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Task 1. Consider two random events (A) and (B) defined for the same random experiment.

- ***Is it possible that (A) and (B) are independent and mutually exclusive (disjoint) at the same time? Explain your answer.***

Answer : yes, it is possible that A and B are both independent and mutually exclusive.

If A and B are *independent*, it must hold true that $P(A \cap B) = P(A) \cdot P(B)$

If A and B are *disjoint*, it must hold true that $P(A \cap B) = 0 \implies$ we obtain the equality

$$P(A \cap B) = P(A) \cdot P(B) = 0$$

\therefore it is possible when at least one of $\{A, B\} = 0$

- ***Does the answer change if given that $(P(A) > 0)$ and $(P(B) > 0)$? Explain your answer.***

Answer : yes, the answer changes, as the equality is violated

$$\implies P(A \cap B) = P(A) \cdot P(B) \neq 0 \mid P(A) > 0, P(B) > 0$$

\therefore under this restrictions events A and B cannot be both disjoint and independent at the same time by definition.