

# Homework 2

(Due Date: Monday, Feb. 5)

**Problem 1:**

Suppose that you roll 10 dice. Calculate the probability that “x” dice will land with the number 4 up. Note that “x” is a random variable that can take values from 0 to 10.

Plot the probability distribution for the random variable “x”. (use matlab)

What is the mean and standard deviation of the distribution?

*(Hint: use the binomial distribution with success event a die landing on 4 up.)*

**Problem 2:** (Bevington 2.12)

Members of a large collaboration that operated a giant proton-decay detector in a salt mine near Cleveland, Ohio, detected a burst of 8 neutrinos in their apparatus coincident with the optical observation of the explosion of the Supernova 1987A.

(a) If the average number of neutrinos detected in the apparatus is 2 per day, what is the probability of detecting a fluctuation of 8 or more in one day?

(b) In fact, the 8 neutrinos were all detected within a 10-min period. What is the probability of detecting a fluctuation of 8 or more neutrinos in a 10-min period if the average rate is 2 per 24 hours?

**Problem 3:** (Bevington 3.9)

Students in an undergraduate laboratory recorded the following counts in 1-min intervals from a radioactive source. The nominal mean decay rate of the source is 3.7 decays per minute.

Decays/min	0	1	2	3	4	5	6	7	8	9	10
Frequency of occurrences	1	9	20	24	19	11	11	0	3	1	1

a) Find the mean decay rate and its standard deviation. Compare the standard deviation to the value expected from the Poisson distribution for the mean value that you obtained.

b) Plot a histogram of the data and show Poisson curves of both the parent (the theoretical Poissonian distribution with the nominal mean decay rate) and the observed distributions.