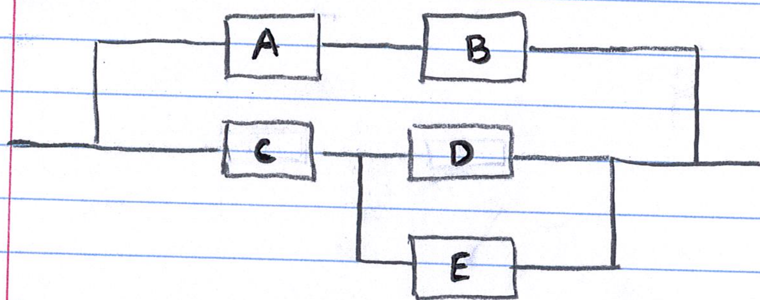
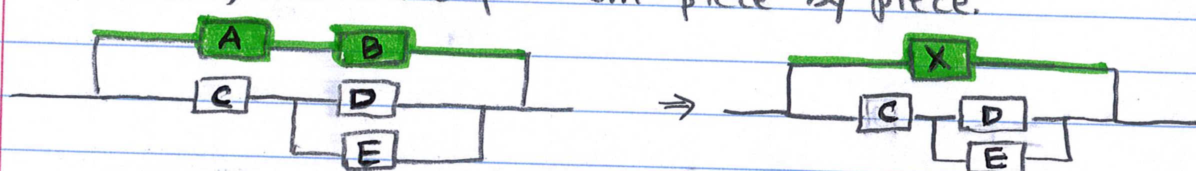
Reliability Example

Each component in system below is operable with probability 0.92 independently of other components. Calculate the reliability



Since the system has components in both parallel and series, solve the problem piece by piece.

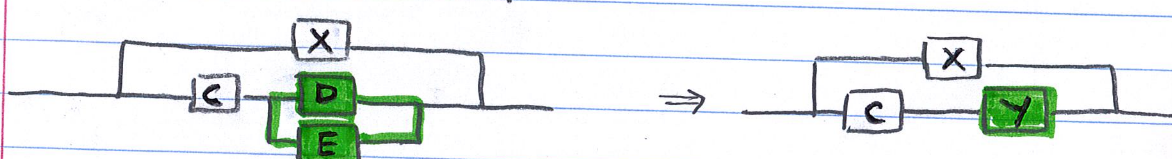
(1)



A, B are arranged in series — it works if both A and B work. Let's call this link X.

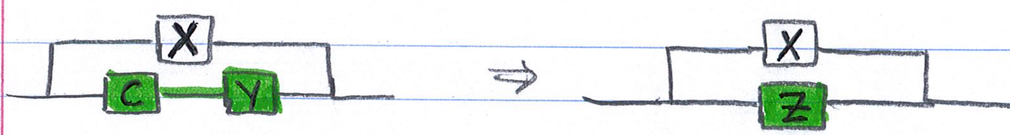
$$P(X) = P(A \cap B) \underset{\text{indep}}{=} P(A)P(B) = (0.92)^2 = 0.8464$$

(2)



D, E are arranged in parallel — it works if at least one works. Let's call this link Y.

$$P(Y) = P(\text{"at least one of D, E works"}) = P(D \text{ "or" } E) = P(D \cup E)$$
$$= 1 - P(\text{"neither D, E works"})$$
$$= 1 - P(\bar{D} \cap \bar{E})$$
$$\underset{\text{indep}}{=} 1 - [P(\bar{D})P(\bar{E})]$$
$$= 1 - [(1-0.92)^2]$$
$$= 0.9936$$

③ 

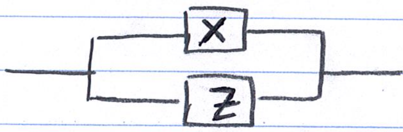
C, Y are arranged in series (both must work)
Let's call this link Z.

$P(Z) = P(C \cap Y)$ indep

$= P(C)P(Y)$

$= (0.92)(0.9936)$

$= 0.9141$

④ 

X, Z are arranged in parallel (at least one works)

P(sys works) = P(at least one of X, Z works)

$= P(X \text{ "or" } Z)$

$= P(X \cup Z)$

$= 1 - P(\bar{X} \cap \bar{Z})$

$= 1 - [P(\bar{X})P(\bar{Z})]$

$= 1 - [(1-0.8464)(1-0.9141)]$

$= 1 - [(0.1536)(0.0859)]$

$= 0.9868$

Reliability of system = 0.9868