Department of Mathematics

Probability and Random Processes **15B11MA301**

Tutorial Sheet 10 **B.Tech. Core**

System Reliability

Q.1: The reliability of a communication channel is 0.40. How many channels should be placed in parallel redundancy so as to achieve the reliability of receiving the information is 0.80. If these channels are used to configure (i) high level and (ii) low level redundant systems, what are the corresponding system reliabilities? **(Ans. n= 4, 0.2949, 0.4096)**

Q.2: Which of the following systems has the higher reliability at the end of 100 hours of operation?

(i) Two constant failure rates redundant components each having MTTF of 1000 hours.

(ii) A Weibull component with shape parameter of 2 and a characteristic life of 10000 hours in series with a constant failure rates components with a failure rate of 0.00005.

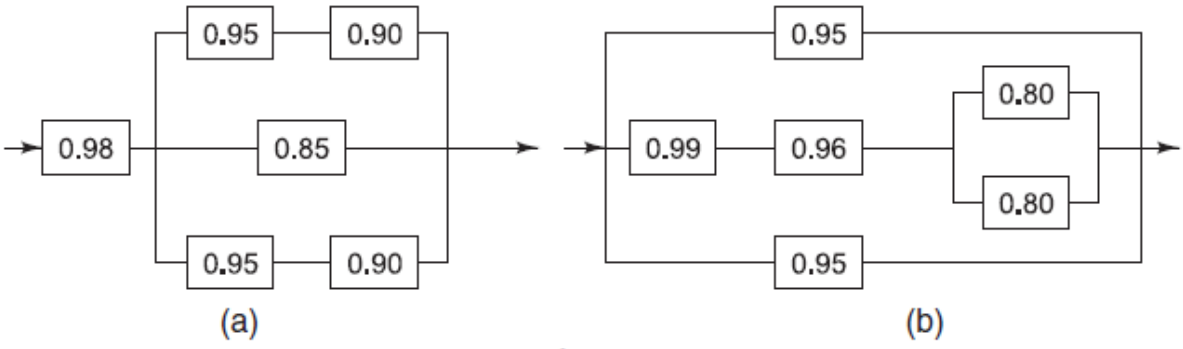
(Ans. 0.9909, 0.9949)

Q.3: Specifications for a power unit consisting of 3 independent and serially connected components require a design life of 5 years with 0.95 reliability.

(i) If the constant failure rates $\lambda_1, \lambda_2, \lambda_3$ are such that $\frac{\lambda_1}{2} = \frac{\lambda_2}{1} = \frac{\lambda_3}{3}$, what should be the MTTF of each component of the system?

(ii) If 2 identical power units are placed in parallel, what is the system reliability at 5 years and what is the system MTTF? **(Ans. (i) 292, 585, 195 (ii) 0.9975, 147 years)**

Q.4: Calculate the reliability of following systems:



(Ans. (a) 0.9769 (b) 0.9998)

Q.5: 2*n* identical constant failure rate components are used to configure redundant systems either with two subsystems in parallel or with *n* subsystems in series. Which system will give higher reliability?

(Ans. *n* subsystems in series)