Problem Set 2
Due Tuesday, January 28, 2003
Reading Assignment: Textbook pp. 44 - 60

1. Figure 1 shows a sketch of a mercury-in-glass thermometer. Based upon this sketch, can you estimate the sensitivity, range, resolution, and precision of the instrument? The sensor in the drawing is shown in actual size, so sensitivity can be presented as a linear displacement as a function of temperature.

2. An analog-to-digital converter is used to digitize a biomedical signal. The highest frequency component of the signal was determined by performing a power spectral analysis of the signal at the input to the analog-to-digital converter. It was found to be 85 Hz.

    a. What is the theoretical minimum sampling rate to accurately reproduce this signal? Explain your answer.
    b. What would be a practical sampling rate for the analog-to-digital converter to accurately, yet efficiently, measure the signal?
    c. If we were to do a power spectral analysis of the signal reconstructed through a digital-to-analog converter, would the resulting power spectrum be identical to that of the signal at the input to the analog-to-digital converter? Explain your answer.

3. Textbook Chapter 2, Problem 2.2. You will need to specify the radius for the rotational potentiometer.
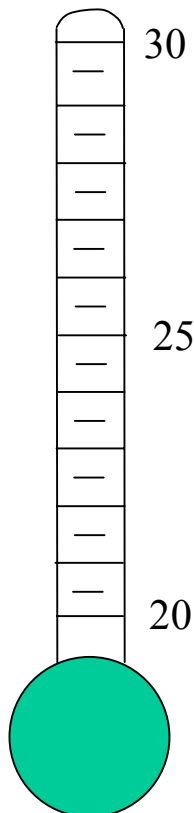

Fig. 1. Thermometer shown at actual size.
      Temperature scale is in degrees Celsius.