Assignment 4

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Question: If A,B,C are three events associated with a random experiment,prove that

$$P(A+B+C) = P(A) + P(B) + P(C) - P(AB) - P(BC) - P(CA) + P(ABC) \quad (1)$$

Solution: Consider

$$E = B + C \quad (2)$$

$$P(A+B+C) = P(A+E) = P(A) + P(E) - P(AE) \quad (3)$$

$$P(E) = P(B+C) = P(B) + P(C) - P(BC) \quad (4)$$

$$AE = A(B+C) = (AB) + (AC) \quad (5)$$

$$P(AE) = P[(AB) + (AC)] = P(AB) + P(AC) - P[(AB)(AC)] \quad (6)$$

$$\Rightarrow P(AE) = P(AB) + P(AC) - P(ABC) \quad (7)$$

using equation(3) and equation(4) and equation(7)

$$P(A+B+C) = P(A) + P(B) + P(C) - P(AB) - P(BC) - P(CA) + P(ABC) \quad (8)$$

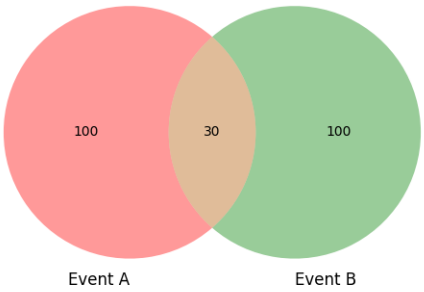

Fig. 1. By this figure generated by python code,we can verify equation (3) intutively

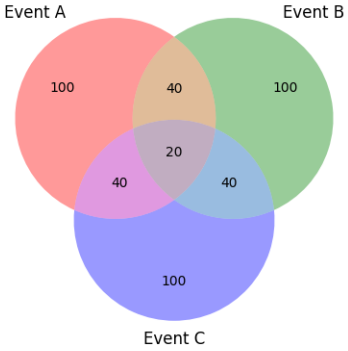

Fig. 2. By this figure generated by python code,we can verify equation (8) intutively