MAT 135, Discussion Questions 3.23

1. What are the properties of the binomial distribution?

fixed trials
constant probability
2 outcomes: success or failure

2. What are some situations we can use the binomial distribution to model? Give at least three.

# of head in n coin flips
# of 4's in n dice rolls.
# of boys in a class of n students
answers will vary

3. The formula for the binomial distribution is given by $P(X = x) = \binom{n}{x} p^x (1-p)^{n-x}$. What do p, n, and x stand for?

n # of trials
p = probability of success
x # of successes

4. For the scenario in which we flip 5 fair coins and count the number of heads, state the probability distribution in the table below.

# of Heads	0	1	2	3	4	5
$p(x)$	.03125	.15625	.3125	.3125	.15625	.03125
	1/32	5/32	5/16	5/16	5/32	1/32

binomial (5, 1/2, # of heads)

5. Give the cumulative distribution for the above scenario in the table below.

# of Heads	0	1	2	3	4	5
$p(x)$	.03125	.1875	.5	.8125	.96875	1
	1/32	6/32	16/32	26/32	31/32	32/32

6. How does the distribution change if we are rolling 5 dice and counting the number of 4s? You can round your answers to 4 decimal places.

# of 4s	0	1	2	3	4	5
$p(x)$	.40188	.40188	.16075	.03215	.003215	1.286×10^{-4} = .0001286

binomialpdf(5, 1/6, # of 4s)

7. Suppose that 90% of all batteries from a certain factory have acceptable voltages. A certain type of flashlight requires two D batteries, and the flashlight will work only if both batteries have acceptable voltages. Among ten randomly selected flashlights, what is the probability that that at least nine will work?

$.9 * .9 = .81$ chance both work

binomialpdf(10, .81, 9) + binomialpdf(10, .81, 10) or
1 − binomialcdf(10, .81, 8) = .406756 around 41%

8. What are the formulas for the mean and standard deviation of the binomial distribution?

$\mu = \bar{x} = np$

$\sigma = s = \sqrt{npq} = \sqrt{np(1-p)}$

9. There are two ways to describe results that are unusual: a) something that occurs less than 5% of the time, b) an event more than two standard deviations from the mean. In the binomial distribution for rolling a standard 6-sided dice for 20 trials, we are interested in the number of results of rolls that come up as 2s. How many successful results (how many 2s) would be considered unusual according to definition a? What about definition b?

$\mu = 20 \cdot 1/6 = 3.\overline{33}$

$\sigma = \sqrt{20 \cdot 1/6 \cdot 5/6} \approx 1.67$

2σ's $= 3.\overline{33}$

by standard deviations only outcomes greater than 7 would be unusual (since you can't go less than 0)

however 0 2's is likely only 2.6% of the time and so unusual by the first definition as are outcomes 7 or higher