Assignment 1
AI1110: Probability and Random Variables

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12.13.6.15 : Question. An electronic assembley consists of two subsystems,say A and B.From previous testing procedures, the following probabilities are assumed to be known:
p(A fails)=0.2
p(B alone fails)=0.15
p(A and B fails)=0.15
Evaluate the following probabilities
(i) p(A fails given B has failed)
(ii) p(A fails alone)
ans:
p(A fails given B has failed)=0.5
p(A fails alone)=0.05
Solution:
let:
A represent when subsystem A works
Similary **B** represent when subsystem B works
Given in question,
Probability that **A** fails $p(\mathbf{A}^c) = 0.2$
Probability that **B** fails alone $p(\mathbf{A} \cap \mathbf{B}^c t) = 0.15$
Probability that both **A** and **B** fail $p(\mathbf{A}^c \cap \mathbf{B}^c) = 0.15$
Now to find,
Probability that both **A** fails given **B** has failed $p(\mathbf{A}^c|\mathbf{B}^c)$ and Probability that **A** fails alone $p(\mathbf{B} \cap \mathbf{A}^c)$

To obtain $p(\mathbf{A}^c|\mathbf{B}^c)$
we know that,
$p(\mathbf{A}^c|\mathbf{B}^c) = p(\mathbf{A}^c \cap \mathbf{B}^c)/p(\mathbf{B}^c)$
to obtain $p(\mathbf{B}^c)$
let us use $p(\mathbf{A} \cap \mathbf{B}^c)$ *and* $p(\mathbf{A}^c \cap \mathbf{B}^c)$
we know that,
$p(\mathbf{B}^c) = p(\mathbf{A} \cap \mathbf{B}^c) + p(\mathbf{A}^c \cap \mathbf{B}^c)$
$= 0.15 + 0.15$
$p(\mathbf{B}^c) = 0.3$
now we have $p(\mathbf{B}^c)$ we can find $p(\mathbf{A}^c|\mathbf{B}^c)$
$p(\mathbf{A}^c|\mathbf{B}^c) = 0.15/0.3$
$p(\mathbf{A}^c|\mathbf{B}^c) = 0.5$

similiarly,
To obtain $p(\mathbf{B} \cap \mathbf{A}^c)$ we have to use $p(\mathbf{A}^c \cap \mathbf{B}^c)$ and $p(\mathbf{A}^c)$
we know that,
$p(\mathbf{B} \cap \mathbf{A}^c) = p(\mathbf{A}^c) - p(\mathbf{A}^c \cap \mathbf{B}^c)$
$= 0.2 - 0.15$
$p(\mathbf{B} \cap \mathbf{A}^c) = 0.05$