

## 비복원추출한 표본의 표본평균의 평균과 분산과 표준편차

(Mean and Variance and and Standard Deviation of Sample Mean of Samples without Replacement)

# Mean and Variance and Standard Deviation of Sample Mean of Samples without Replacement

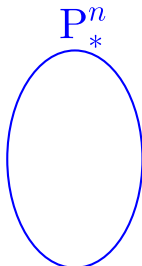
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# Mean and Variance and Standard Deviation of Sample Mean of Samples without Replacement

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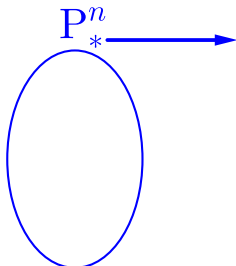


$$P_*^n = \{(a_{i_1}, \dots, a_{i_n}) | a_{i_j} \in P \text{ and } a_{i_j} \neq a_{i_{j_2}} \text{ if } j_1 \neq j_2\}$$

# Mean and Variance and Standard Deviation of Sample Mean of Samples without Replacement

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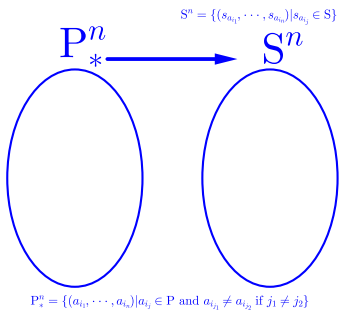


$$P_*^n = \{(a_{i_1}, \dots, a_{i_n}) | a_{i_j} \in P \text{ and } a_{i_j} \neq a_{i_{j_2}} \text{ if } j_1 \neq j_2\}$$

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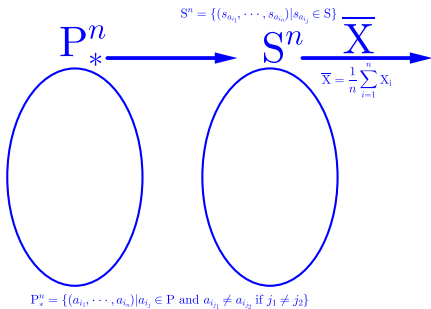
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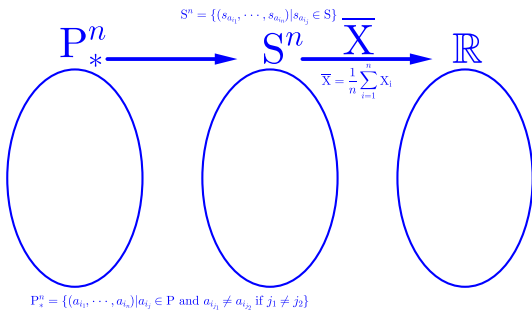
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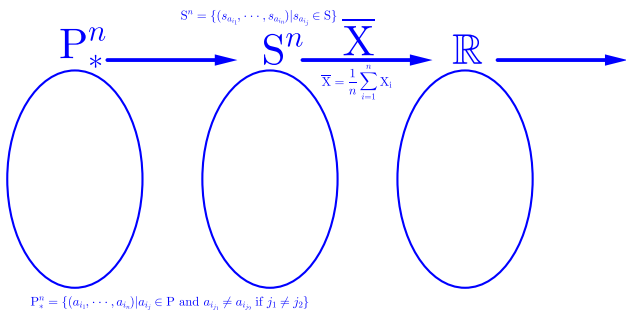
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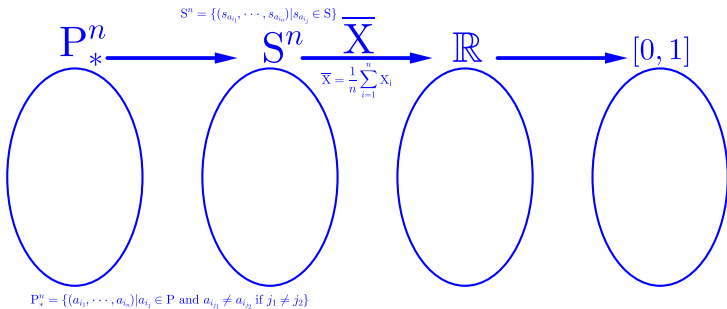




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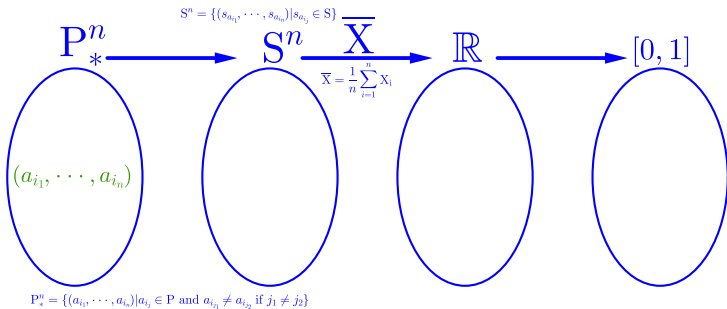
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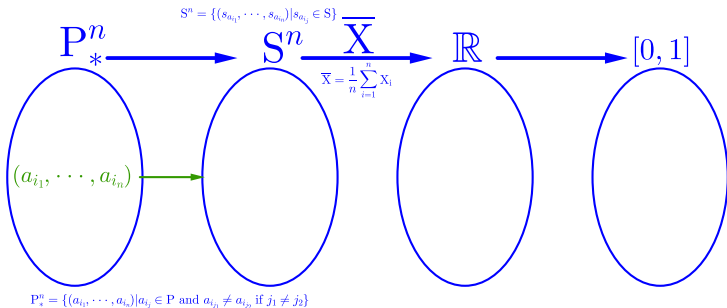
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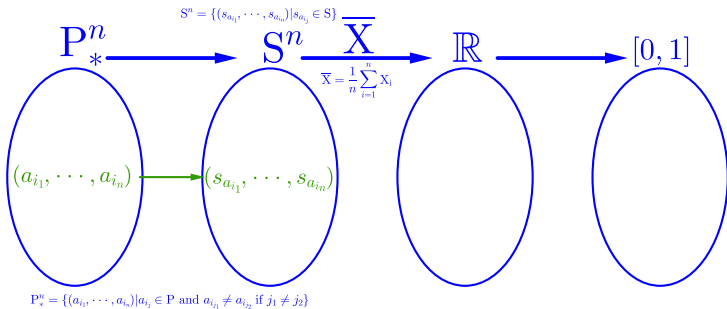
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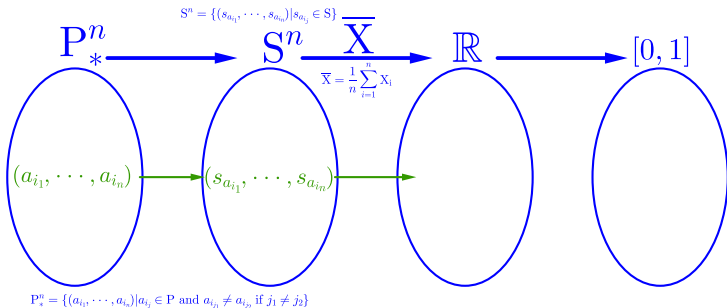
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# Mean and Variance and Standard Deviation of Sample Mean of Samples without Replacement

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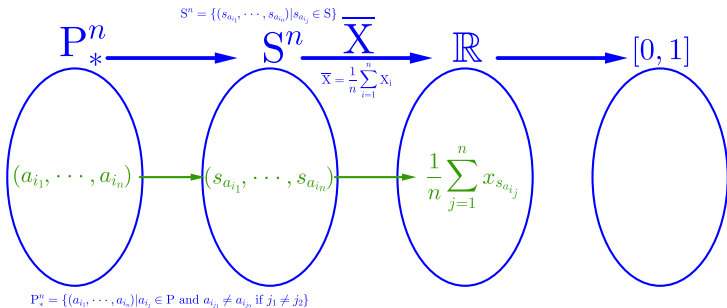
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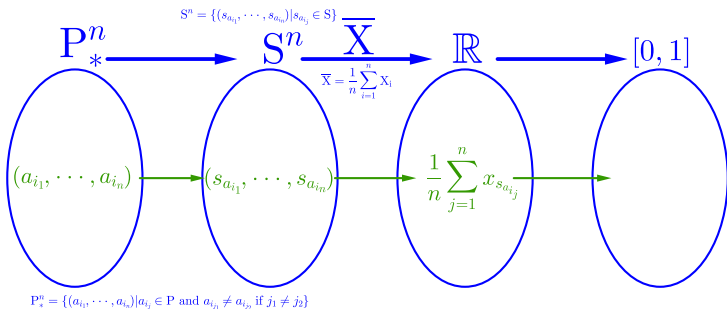
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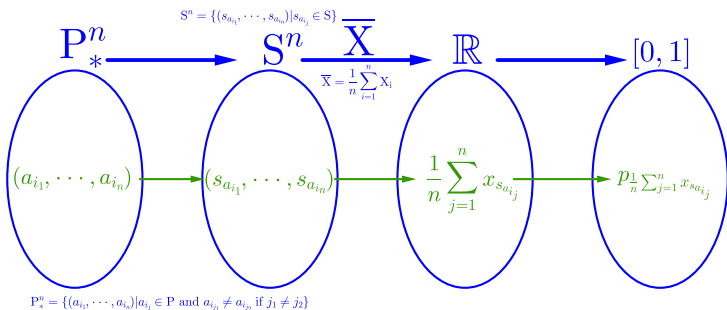
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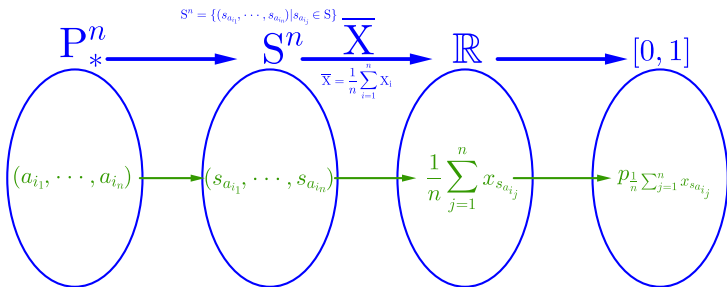




# Mean and Variance and Standard Deviation of Sample Mean of Samples without Replacement

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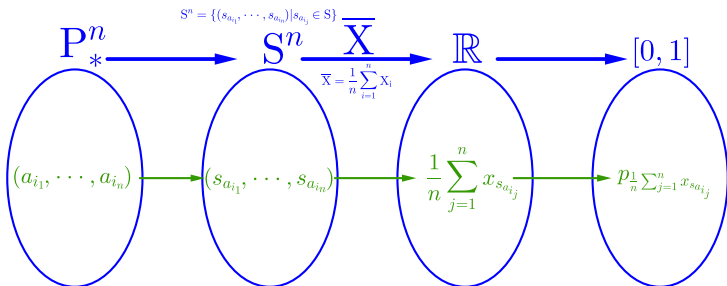
$$P^* = \{(a_{i_1}, \dots, a_{i_n}) | a_{i_j} \in P \text{ and } a_{i_j} \neq a_{i_{j_2}} \text{ if } j_1 \neq j_2\}$$

$$E(\bar{X})$$

# Mean and Variance and Standard Deviation of Sample Mean of Samples without Replacement

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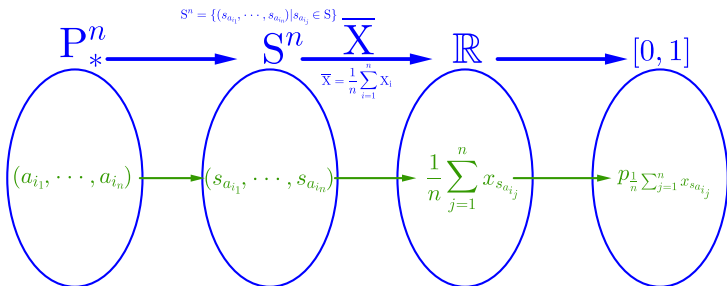
$$P_*^n = \{(a_{i_1}, \dots, a_{i_n}) | a_{i_j} \in P \text{ and } a_{i_j} \neq a_{i_{j_2}} \text{ if } j_1 \neq j_2\}$$

$$E(\bar{X}) = \sum \bar{x} \cdot p_{\bar{x}}$$
$$\bar{x} \in \bigcup_{(a_{i_1}, \dots, a_{i_n}) \in P_*^n} \left\{ \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \right\}$$

# Mean and Variance and Standard Deviation of Sample Mean of Samples without Replacement

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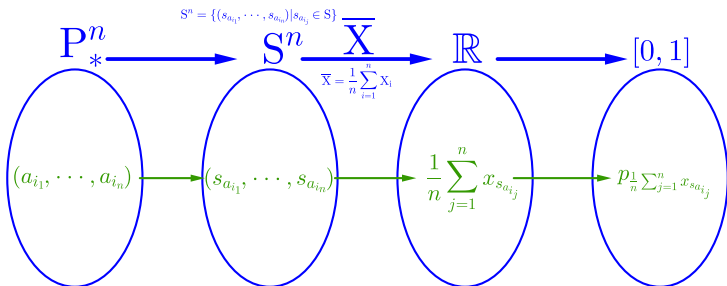


$$\begin{aligned}
 P_n^* &= \{(a_{i_1}, \dots, a_{i_n}) | a_{i_j} \in P \text{ and } a_{i_j} \neq a_{i_{j_2}} \text{ if } j_1 \neq j_2\} \\
 E(\bar{X}) &= \sum_{\substack{\bar{x} \in \bigcup_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left\{ \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \right\} \\ (a_{i_1}, \dots, a_{i_n}) \in P_n^*}} \bar{x} \cdot p_{\bar{x}} = \sum_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left( \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \times \frac{1}{N P_n} \right)
 \end{aligned}$$

# Mean and Variance and Standard Deviation of Sample Mean of Samples without Replacement

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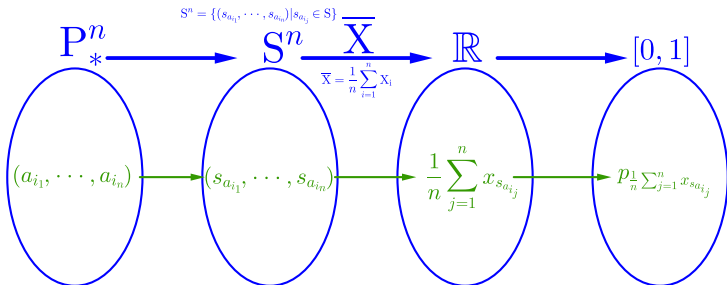
$$E(\bar{X}) = \sum_{\substack{\bar{x} \in \bigcup_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left\{ \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \right\} \\ (a_{i_1}, \dots, a_{i_n}) \in P_n^*}} \bar{x} \cdot p_{\bar{x}} = \sum_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left( \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \times \frac{1}{N P_n} \right)$$

$$E(\bar{X}^2)$$

# Mean and Variance and Standard Deviation of Sample Mean of Samples without Replacement

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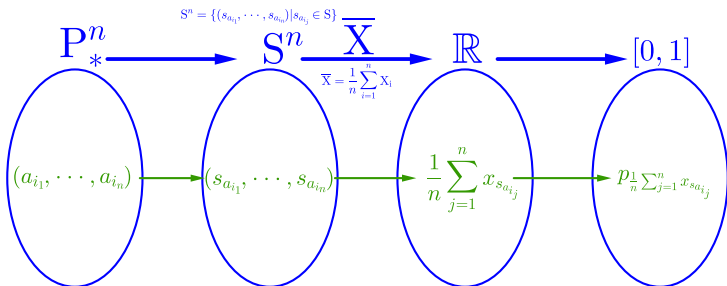
$$P_n^* = \{(a_{i_1}, \dots, a_{i_n}) | a_{i_j} \in P \text{ and } a_{i_j} \neq a_{i_{j_2}} \text{ if } j_1 \neq j_2\}$$
$$E(\bar{X}) = \sum_{\substack{\bar{x} \in \bigcup_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left\{ \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \right\}}} \bar{x} \cdot p_{\bar{x}} = \sum_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left( \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \times \frac{1}{NP_n} \right)$$

$$E(\bar{X}^2) = \sum_{\substack{\bar{x} \in \bigcup_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left\{ \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \right\}}} \bar{x}^2 \cdot p_{\bar{x}}$$

# Mean and Variance and Standard Deviation of Sample Mean of Samples without Replacement

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$$P_n^* = \{(a_{i_1}, \dots, a_{i_n}) | a_{i_j} \in P \text{ and } a_{i_j} \neq a_{i_{j_2}} \text{ if } j_1 \neq j_2\}$$

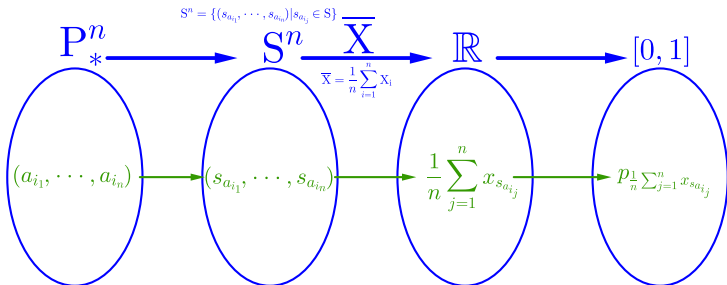
$$E(\bar{X}) = \sum_{\substack{\bar{x} \in \bigcup_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left\{ \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \right\}}} \bar{x} \cdot p_{\bar{x}} = \sum_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left( \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \times \frac{1}{NP_n} \right)$$

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$$E(\bar{X}) = \sum_{\substack{\bar{x} \in \bigcup_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left\{ \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \right\}}} \bar{x} \cdot p_{\bar{x}} = \sum_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left( \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \times \frac{1}{NP_n} \right)$$

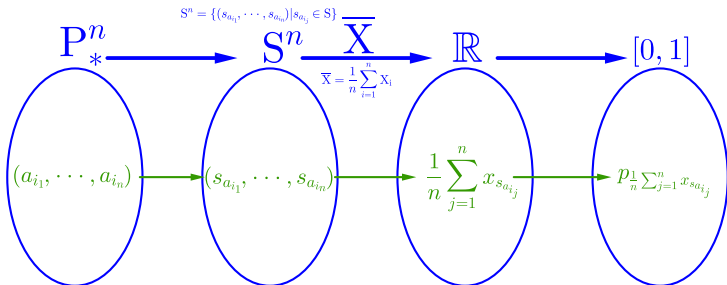
$$E(\bar{X}^2) = \sum_{\substack{\bar{x} \in \bigcup_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left\{ \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \right\}}} \bar{x}^2 \cdot p_{\bar{x}} = \sum_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left\{ \left( \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \right)^2 \times \frac{1}{NP_n} \right\}$$

$$V(\bar{X})$$

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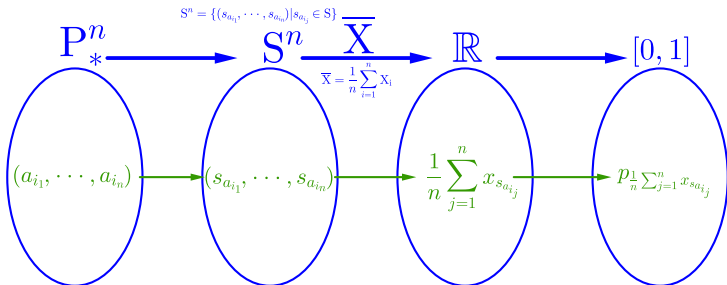
$$V(\bar{X}) = E(\bar{X}^2) - \{E(\bar{X})\}^2$$



# Mean and Variance and Standard Deviation of Sample Mean of Samples without Replacement

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$$P_n^* = \{(a_{i_1}, \dots, a_{i_n}) | a_{i_j} \in P \text{ and } a_{i_j} \neq a_{i_{j_2}} \text{ if } j_1 \neq j_2\}$$

$$E(\bar{X}) = \sum_{\substack{\bar{x} \in \bigcup_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left\{ \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \right\}}} \bar{x} \cdot p_{\bar{x}} = \sum_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left( \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \times \frac{1}{NP_n} \right)$$

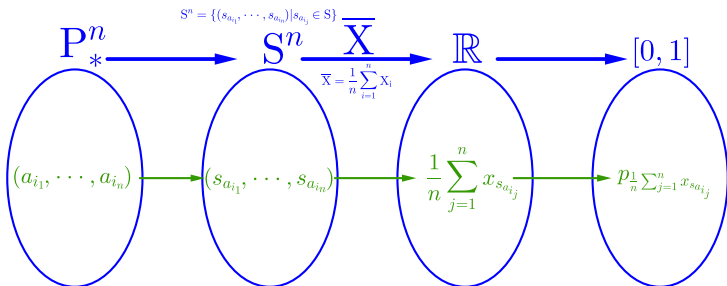
$$E(\bar{X}^2) = \sum_{\substack{\bar{x} \in \bigcup_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left\{ \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \right\}}} \bar{x}^2 \cdot p_{\bar{x}} = \sum_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left\{ \left( \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \right)^2 \times \frac{1}{NP_n} \right\}$$

$$V(\bar{X}) = E(\bar{X}^2) - \{E(\bar{X})\}^2 \quad \sigma(\bar{X})$$

# Mean and Variance and Standard Deviation of Sample Mean of Samples without Replacement

▶ Start

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$$E(\bar{X}) = \sum_{\substack{\bar{x} \in \bigcup_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left\{ \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \right\}}} \bar{x} \cdot p_{\bar{x}} = \sum_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left( \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \times \frac{1}{NP_n} \right)$$

$$E(\bar{X}^2) = \sum_{\substack{\bar{x} \in \bigcup_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left\{ \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \right\}}} \bar{x}^2 \cdot p_{\bar{x}} = \sum_{(a_{i_1}, \dots, a_{i_n}) \in P_n^*} \left\{ \left( \frac{1}{n} \sum_{j=1}^n x_{s_{a_{i_j}}} \right)^2 \times \frac{1}{NP_n} \right\}$$

$$V(\bar{X}) = E(\bar{X}^2) - \{E(\bar{X})\}^2 \quad \sigma(\bar{X}) = \sqrt{V(\bar{X})}$$

# Mean and Variance and Standard Deviation of Sample Mean of Samples without Replacement

Github:

<https://min7014.github.io/math20230703001.html>

Click or paste URL into the URL search bar,  
and you can see a picture moving.