Reliability

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Reliability

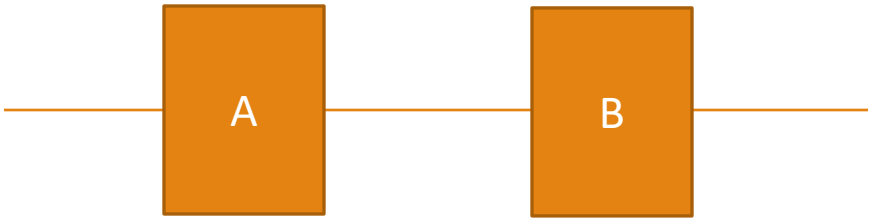
The Reliability of a component, which can be denoted by r, can in general be thought of as the probability that it performs a certain task. The complement of this probability is therefore the probability that the components fails to perform the required task, or the probability that the components fails.

Components in series

A set of components are considered in series if the system works only if each one of the components works.

if two components A and B are attached in a series, then the reliability is

$$\mathrm{r} = \mathrm{P}(\mathrm{A} \cap B) = P(A).P(B)$$



Components in series

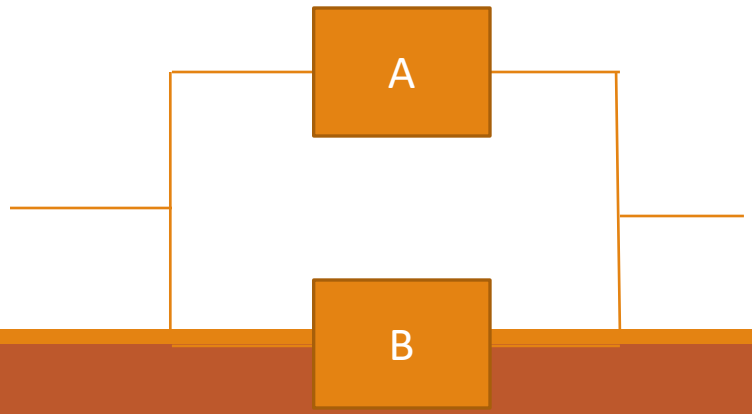
If a system consists of n components with independent reliabilities $r = r_1, r_2, r_3, \ldots, r_n$ placed in series, then the over all system reliability is

$$r = r_1 \times r_2 \times r_3 \times \cdots \times r_n$$

Components in parallel

A set of components is considered to be in parallel if the system works whenever at lease one of the components works. In other words, the system fails only when all the components have failed. if two components A and B are attached in parallel, then the reliability is

$$\mathrm{r} = \mathrm{P}(\mathrm{A} \cup B) = 1 - \{(1 - P(A)).(1 - P(B))\}$$



Components in parallel

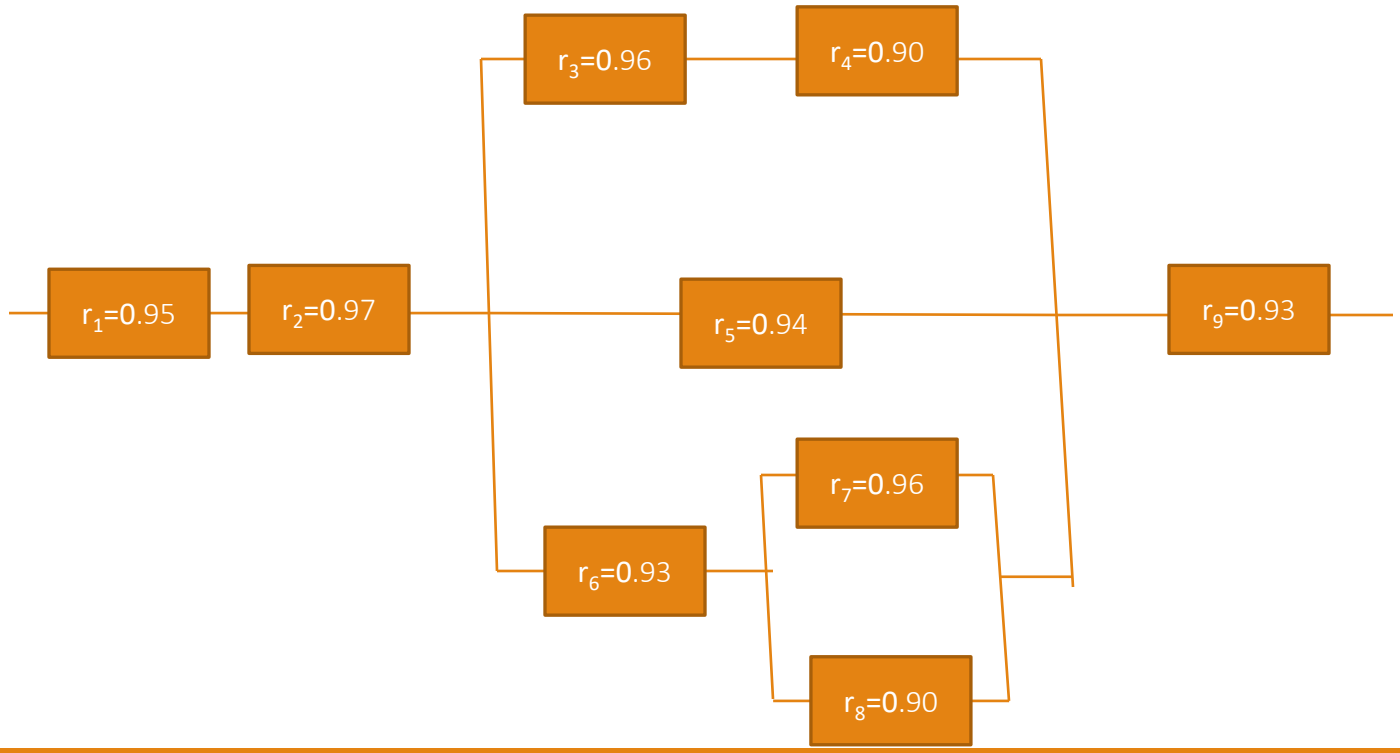
If a system consists of n components with independent reliabilities $r = r_1, r_2, r_3, \ldots, r_n$ placed in parallel, then the over all system reliability is

$$r = 1 - (1 - r_1) \times (1 - r_2) \times (1 - r_3) \times \cdots \times (1 - r_n)$$

Question 1

Calculate the reliability of the system shown in diagram

Below.



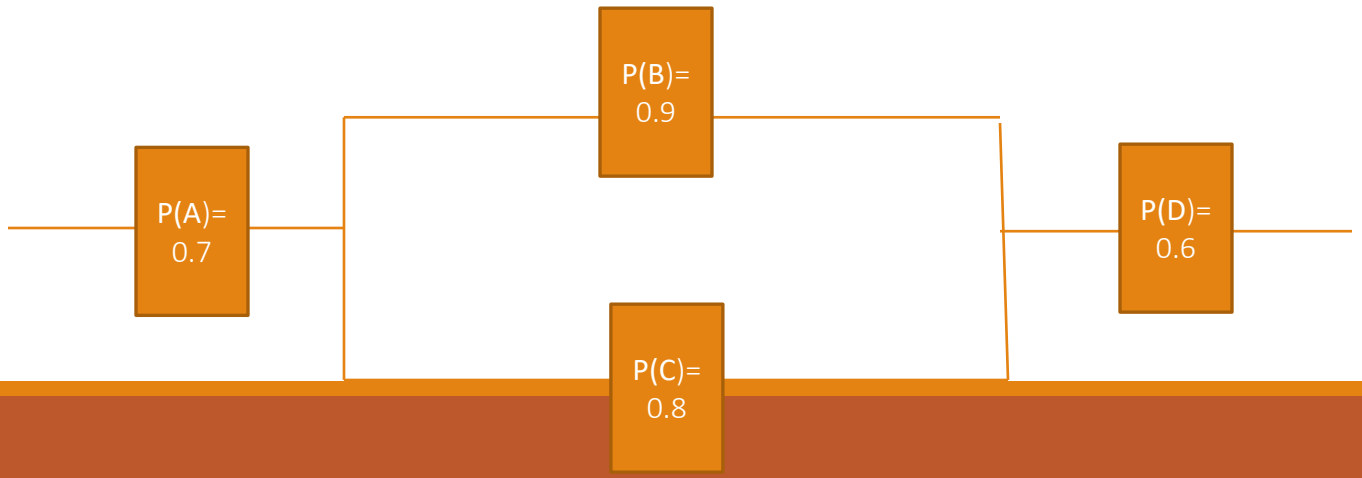
Question 2

Suppose an electrical system given in the figure below. The probability of each component is shown in figure.

What is the probability that

The entire system works?

The component B does not work given that the entire system works?



Question 3

Three components with reliabilities r_1=0.92, r_2=0.95, and r_3=0.975 are placed in a series. A fourth component with reliability r_4=0.96 can be placed in parallel with one of these three components.

How should the forth component be placed in order to maximize the overall system reliability?

Does your answer to part (i) change if the value of r_4 changes?