M463 Homework 2

Enrique Areyan
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1.3.4 Let $\Omega = \{0, 1, 2\}$ be the outcome space in a model for tossing a coin twice and observing the total number of heads. Then:

a) **Yes**, the event that the coin does not land head both times is $E = \{0\}$

b) **Yes**, the event that on one toss the coin land heads and on the other toss it lands tails is $E = \{0\}$

c) **No**, since there is no notion of tosses order in Ω.

d) **Yes**, the event that the coin lands head at least once $E = \{1, 2\}$

1.3.10. Let A, B, and C be events defined in an outcome space. Then:

a)

$$\begin{aligned} P(\text{exactly two of } A, B, C \text{ occurs}) &= P(AB \text{ only or } AC \text{ only or } BC \text{ only}) \\ &= [P(AB) - P(ABC)] + [P(AC) - P(ABC)] + [P(BC) - P(ABC)] \\ &= \boxed{P(AB) + P(AC) + P(BC) - 3P(ABC)} \end{aligned}$$

b)

$$\begin{aligned} P(\text{exactly one of } A, B, C \text{ occurs}) &= P(A \text{ only or } B \text{ only or } C \text{ only}) \\ &= [P(A) - P(AB) - P(AC) + P(ABC)] \\ &+ [P(B) - P(AB) - P(BC) + P(ABC)] \\ &+ [P(C) - P(CB) - P(AC) + P(ABC)] \\ &= \boxed{P(A) + P(B) + P(C) - 2[P(AB) + P(AC) + P(BC)] + 3P(ABC)} \end{aligned}$$

c)

$$\begin{aligned} P(\text{none one of } A, B, C \text{ occurs}) &= 1 - P(\text{some event } A, B, C \text{ occurs}) \\ &= 1 - P(A \cup B \cup C) \\ &= 1 - [P(A) + P(B) + P(C) - P(AB) - P(AC) - P(BC) + P(ABC)] \\ &= \boxed{1 - P(A) - P(B) - P(C) + P(AB) + P(AC) + P(BC) - P(ABC)} \end{aligned}$$