Assignment 1

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1) Check whether the following probabilities $\Pr(A)$ and $\Pr(B)$ are consistently defined
   a) $\Pr(A) = 0.5$, $\Pr(B) = 0.7$, $\Pr(A \cap B) = 0.6$
   b) $\Pr(A) = 0.5$, $\Pr(B) = 0.7$, $\Pr(A \cup B) = 0.8$

   Solution: To check whether the given probabilities are consistently defined, we check whether the following property holds correctly with the probability axioms

$$\Pr(A + B) = \Pr(A) + \Pr(B) - \Pr(AB) \quad (0.0.1)$$

   a) Given that

$$\Pr(A) = 0.5 \quad (0.0.2)$$
$$\Pr(B) = 0.7 \quad (0.0.3)$$
$$\Pr(AB) = 0.6 \quad (0.0.4)$$

   From (0.0.1) we get,

$$\Pr(A + B) = 0.5 + 0.7 - 0.6 \quad (0.0.5)$$
$$= 0.6 \quad (0.0.6)$$

   From (0.0.6) we have

$$0 \leq \Pr(A + B) \leq 1 \quad (0.0.7)$$

   Hence the given probabilities are consistently defined

   b) Given that

$$\Pr(A) = 0.5 \quad (0.0.8)$$
$$\Pr(B) = 0.7 \quad (0.0.9)$$
$$\Pr(A + B) = 0.8 \quad (0.0.10)$$

   From (0.0.1) we get,

$$\Pr(AB) = 0.5 + 0.7 - 0.8 \quad (0.0.11)$$
$$= 0.4 \quad (0.0.12)$$

   From (0.0.12) we have

$$0 \leq \Pr(AB) \leq 1 \quad (0.0.13)$$

   Hence the given probabilities are consistently defined