Lecture 16 Sampling Distribution And The Central Limit Theorem, part II

BIO210 Biostatistics

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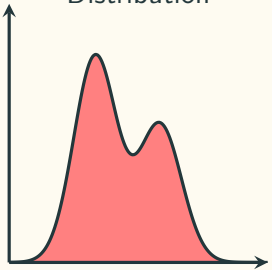
Three Distributions

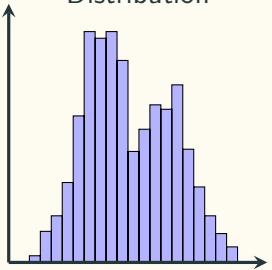
Population Distribution



Population parameters

$\mu,\ \sigma^2, \sigma$

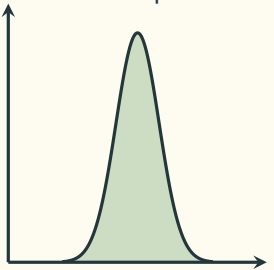
Sample Distribution



Sample statistics

$\bar{x},\ s^2, s$

Sampling Distribution of The Sample Mean

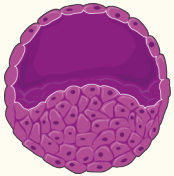


Parameters

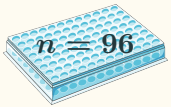
$\mu_{\bar{X}},\ \sigma^2_{\bar{X}}, \sigma_{\bar{X}}$

Practice: $Oct4$ Expression

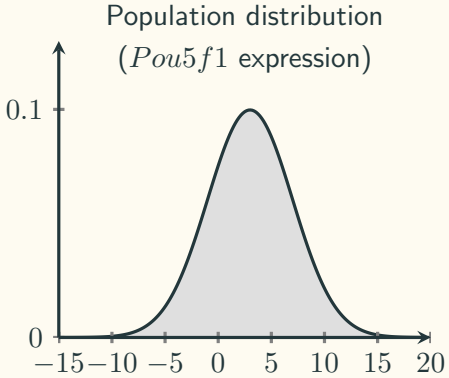
Based on the previous research, the expression of $Pou5f1$ in all ES cells follow a normal distribution with $\mu = 3$ and $\sigma^2 = 4^2$.



$P(x \geqslant 8)$?

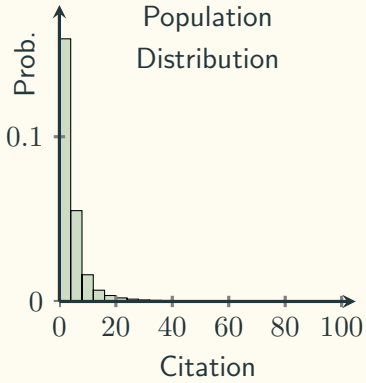


$P(\bar{x} \geqslant 3.8)$?



Citations of publications

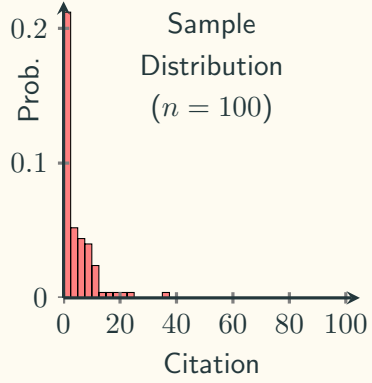
A simple proposal for the publication of journal citation distributions:
https://www.biorxiv.org/content/10.1101/062109v1



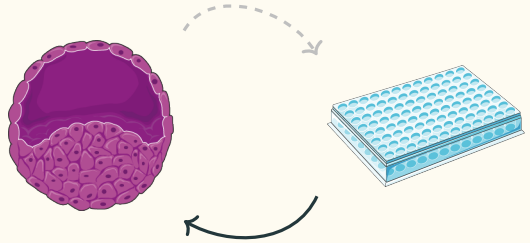
100 papers

$P(x \geqslant 20) = ?$

$P(5 \leqslant \bar{x} \leqslant 6) = ?$



Estimation



Use info. from the sample
to do a point estimation

Population parameter

μ, σ^2

Sample statistics

$\bar{x}, s^2$

- **Estimator**

$$\bar{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$$

$$S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(X_i - \bar{X})^2$$

- **Estimate**

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

$$s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2$$

Unbiased Estimator

We say the following estimators are unbiased estimators:

$$\bar{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$$

$$S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(X_i - \bar{X})^2$$

Because:

$$E[\bar{X}] = \mu$$

$$E[S^2] = \sigma^2$$