2. Set operations and probabilities

Problem Set due Feb 5, 2020 05:29 IST *Completed*

Problem 2. Set operations and probabilities

3/3 points (graded)

Find the value of $\mathbf{P}\left(A \cup (B^c \cup C^c)^c\right)$ for each of the following cases:

1. The events A, B, C are disjoint events and $\mathbf{P}(A) = 2/5$.

   $\mathbf{P}\left(A \cup (B^c \cup C^c)^c\right) =$ 2/5 ✔ **Answer:** 0.4

2. The events A and C are disjoint, and $\mathbf{P}(A) = 1/2$ and $\mathbf{P}(B \cap C) = 1/4$.

   $\mathbf{P}\left(A \cup (B^c \cup C^c)^c\right) =$ 3/4 ✔ **Answer:** 0.75

3. $\mathbf{P}\left(A^c \cap (B^c \cup C^c)\right) = 0.7$.

   $\mathbf{P}\left(A \cup (B^c \cup C^c)^c\right) =$ 0.3 ✔ **Answer:** 0.3

Solution:

1. Using de Morgan's law, we have $(B^c \cup C^c)^c = B \cap C = \emptyset$ so that

$$\mathbf{P}\left(A \cup (B^c \cup C^c)^c\right) = \mathbf{P}(A \cup \emptyset) = \mathbf{P}(A) = \boxed{2/5}.$$

2. Note that A and $B \cap C$ are disjoint. Therefore, using de Morgan's law again, together with the additivity axiom for two disjoint events, we have

$$\mathbf{P}\left(A \cup (B^c \cup C^c)^c\right) = \mathbf{P}\left(A \cup (B \cap C)\right) = \mathbf{P}\left(A\right) + \mathbf{P}\left(B \cap C\right) = \boxed{3/4}.$$

3. De Morgan's law implies that $\left(A^c \cap (B^c \cup C^c)\right)^c = A \cup (B^c \cup C^c)^c$, which is the event of interest. Therefore,

$$\mathbf{P}\left(A \cup (B^c \cup C^c)^c\right) = 1 - \mathbf{P}\left(A^c \cap (B^c \cup C^c)\right) = \boxed{0.3}.$$

Submit You have used 1 of 3 attempts

Answers are displayed within the problem

Discussion

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Topic: Unit 1: Probability models and axioms:Problem Set 1 / 2. Set operations and probabilities

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?	Q2. how do you know A and B is disjoint? In order to A and B intersection C are to be disjoint. I think we should know that A and B disjoint also. Ho...	4
☑	Question 1 Hi, Could someone explain why $B \cap C = \emptyset$?	3
☑	Why is there a no "Show answers" option after we submit all 3 times? There is no way to check the answer after submission to check if our logic was correct, why is this so?	3
💬	Submit button is not working I have filled the answers but submit button is not responding	3
💬	I struggled with this question I have been struggling with this question for over a day now, which videos would you suggest I review?	2
☑	Re: Question 3, not sure if the parameters set in section 2 are still applying in question 3 The parameters in question 2 must apply to question 3 as well, yes? Otherwise, it seems that there's not ...	9 new
?	Will we get the solution Hi All, Failed question #3, would like to be able to have the correct (step by step) procedure/answer, tha...	

? Question 3
In question 3 , since it is referring to an intersection, I cannot apply the additivity axiom. Therefore, how ... 2

? U/n notation
How do you type U and the upside down U (denoting intersection) in the answer boxes? 2

? Any clues on solving part 1?
I have tried to use all the properties/axioms. Not sure what am I missing. I am now stuck with an interse... 2

? decimal separator ? . or ,
Hello, on question 2, sub question 3 (value of P(A∪(B∪C∪C)c)). I was wondering if they might be a trick bet... 2

? Ok, I missed something.
Where was this discussed in the lectures? Lecture 1, section 10 'Simple properties of probabilities' seems... 6