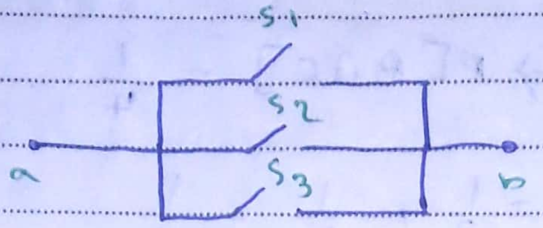
Subject: .... / /

$P[A_{ab}] = P[S_1 \cap S_2 \cap S_3]$

$= P[S_1]\, P[S_2]\, P[S_3] = A_1 A_2 A_3$

S_1, S_2 and S_3 can operate independtly



$A_{ab} = 1 - \overline{A_{ab}}$

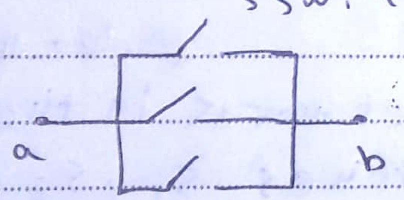
$\overline{A_{ab}} = P[\overline{S_1} \cap \overline{S_2} \cap \overline{S_3}]$

$P[\overline{S_1}]\, P[\overline{S_2}]\, P[\overline{S_3}]$

$= \overline{A_1}\, \overline{A_2}\, \overline{A_3}$

Independent Events [system Reliability]

switches



Assume that each switch can operate with probability = 0.9 what is the probability that the path from point a to point b can function?

$P_{ab} = 1 - \overline{P_{ab}}$

$= 1 - P[\overline{S_1} \cap \overline{S_2} \cap \overline{S_3}]$

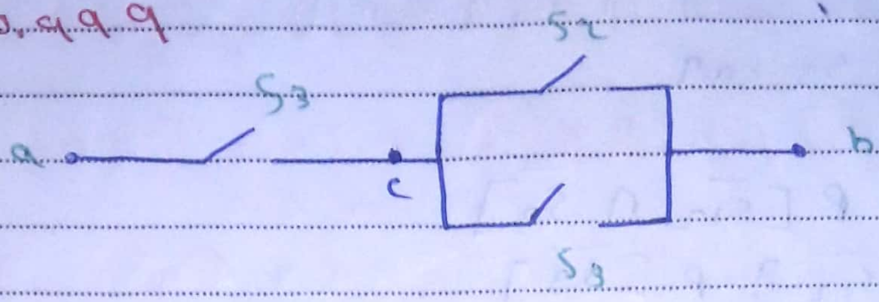
$= 1 - P[\overline{S_1}]\, P[\overline{S_2}]\, P[\overline{S_3}]$

$= 1 - (0.1)(0.1)(0.1)$

$= 1 - 0.001$

$= 0.999$

(3)



S2 and S3 are independent events

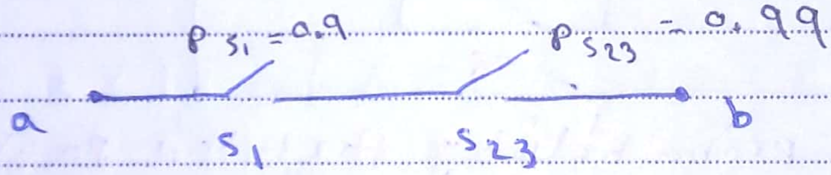
$$P_{cb} = 1 - P[\overline{S_2} \cap \overline{S_3}]$$

$$= 1 - P[\overline{S_2}]\,P[\overline{S_3}]$$

$$= 1 - (0.1)(0.1)$$

$$= 0.99$$

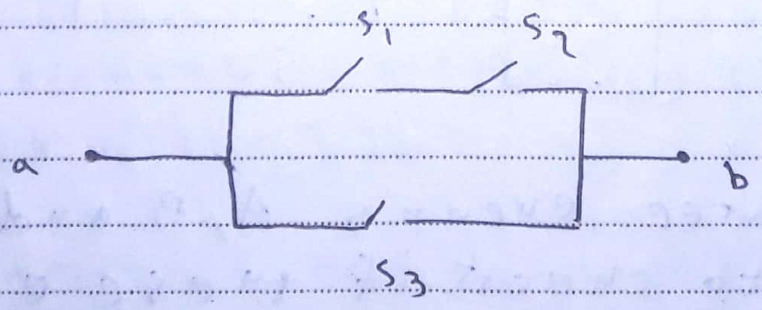
P_{cb} → probability that the path from point c to point b can function



$$P_{ab} = P[S_1 \cap S_{23}]$$

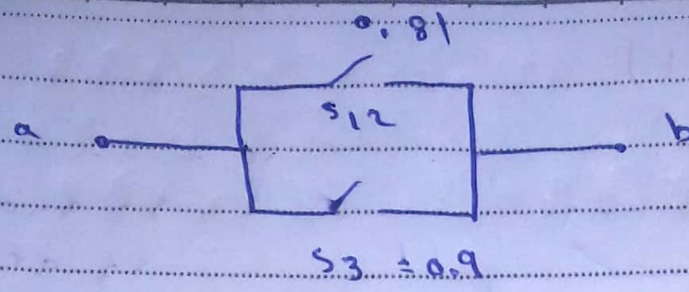
$$= P[S_1]\,P[S_{23}] = (0.9)(0.99) =$$

(4)



$$P[S_1 \cap S_2] = P[S_1]\,P[S_2]$$

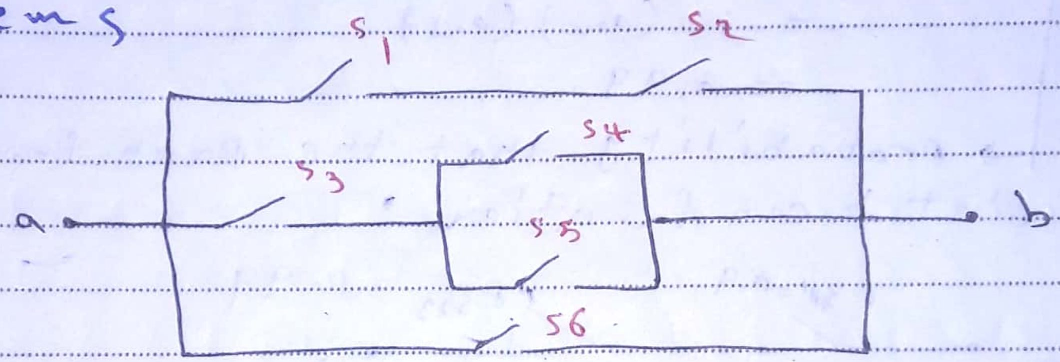
$$= (0.9)(0.9) = 0.81$$



$$P_{ab} = 1 - P[\overline{S_{12}} \cap \overline{S_3}]$$
$$= 1 - P[\overline{S_{12}}]\, P[\overline{S_3}]$$
$$= 1 - (0.19)(0.1) = 1 - 0.019 = 0.981$$

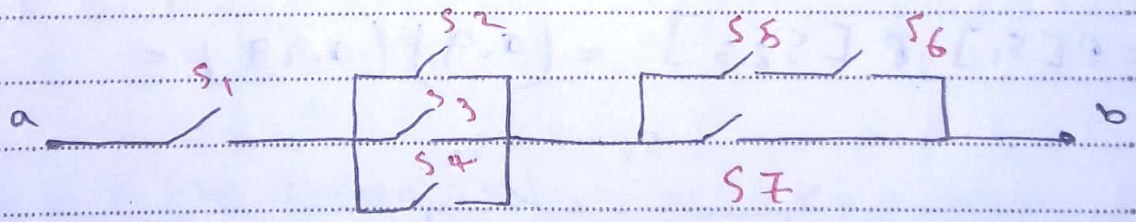
Problems

1)



Find the probability that the path from point a to point b can function?

2)



we have three events A, B and C
we need to check if these events are independent?

The events A, B and C are ~~xxx~~ said to be independent off

يجب أن تتحقق
كل الشروط حتى
تكون Independent

1) $P[A \cap B] = P[A]\,P[B]$

2) $P[A \cap C] = P[A]\,P[C]$

3) $P[B \cap C] = P[B]\,P[C]$

4) $P[A \cap B \cap C] = P[A]\,P[B]\,P[C]$

ch 2 : Random variables [r.v]

$S = \{ \_\_ , \_\_ , \_\_ , \_\_ \}$

$$S = \{HH, HT, TH, TT\}$$
$$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$$

real numbers $\frac{1}{4} \quad \frac{1}{4} \quad \frac{1}{4} \quad \frac{1}{4}$

random variable : mapping from Sample space into real numbers
[each elemant in the sample spase is given a probability]

An experiment can be modelled by using Cumlative Density function [CDF]

$f(x)$ → real values.
x ↳ random variable.

$f_x(0)$, $f_x(1)$, $F_x(0.5)$, $F_x(0.3$

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$P[X \le x] = F_X(x)$

$P[X > x] = 1 - P[X \le x]$

A CDF is given by

$$F_X(x) = \begin{cases} 0 & x < 0 \\ x + 0.5 & 0 \le x < 0.5 \\ 1 & x \ge 0.5 \end{cases}$$

① $P[X \le 0.2] = F_X(0.2)$
$= 0.2 + 0.5 = 0.7$

② $P[X \le 0.8] = F_X(0.8) = 1$

$P[a \le X \le b] = P[X \le b] - P[X \le a]$
$= F_X(b) - F_X(a)$

③ $P[0.1 \le X \le 0.4] = F_X(0.4) - F_X(0.1)$
$= 0.9 - 0.6 = 0.3$

④ $P[0.2 \le X \le 0.6]$
$= P[0.2 \le X \le 0.6] = P[X \le 0.6] - P[X \le 0.2]$
$= 1 - 0.7 = 0.3$

$F_X(x) = P[X \le x]$, $P[X > x] + P[X \le x] = 1$

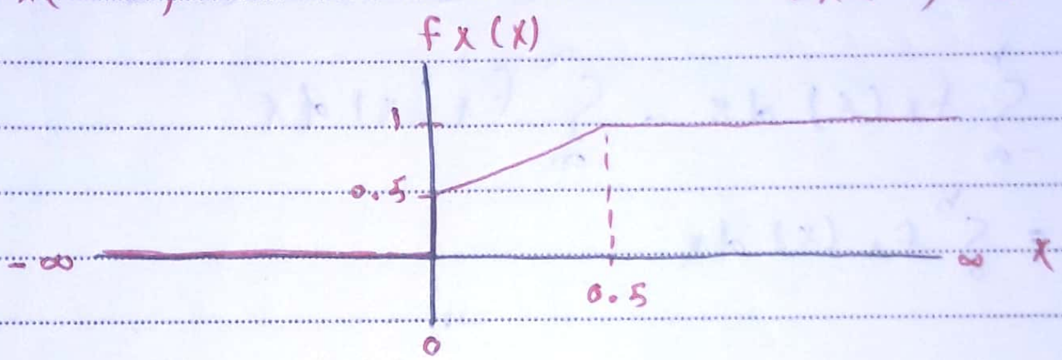
⑤ $P[X > 0.2] = 1 - P[X \leq 0.2]$
$= 1 - F_X(0.2) = 1 - 0.7 = 0.3$

⑥ $P[X \leq -\infty] = F_X(-\infty) = 0$

⑦ $P[X \leq \infty] = F_X(\infty) = 1$

$0 \leq F_X(x) = P[X \leq x] \leq 1$

$F_X(-\infty)$ $F_X(\infty)$



Cumulative Density function [CDF]

$F_X(x)$

Probability density function [Pdf]

CDF

$$f_X(x) = \frac{dF_X(x)}{dx}$$

pdf

$$F_X(x) = \int_{-\infty}^{x} f_X(u)\, du.$$

Subject: .... / /

$$P[a \leq X \leq b] = \int_a^b \underbrace{f_X(x)}_{\text{pdf}}\, dx$$

$$\to P[X \leq b] - P[X \leq a]$$

$$\underbrace{P[X \leq b]}_{\to \int_{-\infty}^{b} f_X(x)\, dx}$$

$$\int_{-\infty}^{\infty} f_X(x)\, dx = 1$$

$$P[a \leq X \leq b] = P[X \leq b] - P[X \leq a]$$

$$= \int_{-\infty}^{b} f_X(x)\, dx - \int_{-\infty}^{a} f_X(x)\, dx$$

$$= \int_a^b f_X(x)\, dx$$