figure 1 and hence evaluate the unreliability of the system if all components have a reliability of 0.85.[15]

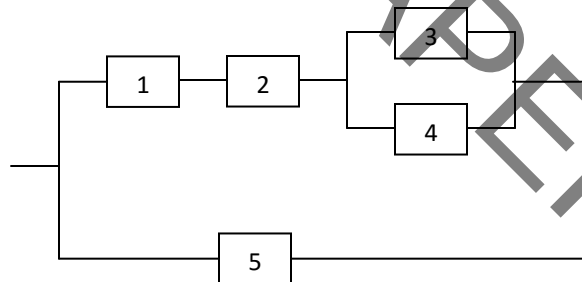


Figure 1

4. For the system shown figure 2, success requires that atleast one of the paths is good. Evaluate a general expression for system success and also evaluate the reliability of the system using cut set based approach if each component has a reliability of 0.8. [15]

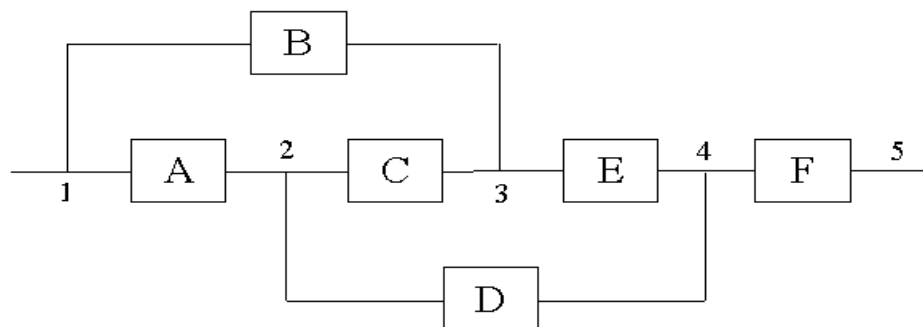


Figure 2

5.a) What are partially redundant systems? Explain with an example.

b) The hazard rate of a device is $\lambda(t) = \frac{1}{\sqrt{t}}$. Deduce

i) The probability density function

ii) The survivor function

iii) The expected value, and

iv) The variance

[7+8]

6. A system is composed of three elements. Component 1 is in series with the parallel redundant combination of components 2 and 3 which are identical.

$\lambda_1 = 1$ f/yr, $\lambda_2 = \lambda_3 = 3$ f/yr, $\mu_1 = 98$ r/yr, $\mu_2 = \mu_3 = 50$ r/yr.

a) Calculate the reliability of this system for a mission of 1000 hr.

b) What is the mean time to failure for this system?

[15]

7. Consider the three-state system shown in the below figure 3 and the transitional probabilities among the states indicated. Evaluate the limiting state probabilities associated with each state.

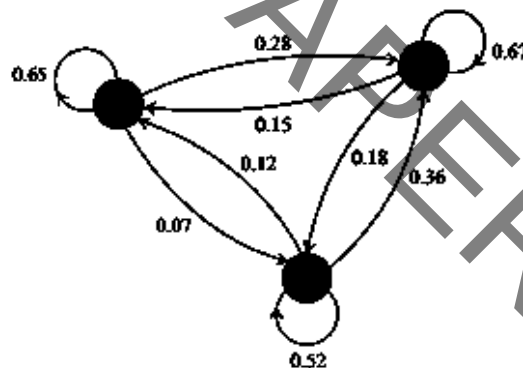


Figure 3

8. A system contains two components. Both components are required for system success. If one component fails, the other can not fail while the failed component is being repaired. If the component failure rates are $\lambda_1 = \lambda_2 = 0.1$ f/yr and repair rates are $\mu_1 = \mu_2 = 365$ r/yr, determine the probability of failure, the frequency of failure and the average down time of the system.

[15]

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