

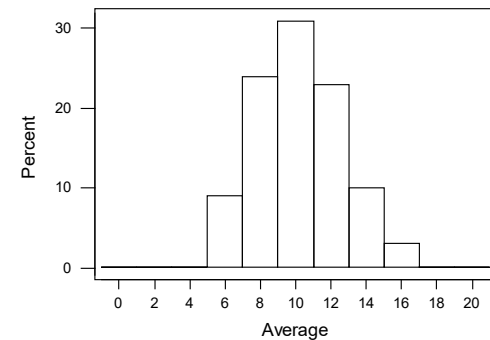
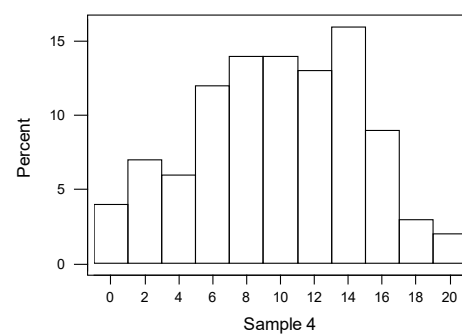
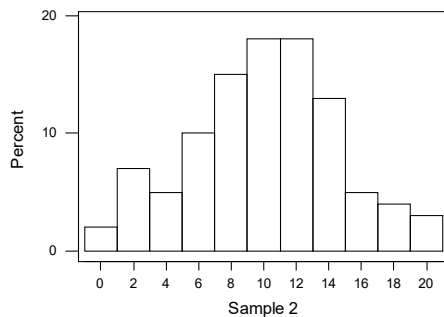
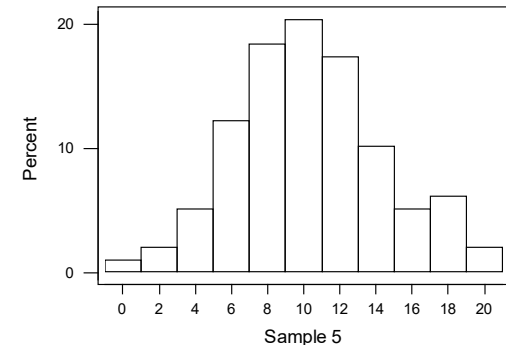
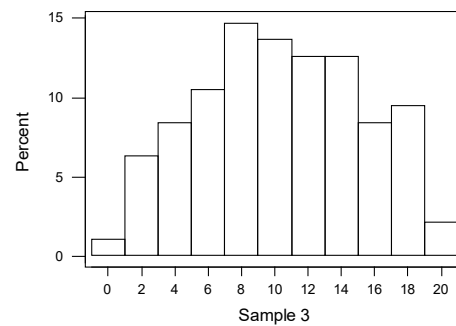
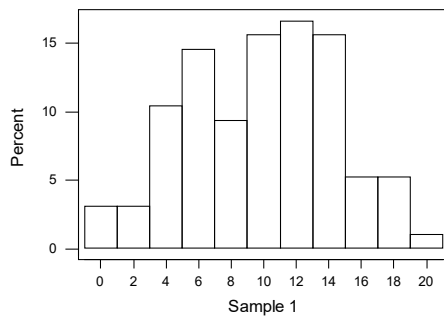
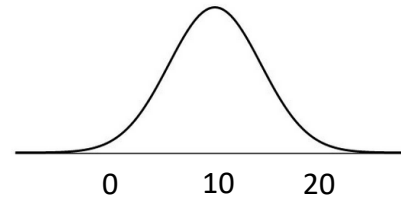
# Parameters and Statistics

## SAMPLING DISTRIBUTION

The **sampling distribution** of a statistic is the distribution of values taken by the statistic in all possible samples of the same size from the same population.

# Sampling Distribution of a Sample Mean

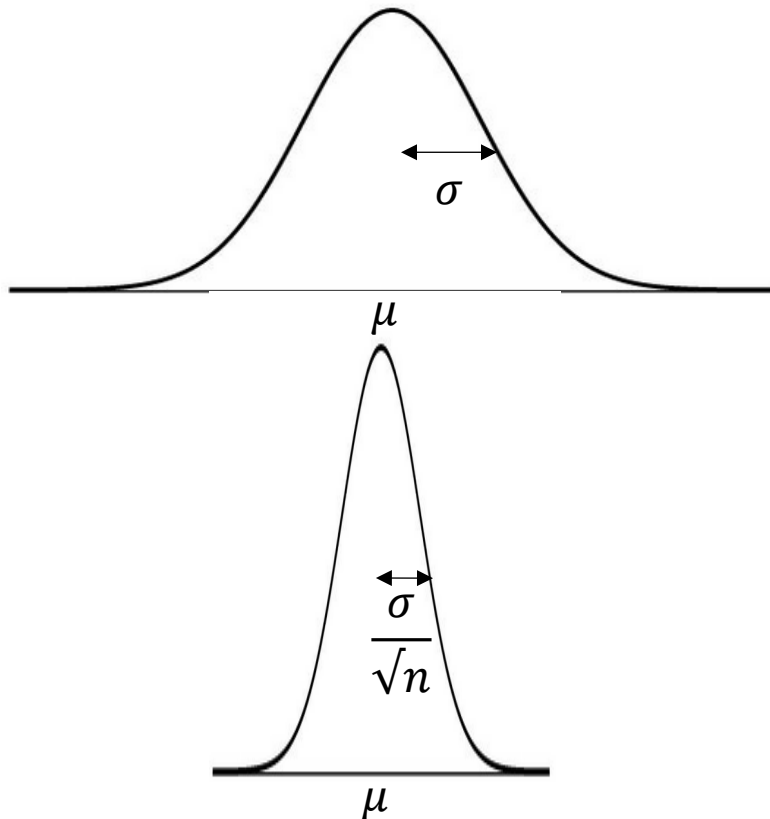
5 samples from an  $N(10,5)$  distribution



# Sampling Distribution of a Sample Mean

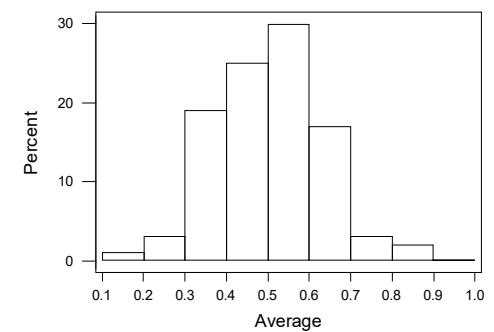
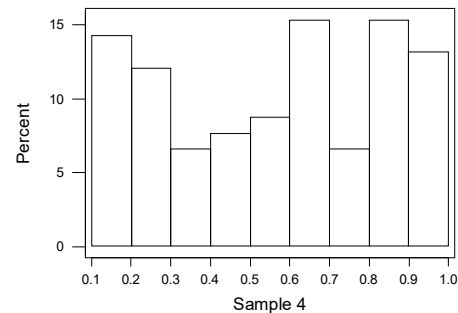
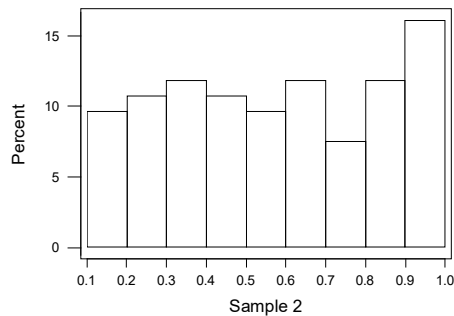
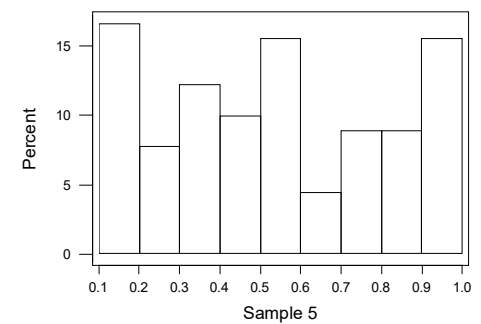
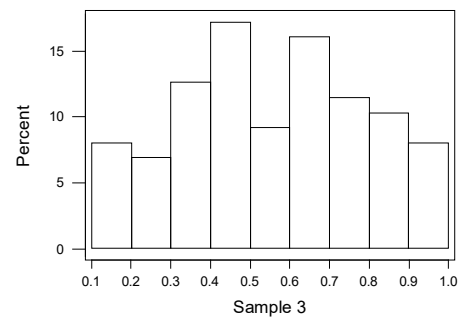
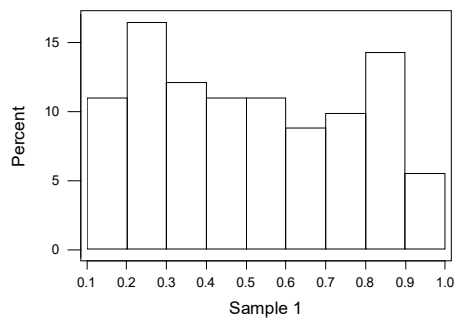
## SAMPLING DISTRIBUTION OF A SAMPLE MEAN

If a population has the  $N(\mu, \sigma)$  distribution, then the sample mean  $\bar{x}$  of  $n$  independent observations has the  $N(\mu, \sigma/\sqrt{n})$  distribution.



# Sampling Distribution of a Sample Mean

5 samples from a  $U(0,1)$  distribution



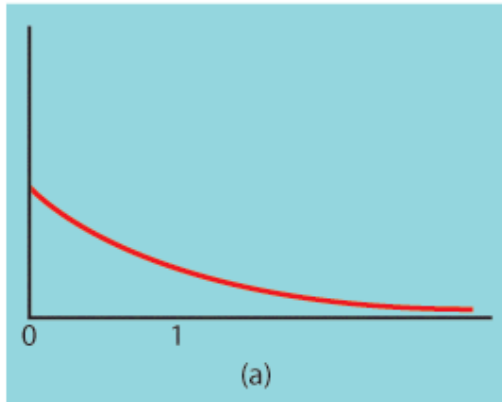
# The Central Limit Theorem

## CENTRAL LIMIT THEOREM

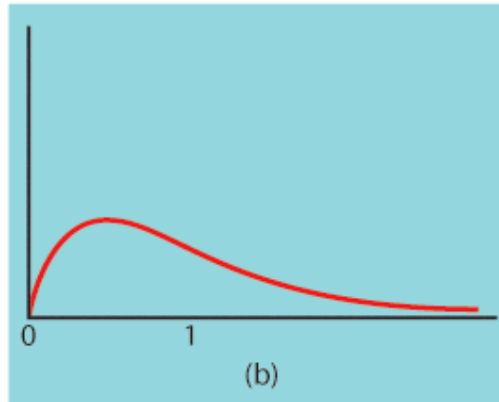
Draw an SRS of size  $n$  from any population with mean  $\mu$  and finite standard deviation  $\sigma$ . When  $n$  is large, the sampling distribution of the sample mean  $\bar{x}$  is approximately Normal:

$$\bar{x} \text{ is approximately } N\left(\mu, \frac{\sigma}{\sqrt{n}}\right)$$

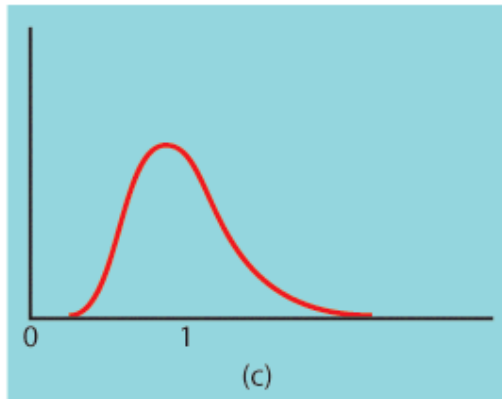
Population with  
strongly skewed  
distribution



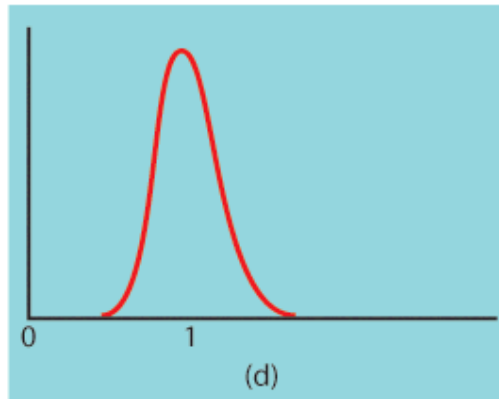
Sampling  
distribution of  
 $\bar{x}$  for  $n = 2$   
observations



Sampling  
distribution of  
 $\bar{x}$  for  $n = 10$   
observations



Sampling  
distribution of  
 $\bar{x}$  for  $n = 25$   
observations



# How Large Should $n$ Be?

It depends on the population distribution. More observations are required if the population distribution is far from normal.

- A sample size of 25 is generally enough to obtain a normal sampling distribution from a strong skewness or even mild outliers.
- A sample size of 40 will typically be good enough to overcome extreme skewness and outliers.