### M E 345

#### Today, we will:

- Do a review example problem PDFs
- Review the pdf module: The Gaussian or Normal Probability Density Function
- Do some example problems Gaussian PDFs and probability estimates

### **Example: PDFs**

**Given**: A sample consists of 1000 length measurements. The sample mean is 53.65 cm and the sample standard deviation is 1.25 cm. 136 measurements lie between  $55.0 < x \le 57.0$  cm.

### To do:

(a) Estimate the probability (%) that a length measurement lies between 55.0 and 57.0 cm.

(b) Calculate the transformed variables  $z_1$  at  $x_1 = 55.0$  cm and  $z_2$  at  $x_2 = 57.0$  cm.

(c) Discuss why it is useful to transform from f(x) to f(z).

**Example: Confidence level** 

**Given**: Many voltage readings are taken from a power supply.

- The sample mean voltage reading is  $\overline{V} = 10.12 \text{ V}$
- The sample standard deviation of all the readings is 0.022 V
- We assume that the errors in the readings are purely random

**To do**: Write the voltage to 95% confidence level.

Solution:

### **Example: Probability – exam scores**

**Given**: In one of Professor Cimbala's midterm exams, the mean was 73.6 (out of 100 possible points) and the standard deviation was 9.2. We assume that the distribution of exam scores is Gaussian. The cutoff grade for a D is 60 points.

**To do**: Predict the percentage of students who failed the exam (score < 60 points).

**Example: Probability** 

**Given**: 100 velocity measurements are taken in a wind tunnel.

- The sample mean velocity is  $\overline{V} = 5.126$  m/s
- The sample standard deviation of all the readings is 0.0690 m/s
- We assume that the errors in the readings are purely random

(*a*) To do: Calculate the probability that the velocity of a random measurement is in the range 5.126 m/s < V < 5.200 m/s. In other words, calculate P(5.126 < V < 5.200).

(*b*) To do: Calculate the probability that the velocity of a random measurement is in the range 5.000 m/s < V < 5.200 m/s. In other words, calculate P(5.000 < V < 5.200).

#### **Example: PDFs**

Given: A sample consists of 400 voltage measurements. The sample mean is 35.52 V and the sample standard deviation is 1.84 V. There are 7 measurements in the bin  $39.0 < x \le 39.5$  V.

# To do:

(a) Estimate the probability (%) that a voltage measurement lies between 39.0 and 39.5 V.

(b) Calculate the transformed variable z at the midpoint of this bin, i.e., at x = 39.25 V.

(c) Calculate f(z) at x = 39.25 V.

(*d*) Compare the answer to Part (c) with the analytical prediction of f(z) at x = 39.25 V for a Gaussian (normal) pdf.