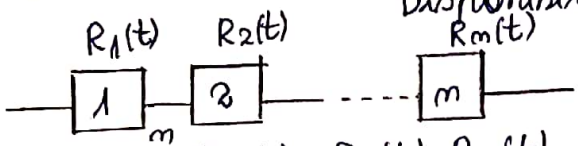
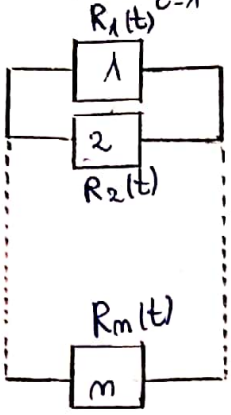
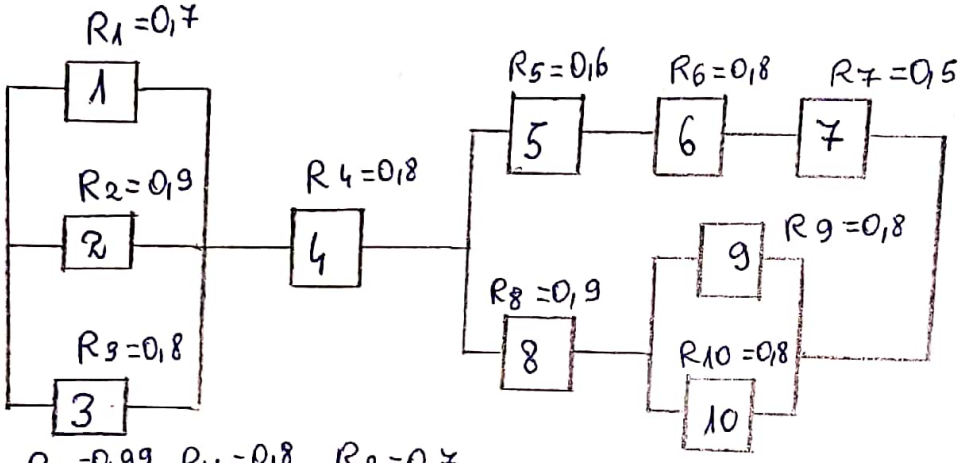
Disponibilitatea sistemelor complexe

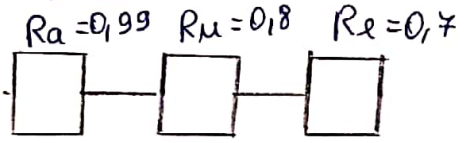


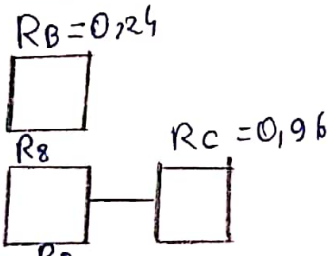
$$R(t) = \prod_{i=1}^{m} R_i(t) = R_1(t) \cdot R_2(t) \dots R_m(t)$$

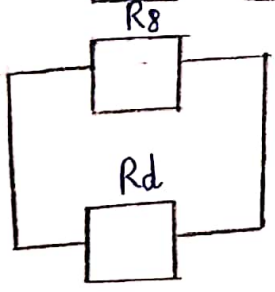


$$R(t) = 1 - \prod_{i=1}^{m} [1 - R_i(t)]$$









1 - 2 - 3 paralel (P)

$$R_a(t) = \prod_{i=1}^{m} R_i = 1 - \prod_{i=1}^{m} (1 - R_i(t)) = 1 - (1 - R_1)(1 - R_2)(1 - R_3) =$$
$$= 1 - 0,3 \cdot 0,1 \cdot 0,2 = 1 - 0,006 = 0,994$$

5 - 6 - 7 serie (S)

$$R_b(t) = \prod_{i=1}^{m} R_i(t) = R_1(t) \cdot R_2(t) \dots R_m(t) \Rightarrow R_5(t) \cdot R_6(t) \cdot R_7(t) = 0,6 \cdot 0,8 \cdot 0,5 =$$
$$= 0,24$$

9-10 paralel (p)

$$R_c(t) = 1 - \prod_{i=1}^{m} (1 - R_i(t)) = 1 - (1 - R_9)(1 - R_{10}) = 1 - (1 - 0{,}8)(1 - 0{,}8)$$
$$= 1 - 0{,}2 \cdot 0{,}2 = 0{,}96$$

8 - C serie (s)

$$R_d(t) = \prod_{i=1}^{m} R_i(t) = R_8 \cdot R_c = 0{,}9 \cdot 0{,}96 = 0{,}864$$

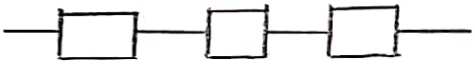
R6 - Rd paralel (p)

$$R_e(t) = 1 - \prod_{i=1}^{m} (1 - R_i(t)) = 1 - (1 - R_6)(1 - R_d) = 1 - (1 - 0{,}8)(1 - 0{,}864) =$$

$$= 1 - 0{,}2 \cdot 0{,}136 = 1 - 0{,}0272 = 0{,}972$$

Ra - R4 - Re serie (s)

$$R_f(t) = \prod_{i=1}^{m} R_i(t) = R_a \cdot R_4 \cdot R_e = 0{,}99 \cdot 0{,}8 \cdot 0{,}97 = 0{,}76$$



Redondanța sistemelor

Fiabilitatea sistemului nerezervat este:

$$R(t) = \prod_{i=1}^{m} R_i(t)$$

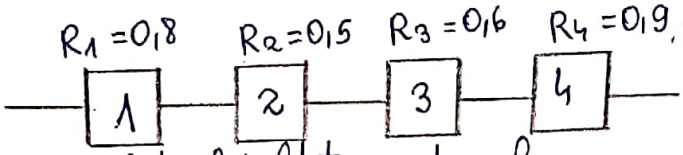
În cazul rezervării globale, fiabilitate devine:

$$R_{rg} = 1 - (1 - \prod_{i=1}^{m} R_i)^k$$

În cazul rezervării la nivel de bloc, se obține:

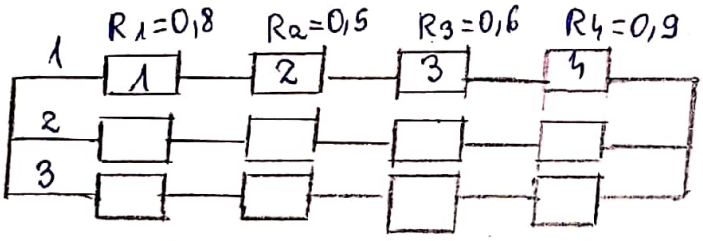
$$R_{rb} = \prod_{i=1}^{m} [1 - (1 - R_i)^k]$$

$R_{rg} > R$; $R_{rb} > R$; $R_{rb} > R_{rg}$



1. Calculați fiabilitatea sistemului R(t)
2. Schema rezervării globale cu două rezerve, calculați $R_{rg}(t)$
3. Schema rezervării totale la nivel de bloc, calculați $R_{rb}(t)$
4. Schema rezervării separate cu maxim două rezerve pe bloc. Calculați $R_{rs}(t)$.
5. Discuții la fiecare, adică >> (mai mare) sau << (mai mic)

1. $R(t) = \prod_{i=1}^{m} R_i(t) = R_1(t) \cdot R_2(t) \cdot R_3(t) \cdot R_4(t) = 0,8 \cdot 0,5 \cdot 0,6 \cdot 0,9 = 0,12$



nr. linii = k = 3

nr. rezerve k − 1 = 2

2. $R_{rg}(t) = 1 - (1 - \prod_{i=1}^{m} R_i(t))^k$

$= 1 - [(1 - R_1(t))(1 - R_2(t))(1 - R_3(t))(1 - R_4(t))]^3$

$= 1 - [(1 - 0,8)(1 - 0,5)(1 - 0,6)(1 - 0,9)]^3$

$= 1 - (0,2 \cdot 0,5 \cdot 0,4 \cdot 0,1)^3$

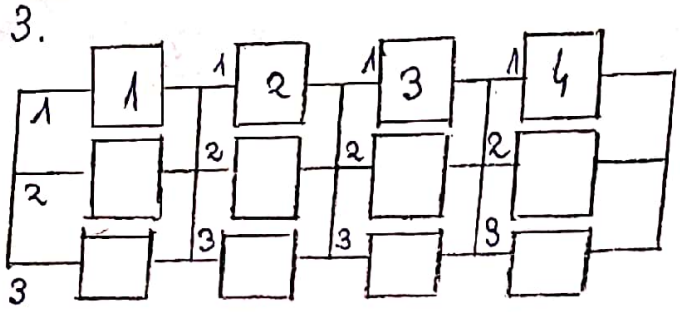
$= 1 -$

$= 1 - (1 - R_1(t) R_2(t) R_3(t) R_4(t))^3$

$= 1 - (1 - 0,12)^3 = 1 - 0,5 = 0,5$

$R_{rg} = 0,5 > R$

3.



$$R_{rb}(t) = \prod_{i=1}^{m} [1-(1-R_i)^k] = [1-(1-R_1)^3] \cdot [1-(1-R_2)^3] \cdot [1-(1-R_3)^3]$$

$$\cdot [1-(1-R_4)^3] =$$

$$= [1-(1-0,8)^3] \cdot [1-(1-0,5)^3] \cdot [1-(1-0,6)^3] \cdot [1-(1-0,09)^3]$$

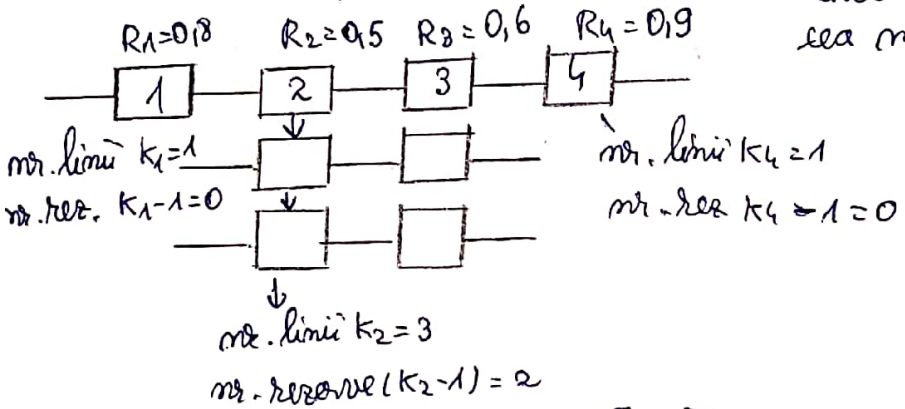
$$= (1-0,008)(1-0,125)(1-0,064)(1-0,001)$$

$$= 0,992 \cdot 0,875 \cdot 0,936 \cdot 0,999 = 0,81$$

$R_{rb} = 0,81 >> R$

$R_{rb} > R_{rg}$

→ blocul 2 pentru că are fiabilitatea cea mai mică



$$R_{rs}(t) = \prod_{i=1}^{m} [1-(1-R_i)^{k_i}] = [1-(1-R_1(t))^{k_1}] \cdot [1-(1-R_2(t)^{k_2}]$$

$$\cdot [1-(1-R_3(t))^{k_3}] \cdot [1-(1-R_4(t)^{k_4}]$$

$$= [1-(1-0,8)^1][1-(1-0,5)^3][1-(1-0,6)^3][1-(1-0,9)^1]$$

$$= (1-0,2) \cdot (1-0,125) \cdot (1-0,064) \cdot (1-0,1)$$

$$= 0,8 \cdot 0,875 \cdot 0,936 \cdot 0,9$$

$$= 0,58$$