Week 8 workshop exercises

1. The following are the numbers of heads obtained from 10 tosses of a coin: 5, 5, 4, 4, 7, 4, 3, 7, 6, 4, 2, 5, 6, 4, 5, 3, 5, 4, 2, 6, 7, 2, 4, 5, 6, 5, 6, 4, 3, 4, 4, 5, 5, 6, 7, 5, 3, 6, 5, 5, 6, 7, 9, 4, 7, 9, 8, 8, 5, 10. Calculate **(i)** the mean, **(ii)** the variance, **(iii)** the standard deviation, and **(iv)** the standard deviation of the mean for this data.

2. For T = 298 K with a standard deviation of 5 K, find the standard deviation of T^2.

3. A reaction was started with 5.0 ± 0.2 grams of the reagent. The concentration of the reagent follows the first order kinetics:

$$A(t) = A(0)e^{-kt}$$

where the rate constant is 0.19 ± 0.03 min^{-1}. How much reagent will be left after exactly ten minutes, and what is the standard deviation of that quantity?

4. Find the correlation coefficient for the following variables:

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Per capita cheese consumption in the United States, lbs	29.8	30.1	30.5	30.6	31.3	31.7	32.6	33.1	32.7	32.8
Number of people in the US who died as a result of becoming tangled in their bedsheets	327	456	509	497	596	573	661	741	809	717

Sources: US Department of Agriculture, US Center for Disease Control & Prevention.

5. The probability of multiple independent experimental outcomes is the product of the probabilities of each individual outcome. Given a 90% chance of failure in any given application for a very prestigious and well paying job, find the probability of 20 sequential application failures.

6. Using the fact that variances add when variables are added together, prove the formula for the standard deviation of the mean: $\sigma_{\langle x \rangle} = \sigma_x / \sqrt{N}$.

7. Derive the error propagation relations from Table 1 of W8L2.