Properties of the Sampling Distribution of $\bar{x}$

x	$P(x)$	$x\,P(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 P(x)$
0	1/4	0	−6	36	36/4
6	1/4	6/4	0	0	0
9	1/2	9/2	3	9	9/2
		6			27/2

$$\mu = \sum \left[x\,P(x) \right] = 0 * \tfrac{1}{4} + 6 * \tfrac{1}{4} + 9 * \tfrac{1}{2} = 6$$

$$\sigma^2 = \sum \left[(x-\mu)^2 \cdot P(x) \right] = 27/2$$

$\bar{x}$	$P(\bar{x})$	$\bar{x}\,P(\bar{x})$	$\bar{x}-\mu_{\bar{x}}$	$(\bar{x}-\mu_{\bar{x}})^2$	$(\bar{x}-\mu_{\bar{x}})^2 P(\bar{x})$
0	1/64	0	−6	36	36/64
2	3/64	6/64	−4	16	16 × 3/64
3	6/64	18/64	−3	9	9 × 6/64
4	3/64	12/64	−2	4	4 × 3/64
5	12/64	60/64	−1	1	1 × 12/64
6	13/64	78/64	0	0	0
7	6/64	42/64	1	1	1 × 6/64
8	12/64	96/64	2	4	4 × 12/64
9	8/64	72/64	3	9	9 × 8/64
		6			9/2

Property #1

$$\mu = \mu_{\bar{x}}$$

Property #2

$$\sigma_{\bar{x}}^2 = \frac{\sigma^2}{n}$$

$$\mu_{\bar{x}} = \sum \left[\bar{x}\,P(\bar{x}) \right] = \cdots = 6$$

$$\sigma_{\bar{x}}^2 = \sum \left[(\bar{x}-\mu_{\bar{x}})^2 P(\bar{x}) \right] = 9/2$$

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THE CENTRAL LIMIT THEOREM

Let's say we take random samples of size n from a population with mean μ and standard deviation σ

When n is "sufficiently large", the sampling distribution of $\bar{x}$ will be "approximately" normal with mean μ and standard deviation $\sigma_{\bar{x}} = \sigma/\sqrt{n}$. The larger the sample size, the better the normal approximation

Original Population	Sampling Distribution of $\bar{x}$ for $n = 3$	Sampling Distribution of $\bar{x}$ for $n = 10$	Sampling Distribution of $\bar{x}$ for $n = 30$