PROBABILITY AND RANDOM VARIABLES
Assignment 1

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PROBLEM

Assigned Problem 6.9
If A and B are two events such that $A \subset B$ and $P(B) \neq 0$, then which of the following is correct?

1) $P\left(\frac{A}{B}\right) = \frac{P(B)}{P(A)}$
2) $P\left(\frac{A}{B}\right) < P(A)$
3) $P\left(\frac{A}{B}\right) \geq P(A)$
4) None of these

SOLUTION

We know that A is the subset of B.
$\Rightarrow$ Every element of A is an element of B.

$$\therefore A \cap B = A \qquad (0.0.1)$$

We know that

$$
\begin{aligned}
P\left(\frac{A}{B}\right) &= \frac{P(A \cap B)}{P(B)} \\
&= \frac{P(A)}{P(B)}
\end{aligned}
\qquad (0.0.2)
$$

Given $0 < P(B) \leq 1$

$$\Rightarrow \frac{1}{P(B)} \geq 1 \qquad (0.0.3)$$

By multiplying with P(A) on both sides of the inequality, we get

$$\frac{P(A)}{P(B)} \geq P(A) \qquad (0.0.4)$$

Using 0.0.2, we have

$$P\left(\frac{A}{B}\right) \geq P(A)$$

Therefore, option 3 is correct.