Quiz 3
ECE302, Division II
Spring 2013

3pts clarity + flow answer.
2pts answer. numeric.

Student Name:_____

Grader Name:_____ +1

Instructions: This is an open notes, open book, collaborative quiz. No Internet allowed.

Question: Let A be the event: "it is sunny today." The B be the event: "Joe ate cereal for breakfast today." Assume that A and B are independent events, and that P(A)=0.5 and P(B)=0.3. What is the probability that only one of these events (either A or B but not both) occurs? Carefully derive the answer, justifying every step along the way.

numeric!

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$P(\text{either A or B but not both}) = P((A \cap B^c) \cup (B \cap A^c))$

$= P(A \cap B^c) + P(B \cap A^c)$, by axiom III since $(A \cap B^c) \cap (B \cap A^c) = \phi$

but A and B^c are independent since

$P(\Omega \mid B) = 1$ by axiom II

$\Rightarrow P(A \cup A^c \mid B) = 1$

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$\Rightarrow P(A \mid B) + P(A^c \mid B) = 1$ since $A \cap A^c = \phi$

since A and B are independent

$\Rightarrow P(A) + P(A^c \mid B) = 1$

$\Rightarrow P(A^c \mid B) = 1 - P(A) = P(A^c)$

and similarly B and A^c are independent

Therefore $P(A \cap B^c) = P(A)P(B^c)$

$= P(A)(1 - P(B))$ (1)

$= 0.5\,(0.7)$

$= 0.35$

and $P(B \cap A^c) = P(B)P(A^c)$

$= P(B)(1 - P(A))$ (1)

$= 0.3\,(0.5)$

$= 0.15$

$\Rightarrow P(\text{either A or B but not both}) = \cancel{0.15}$ 0.5

Score: / 20