AI5002: Assignment 4

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latex codes from

https://github.com/96143/Assignment−4/blob/main/assignment%204.tex

1 Problem

If (A) and (B) are two events such that $P(A) = \frac{1}{4}$, $P(B) = \frac{1}{2}$ and $P(A \cap B) = \frac{1}{8}$, Find $P(\textit{not A and not B})$.

2 Solution

Given-

$$\begin{aligned} P(A) &= \frac{1}{4} \\ P(B) &= \frac{1}{2} \\ P(A \cap B) &= \frac{1}{8} \end{aligned} \tag{2.0.1}$$

To find - $P(\textit{not A and not B}) = P(A' \cap B')$
Using De-Morgan's Law

$$P(A' \cap B') = P(A \cup B)' \tag{2.0.2}$$

Also,

$$P(A \cup B)' = 1 - P(A \cup B) \tag{2.0.3}$$

Using the axiom of Probability

$$P(A \cup B) = P(A) + P(B) - P(A \cap B) \tag{2.0.4}$$

Using (2.0.1) in (2.0.4)

$$P(A \cup B) = \frac{1}{4} + \frac{1}{2} - \frac{1}{8} = \frac{5}{8} \tag{2.0.5}$$

Using (2.0.5) in (2.0.3)

$$P(A \cup B)' = 1 - \frac{5}{8} P(A \cup B)' = \frac{3}{8} \tag{2.0.6}$$

Hence,

$$P(A' \cap B') = \frac{3}{8}$$