



MITx: 6.041x Introduction to Probability - The Science of Uncertainty



Bookmarks

- ▶ Unit 0: Overview
- ▶ Entrance Survey
- ▶ Unit 1: Probability models and axioms
- ▶ Unit 2: Conditioning and independence
- ▶ Unit 3: Counting
- ▶ Unit 4: Discrete random variables
- ▼ Exam 1

Exam 1

Exam 1 due Mar 09, 2016 at
23:59 UTC



Exam 1 > Exam 1 > Exam 1 vertical4



Bookmark

Problem 4: Indicator random variables

(2/2 points)

Let A, B, C be three events and let $X = I_A, Y = I_B, Z = I_C$ be the associated indicator random variables. We already know that $X \cdot Y$ is the indicator random variable of the event $A \cap B$. In the same spirit, give an algebraic expression, involving X, Y, Z for the indicator random variable of the following events.

Note: Express your answers in terms of X, Y and Z (the answer box is case sensitive) using standard notation.

1. The event $A^c \cap C^c$

$(1-X)*(1-Z)$



Answer: $(1-X)*(1-Z)$

2. Exactly one of the events A, B, C occurred.

$X*(1-Y)*(1-Z) + (1-X)*Y*(1-Z) + (1-X)*(1-Y)*Z$



Answer: $1-(1-X)*(1-Y)*(1-Z)*(1-(1-X)*(Y)*(1-Z))*(1-(1-X)*(1-Y)*Z)$

- ▶ Unit 5: Continuous random variables
- ▶ Unit 6: Further topics on random variables
- ▶ Unit 7: Bayesian inference
- ▶ Exam 2
- ▶ Unit 8: Limit theorems and classical statistics

Answer:

1. The indicator variables for the events A^c and C^c are $1 - X$ and $1 - Z$, respectively. Therefore, we see that the indicator random variable for this event is: $(1 - X)(1 - Z)$

2. Exactly one of the events A, B, C occurred corresponds to the event:

$$\begin{aligned} & (A \cap B^c \cap C^c) \cup (A^c \cap B \cap C^c) \cup (A^c \cap B^c \cap C) \\ &= ((A \cap B^c \cap C^c)^c \cap (A^c \cap B \cap C^c)^c \cap (A^c \cap B^c \cap C)^c) \end{aligned}$$

In this form, we see that the indicator random variable for this event is:

$$1 - (1 - (X)(1 - Y)(1 - Z))(1 - (1 - X)(Y)(1 - Z))(1 - (X)(Y)(1 - Z))$$

.

Another possible method to solve this problem is to notice that the indicator random variable for the union of three disjoint events is the sum of the indicator variables of the three disjoint events. Therefore, the indicator random variable for this event is simply:

$$X(1 - Z)(1 - Y) + Y(1 - X)(1 - Z) + Z(1 - X)(1 - Y).$$

You have used 2 of 2 submissions



© edX Inc. All rights reserved except where noted. EdX, Open edX and the edX and Open EdX logos are registered trademarks or trademarks of edX Inc.

