Exercises Section 1.4 [page 39]

44. The article “Oxygen Consumption During Fire Suppression: Error of Heart Rate Estimation” (*Ergonomics*, 1991: 1469-1474) reported the following data on oxygen consumption (mL/kg/min) for a sample of ten firefighters performing a fire-suppression simulation:

29.5 49.3 30.6 28.2 28.0 26.3 33.9 29.4 23.5 31.6

Compute the following:
a. The sample range

b. The sample variance s^2 from the definition (i.e., by first computing deviations, then squaring them, etc.)

c. The sample standard deviation

d. s^2 using the shortcut method

45. The value of Young's modulus (GPa) was determined for cast plates consisting of certain intermetallic substrates, resulting in the following sample observations ("Strength and Modulus of a Molybdenum-Coated Ti-25A1-10Nb-3U-1Mo Intermetallic," *J. of Materials Engr. and Performance*, 1197: 46-50):

$116.4 \quad 115.9 \quad 114.6 \quad 115.2 \quad 115.8$

a. Calculate $\overline{x}$ and the deviations from the mean.

b. Use the deviations calculated in part a to obtain the sample variance and the sample standard deviation.

c. Calculate s^2 by using the computational formula for the numerator S_{xx}.

d. Subtract 100 from each observation to obtain a sample of transformed values. Now calculate the sample variance of these transformed values, and compare it to s^2 for the original data.

46. The accompanying observations on stabilized viscosity (cP) for specimens of a certain grade of asphalt with 18% rubber added are from the article “Viscosity Characteristics of Rubber-Modified Asphalts” (*J. of Materials in Civil Engr.*,1996: 153-156):

2781 2900 3013 2856 2888

a. What are the values of the sample mean and sample median?

b. Calculate the sample variance using the computational formula. [*Hint*" First subtract a convenient number from each observation.]

47. Calculate and interpret the values of the sample median, sample mean, and sample standard deviation for the following observations on fracture strength (MPa, read from a graph in “Heat-Resistant Active Brazing of Silicon Nitride: Mechanical Evaluation of Braze Joints,” *Welding J.*, August, 1997):

87 93 96 98 105 114 128 131 142 168

49. A study of the relationship between age and various visual functions (such as acuity and depth perception) reported the following observations on area of scleral lamina (mm^2) from human optic nerve heads ("Morphometry of Nerve Fiber Bundle Pores in the Optic Nerve Head of the Human," *Experimental Eye Research*, 1988: 559-568):

2.75 2.62 2.74 3.85 2.34 2.74 3.93 4.21 3.88
4.33 3.46 4.52 2.43 3.65 2.78 3.56 3.01

a. Calculate Σx_i and Σx_i^2.

b. Use the values calculated in part a to compute the sample variance s^2 and then the sample standard deviation s.

51. The article "A Thin-Film Oxygen Uptake Test for the Evaluation of Automatic Crankcase Lubricants" (*Lubric. Engr.*, 1984: 75-83) reported the following data on oxidation-induction time (min) for various commercial oils:

87 103 130 160 180 195 132 145 211 105 145
153 152 138 87 99 93 119 129

a. Calculate the sample variance and standard deviation.

b. If the observations were reexpressed in hours, what would be the resulting values of the sample variance and sample standard deviation? Answer without actually performing the reexpression.