DISCUSSION 2

1. Question 13 (textbook p.62)

13. On each die in a set of six dice the pips on each face are diamonds. It is suggested that the weight of the stones will cause the "five" or "six" faces to fall downward, and hence the "one" and "two" faces to fall upward, more frequently than they would with fair dice. To test this conjecture, a trial is conducted as follows: The throwing of a one or two is called a success. The six dice are thrown together 64 times and the frequencies of throws with $0, 1, 2, \ldots, 6$ successes summed over all six pairs are as follows:

Successes out of six (number of dice showing a one or two)	0	1	2	3	4	5	6
Frequency	0	4	19	15	17	7	2

(a) What would be the theoretical probability of success and the mean and variance of the above frequency distribution if all the dice were fair?

(b) What is the empirical probability of success calculated from the data and what is the sample average and variance?

(c) Test the hypothesis that the mean and variance have their theoretical values.

(d) Calculate the expected frequencies in the seven "cells" of the table on the assumption that the probability of a success is exactly $\frac{1}{3}$.

(e) Can you think of a better design for this trial?

2. Question 14 (textbook p.62)

14. The level of radiation in the control room of a nuclear reactor is to be automatically monitored by a Geiger counter. The monitoring device works as follows: Every tenth minute the number (frequency) of "clicks" occurring in t seconds is counted automatically. A scheme is required such that if the frequency exceeds a number c an alarm will sound. The scheme should have the following properties: If the number of *clicks per second* is less than 4, there should be only 1 chance in 500 that the alarm will sound, but if the number reaches 16, there should be only about 1 change in 500 that the alarm will not sound. What values should be chosen for t and c? *Hint*: Recall that the square root of the Poisson distribution is roughly normally distributed with standard deviation 0.5. [*Answer*: $t \cong 2.25$, $c \cong 20$ (closest integer to 20.25).]

3. More Questions ?