

Problems Using Both Addition and Multiplicative Laws

Data Science and A.I. Lecture Series

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- These laws are often used together to solve complex probability problems.

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- **Solution:**
- Let A : Husband is selected, B : Wife is selected.

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- Substitute values:

$$P(A \cup B) = \frac{2}{5} + \frac{1}{5} - \frac{2}{25} = \frac{10}{25} + \frac{5}{25} - \frac{2}{25} = \frac{13}{25}$$

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- A person X speaks the truth in 80
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- **Solution:**

- Let T_X : X speaks the truth, F_X : X lies.

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- A person X speaks the truth in 80
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- Let T_X : X speaks the truth, F_X : X lies.
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- Let T_Y : Y speaks the truth, F_Y : Y lies.
- The events where they contradict each other are:

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- The events where they contradict each other are:
 - X speaks the truth and Y lies: $P(T_X \cap F_Y)$.

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- The events where they contradict each other are:
 - X speaks the truth and Y lies: $P(T_X \cap F_Y)$.
 - X lies and Y speaks the truth: $P(F_X \cap T_Y)$.
- Calculate probabilities:

$$P(T_X) = 0.8, \quad P(F_X) = 0.2, \quad P(T_Y) = 0.9, \quad P(F_Y) = 0.1$$

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- $P(T_X \cap F_Y) = P(T_X) \cdot P(F_Y) = 0.8 \cdot 0.1 = 0.08$.

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- $P(T_X \cap F_Y) = P(T_X) \cdot P(F_Y) = 0.8 \cdot 0.1 = 0.08$.
- $P(F_X \cap T_Y) = P(F_X) \cdot P(T_Y) = 0.2 \cdot 0.9 = 0.18$.

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- $P(F_X \cap T_Y) = P(F_X) \cdot P(T_Y) = 0.2 \cdot 0.9 = 0.18$.
- Total probability of contradiction:

$$P(T_X \cap F_Y) + P(F_X \cap T_Y) = 0.08 + 0.18 = 0.26$$

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$$P(T_X \cap F_Y) + P(F_X \cap T_Y) = 0.08 + 0.18 = 0.26$$

- **Answer:**

- The probability that they contradict each other is 0.26.

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