Cankaya University
ECE307 - Solution for Quiz-1 and Homework-1

October 3rd-7th, 2011

Show that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ for all $A, B \subseteq \Omega$ for which a probability law is assigned.

Solution:

$$P(A \cup B) = P(A) + P(A^c \cap B) \quad (1)$$
$$P(B) = P(A \cap B) + P(A^c \cap B) \quad (2)$$

Above equations directly follow from:
1. A and $A^c \cap B$ are disjoint sets,
2. $A \cap B$ and $A^c \cap B$ are disjoint sets, and
3. Axiom 3.

Subtracting (2) from (1), we get:

$$P(A \cup B) - P(B) = P(A) - P(A \cap B) \quad (3)$$
$$P(A \cup B) = P(A) + P(B) - P(A \cap B) \quad (4)$$