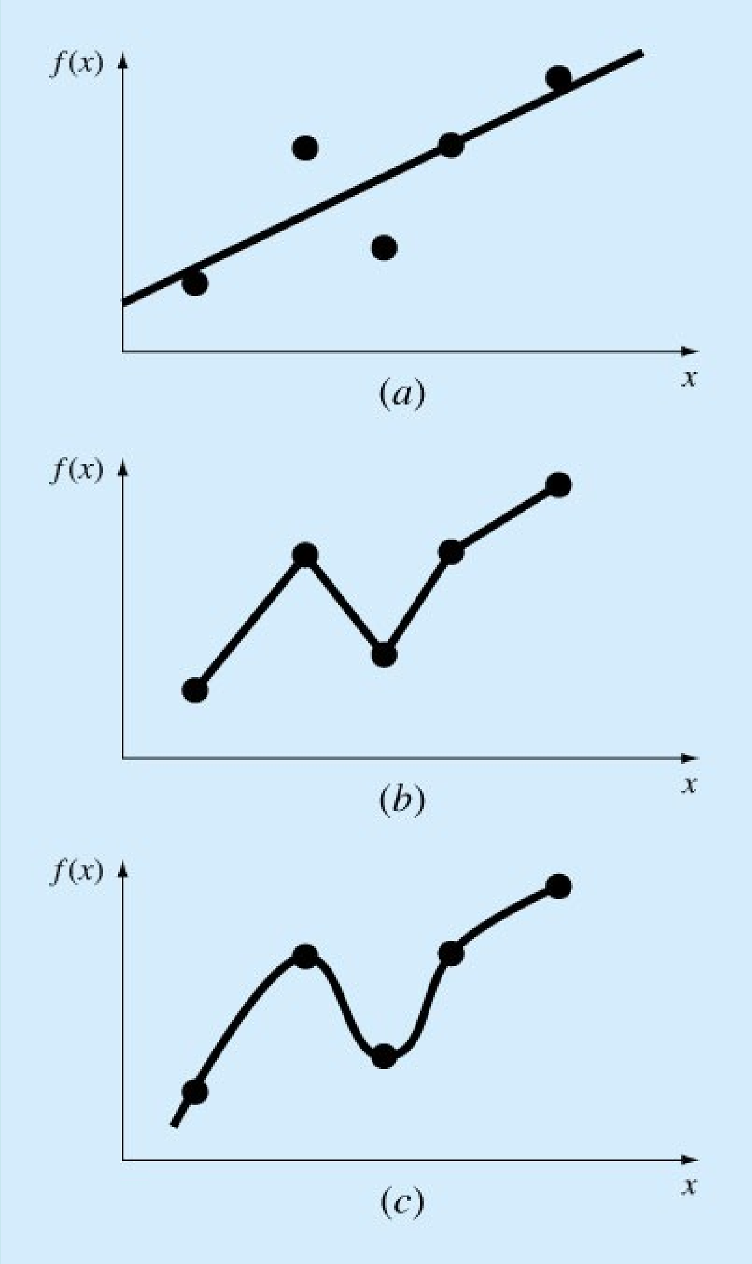
CURVE FITTING

- Describes techniques to fit curves (*curve fitting*) to discrete data to obtain intermediate estimates.

- There are two general approaches two curve fitting:
  - *Data exhibit a significant degree of scatter*. The strategy is to derive a single curve that represents the general trend of the data.
  - *Data is very precise.* The strategy is to pass a curve or a series of curves through each of the points.

- In engineering two types of applications are encountered:
  - Trend analysis. Predicting values of dependent variable, may include extrapolation beyond data points or interpolation between data points.
  - Hypothesis testing. Comparing existing mathematical model with measured data.

Figure:



Mathematical Background

Simple Statistics/

- In course of engineering study, if several measurements are made of a particular quantity, additional insight can be gained by summarizing the data in one or more well chosen statistics that convey as much information as possible about specific characteristics of the data set.
- These descriptive statistics are most often selected to represent
  - The location of the center of the distribution of the data,
  - The degree of spread of the data.

- *Arithmetic mean*. The sum of the individual data points (yi) divided by the number of points (n).

$$\bar{y} = \frac{\sum y_i}{n}$$
$$i = 1, \ldots, n$$

- *Standard deviation*. The most common measure of a spread for a sample.

$$S_y = \sqrt{\frac{S_t}{n-1}}$$
$$S_t = \sum (y_i - \bar{y})^2$$

or

$$S_y^2 = \frac{\sum y_i^2 - \left(\sum y_i\right)^2 / n}{n-1}$$

- *Variance*. Representation of spread by the square of the standard deviation.

$$S_y^2 = \frac{\sum (y_i - \bar{y})^2}{n-1}$$

Degrees of freedom

- *Coefficient of variation*. Has the utility to quantify the spread of data.

$$c.v. = \frac{S_y}{\bar{y}} 100\%$$

Figure :

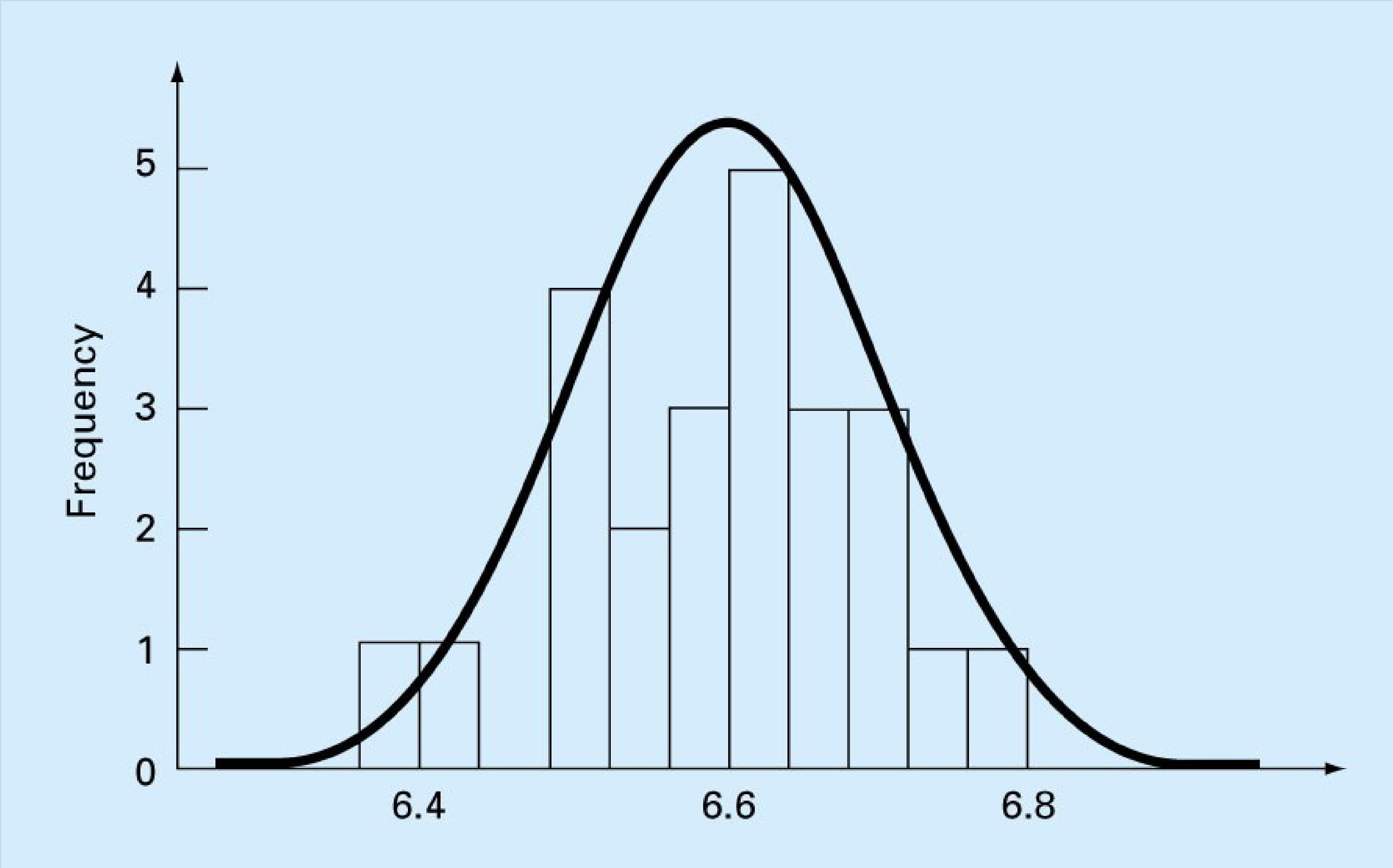
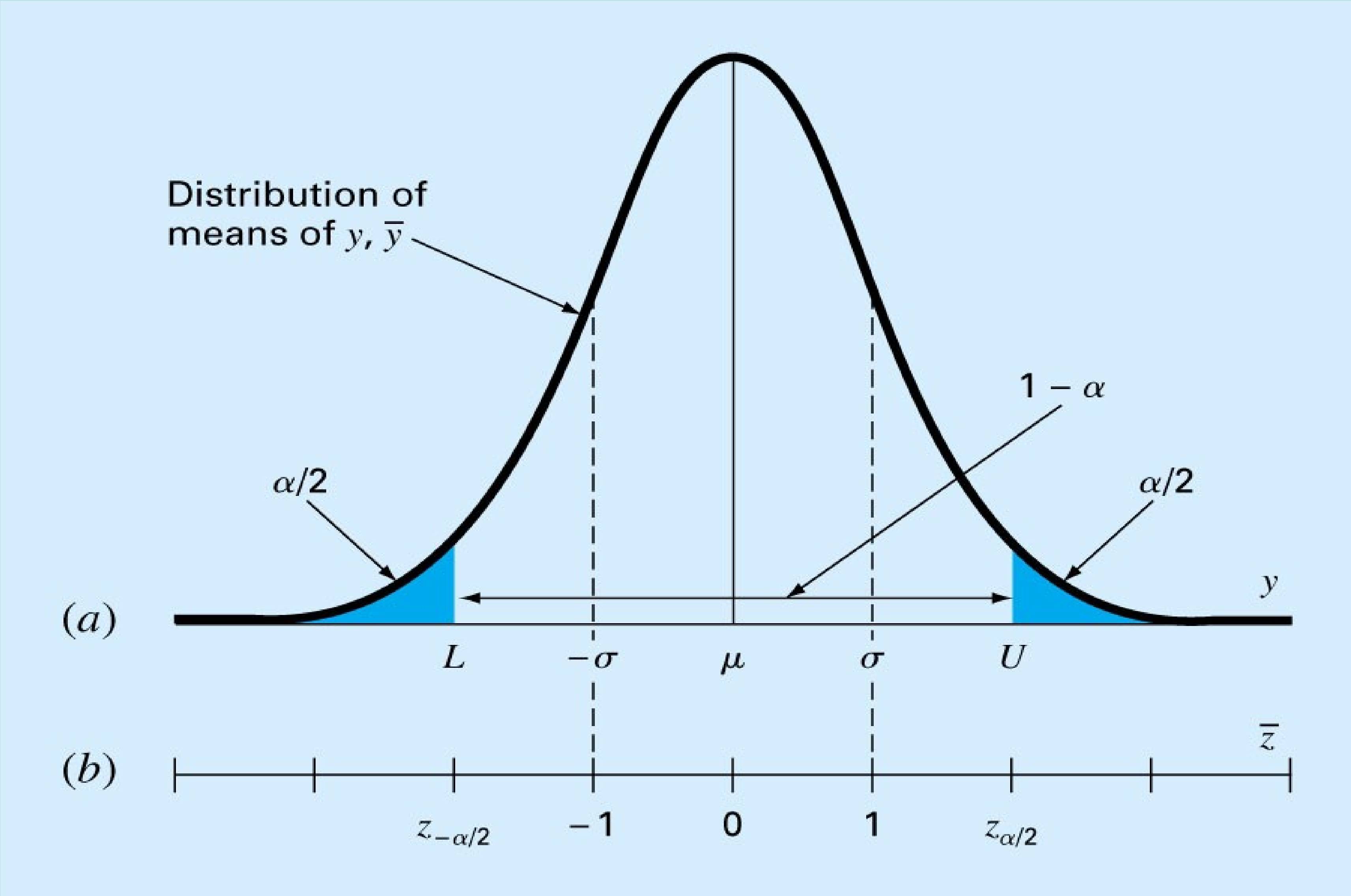


Figure :


Distribution of
means of y, $\bar{y}$
1 − α
α/2
α/2
y
(a)
L
−σ
μ
σ
U
$\bar{z}$
(b)
$z_{-\alpha/2}$
−1
0
1
$z_{\alpha/2}$