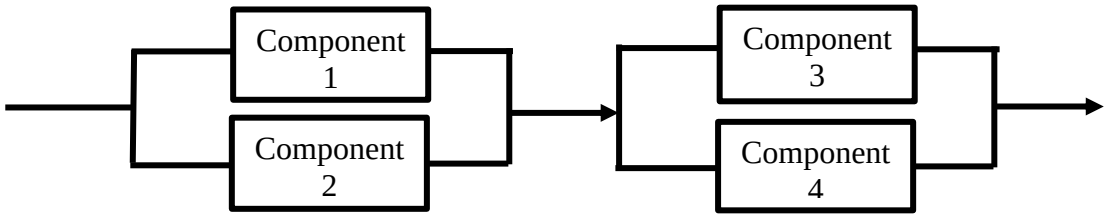
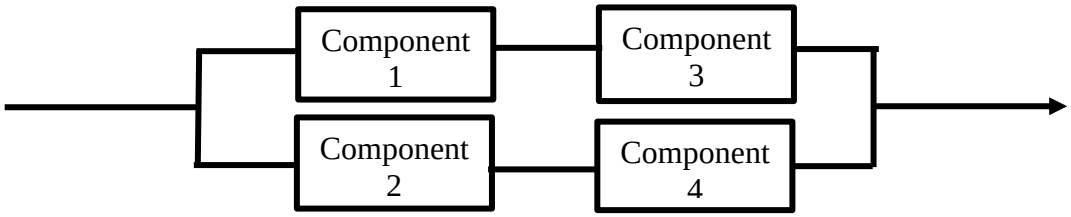
7. Four identical components, with reliability of $R = R_i = 0.9999 (i = 1,...,4)$, are arranged in two different configurations. Which system should be chosen?

System 1: Series-parallel design



System 2: parallel-series design



Solution

Design 1:

$$R_S = R_{12}R_{34} = \left[1-(1-R_1)(1-R_2)\right]\left[1-(1-R_3)(1-R_4)\right]$$
$$= \left[1-(1-R)^2\right]^2 = \left[1-(1-0.9999)^2\right]^2$$
$$P_f = 2\times 10^{-8}$$

Design 2:

$$R_S = 1-(1-R_{12})(1-R_{34}) = 1-(1-R_1R_2)(1-R_3R_4)$$
$$= 1-(1-R^2)^2 = 1-(1-0.9999^2)^2$$
$$P_f = 3.9996\times 10^{-8}$$

Select design 1 because it has smaller p_f .