AP Stats 8.1–5, 7

$\boxed{8.1}$ Binomial – if no multiple births, and if the probability of a female baby is the same for each birth.

$\boxed{8.2}$ Not binomial – number of observations is not fixed.

$\boxed{8.3}$ Not binomial – instruction between questions makes the probability of success change.

$\boxed{8.4}$ Binomial – if the chance of winning is the same each week, and if we count 52 weeks in each year.

$\boxed{8.5}$ a) $n = 5$ $p = .25$ $P(X=2) = .2637$ binompdf(5,.25,2)

b)

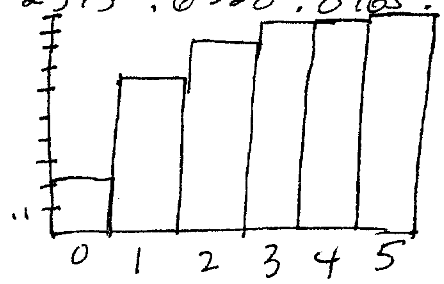
Values of X	0	1	2	3	4	5
prob.	.2373	.3955	.2637	.0879	.0146	.00098

c) Sum = .99998 with rounded values. Exactly 1 if not rounded

d) 

e) cdf

.2373 .6328 .8965 .9844 .9990 1



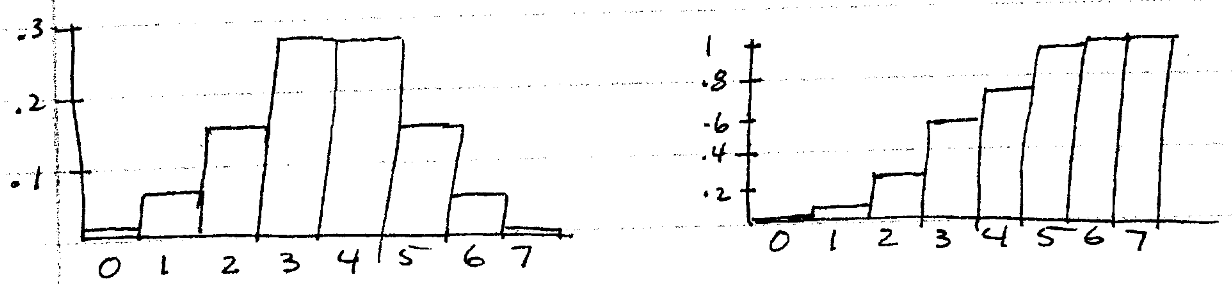
Both histograms peak at 1 on the right. This one gets taller earlier than Corinne's.

8.7

a) $B(7, .5)$ the distribution is symmetric.
The shape depends on **p**.
Since .5 is halfway between
0 and 1 the histogram is symmetric.

b)

Values of X	0	1	2	3	4	5	6	7
prob.	.0078	.0547	.1641	.2734	.2734	.1641	.0547	.0078
cdf	.0078	.0625	.2266	.5	.7734	.9375	.9922	1



p.d.f

c) $P(X=7) = .0078125$

Stats $\boxed{8.8 - 10, 14}$

$\boxed{8.8}$ $B(15, .3)$

a) $\binom{15}{3}(0.3)^3(0.7)^{12} = (455)(.027)(.0138412872)$

$= .1700402133$

or binompdf(15, .3, 3) $= \boxed{.17004}$ 17%

b) $P(0, 1 \text{ or } 2 \text{ or } 3) = \binom{15}{0}(.3)^0(.7)^{15} + \binom{15}{1}(.3)^1(.7)^{14} + \binom{15}{2}(.3)^2(.7)$

$+ .17004$

or binomcdf(15, .3, 3) $= .2968679279 = \boxed{.29687}$

$\boxed{8.9}$ $B(20, .8)$ $P(X=10) = \binom{20}{10}(.8)^{10}(.2)^{10} = \boxed{.00203}$

or binompdf(20, .8, 10) .2%

$\boxed{8.10}$ a) $B(10, .25)$ b) $P(X=2) = \binom{10}{2}(.25)^2(.75)^8 = \boxed{.28157}$

or binompdf(10, .25, 2)

c) $P(X = 2 \text{ or } 1 \text{ or } 0) = .28157 + \binom{10}{1}(.25)(.75)^9 + \binom{10}{0}(.25)^0(.75)^{10}$

binomcdf(10, .25, 2) = 0.52559

$\boxed{8.14}$ $B(5, .25)$ $\mu = np = (5)(.25) = \boxed{1.25}$

$\sigma = \sqrt{np(1-p)} = \sqrt{1.25(1-.25)} = \boxed{.96825}$

APStats $\boxed{8.15, 19, 21, 22}$

$\boxed{8.15}$ $B(15, .3)$ a) $\mu = np = 15(.3) = \boxed{4.5}$

b) $\sigma = \sqrt{np(1-p)} = \sqrt{4.5(.7)} = \boxed{1.77482}$

c) $\sigma = \sqrt{15(.1)(.9)} = \boxed{1.161895}$

$\boxed{8.19}$ a) $B(20, .25)$ b) $\mu = (20)(.25) = 5$

c) $P(X=5) = \binom{20}{5}(.25)^5(.75)^{15} = \boxed{.20233}$

binompdf(20, .25, 5) = .20233

$\boxed{8.21}$ $B(12, .2)$ a) $P(X=0) = \binom{12}{0}(.2)^0(.8)^{12} = \boxed{0.06872}$

prob. all are truthful 6.872%

prob. at least one deceptive $= 1 - .06872$

$= .93128$

b) $\mu = (12)(.2) = \boxed{2.4}$ $\sigma = \sqrt{2.4(.8)} = \boxed{1.3856}$

$\boxed{8.22}$ a) $B(20, .99)$ b) $P(X=20) = \boxed{.81791}$ $\binom{20}{20}.99^{20}$

$P(X<20) = 1 - .81791 = \boxed{.18209}$

c) $\mu = 20(.99) = \boxed{19.8}$

$\sigma = \sqrt{19.8(.01)} = \boxed{.44497}$

APstats $\boxed{8.24-26}$

$\boxed{8.24}$ a) Geometric: success = tail failure = head

b) Not Geometric: You are not counting number of trials before the first success.

c) Geometric: success = jack failure = any other card.

d) Geometric: success = match all 6 failure = don't match all 6

e) Not Geometric: trials are not independent because we don't replace the marbles. Also, we want 3 successes not just the first one.

$\boxed{8.25}$ a) 1. each roll is either prime or not.

2. Prob. of success = $3/6 = 1/2$

3. Each roll is independent

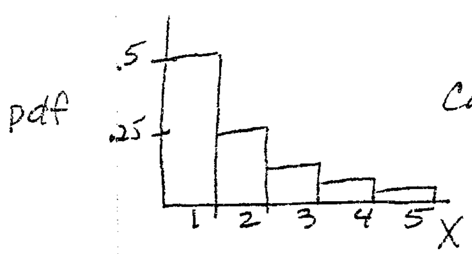
4. We will roll until we get a prime number.

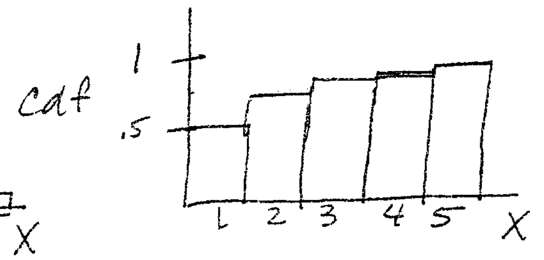
b)

X	1	2	3	4	5	...
P(X)	.5	.25	.125	.0625	.03125	
cdf	.5	.75	.875	.9375	.96875	

geometpdf(.5, {1,2,3,4},

geometcdf(.5, {1,2,3,4})





e) $\text{sum} = \frac{a}{1-r} = \frac{.5}{1-.5}$
$= 1$

$\boxed{8.26}$ a) X = number of drives tested to find the first defective drive.

success = defective drive

b) $P(X=5) = (1-.03)^{5-1}(.03) = (.97)^4(.03) = .02656$

c)

X	1	2	3	4
P(X)	.03	.0291	.0282	.0274

geometpdf(.03, {1,2,3,4}) =

AP Stats $\boxed{8.30-33}$

$\boxed{8.30}$ a) Geometric – X = # marbles you must draw to get a red.
The number of trials is unknown
$P(\text{red}) = 20/35 = 4/7$

b) $P(X=2) = (1-4/7)^{2-1}(4/7) = 3/7 \cdot 4/7 = \boxed{12/49}$
$P(X \leq 2) = P(X=1) + P(X=2)$
$= 4/7 + 12/49 = \frac{28+12}{49} = \boxed{\frac{40}{49}}$
$P(X>2) = (1-4/7)^2 = (3/7)^2 = \boxed{9/49}$

$\boxed{8.31}$ Not Geometric – the probability of getting a red changes with each draw.

$\boxed{8.32}$ a) X = # of questions Carla must answer to get the first correct answer
Success is getting a correct answer.
$P(\text{Success}) = 1/5 = .2$

b) $P(X=5) = (1-1/5)^{5-1}(1/5) = (4/5)^4(1/5) = \frac{256}{3125} = \underline{\underline{.08192}}$

c) $P(X>4) = (1-1/5)^4 = (4/5)^4 = \frac{256}{625} = .4096$

d)

X	1	2	3	4	5	...
$P(X)$	.2	.16	.128	.1024	.0819	...

e) $\mu_x =$

$\boxed{8.33}$ a) $\mu_x = 1/.5 = 2$ The average number of children required to have a son is 2.

b) If the average size of a family is 2 (from (a)), and the last child is a boy, the average number of girls is one.

c) Let even digit = girl, odd digit = boy. Read digits until an odd then count # of children. Repeat [illegible]

AP Stats 8.30, 32, 33, 34

$\boxed{8.30}$ a) Geometric – draw until you get a red. # trials not fixed

b) $p(\text{red}) = \frac{20}{35} = \frac{4}{7}$ $\quad P(X=2) = (1-4/7)^{2-1}(4/7) = 3/7 \cdot 4/7 = 12/49$

or geometpdf(4/7, 2)

$P(X \le 2) = P(X = 1 \text{ or } 2) = \frac{4}{7} + \frac{12}{49} = \frac{40}{49}$

or geometcdf(4/7, 2)

$P(X > 2) = 1 - 40/49 = 9/49$

or $(1 - 4/7)^2 = (3/7)^2 = 9/49$

c) To get 1, 2, 3, ⋯ 20 into L_1

2nd STAT (List) OPS 5: seq

seq(X, X, 1, 20, 1) → L_1

To get the geometric probabilities in L_2

2nd VARS (DISTR) D: geometpdf

geometpdf(4/7, L_1) → L_2

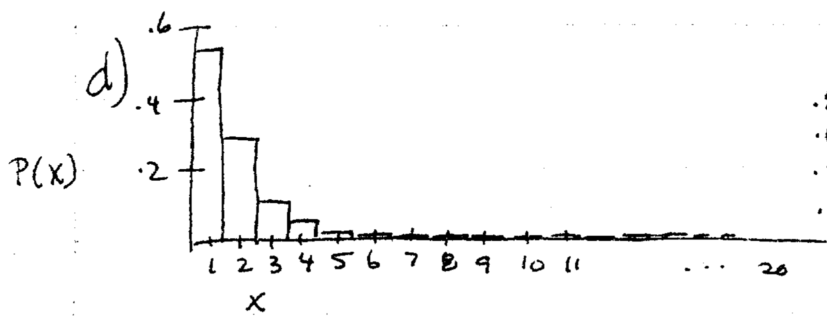
To get the cumulative probabilities in L_3

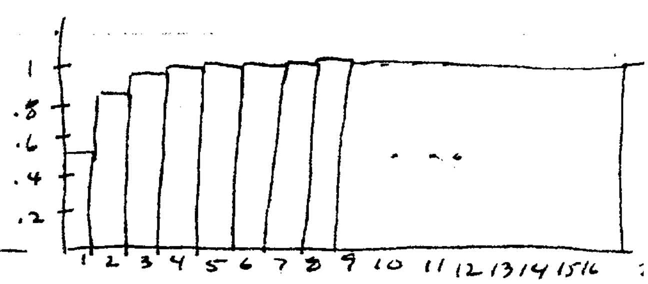
2nd VARS (DISTR) E: geometcdf

geometcdf(4/7, L_1) → L_3

Values of X	1	2	3	4	5	⋯	20
P(X)	.571	.245	.105	.045	.019		.000
cdf	.571	.816	.921	.966	.986		1

d)





8.32 a) success = getting a correct answer
X = number of questions Carla must answer to the first correct answer.
$p = 1/5 = .2$

b) $P(X=5) = (1-.2)^4(.2) = \boxed{.08192}$ or $256/$
geometpdf(.2, 5)

c) $P(X>4) = (1-.2)^4 = (.8)^4 = \boxed{.4096}$ or $256/$

d)

X	1	2	3	4	5	...
P(X)	.2	.16	.128	.1024	.08192	

e) $\mu_x = \frac{1}{.2} = 5$ $\boxed{\text{5 questions}}$

8.33 $p = 1/2$ success = having a son Geometric

a) avg. # children = $\mu_x = 1/\tfrac{1}{2} = \boxed{2}$

b) Avg. family is 2. Last child is a boy so first one must be a girl.

c) Use random digits table. even = boy odd = gi
Read digits until an odd digit occurs. Count #
Repeat many times and average the family size

4 a) $S = \{G, BG, BBG, BBBG, BBBB\}$ G = succe

b) $X = 0, 1, 2, 3,$ or 4
$P(X=0) = 1/2$
$P(X=1) = (1/2)(1/2) = 1/4$
$P(X=2) = (1/2)(1/2)(1/2) = 1/8$

X	0	1	2	3	4
P(X)	.5	.25	.125	.0625	.062

sum = 1

$\boxed{8.34}$ cont'd

c) $Y = \#$ children until a girl $Y = 1, 2, 3, 4$

The distribution is geometric at the beginning.
(Continue having children until you have a girl.)
But the family will stop at 4 children even if a girl is not produced.

Y	1	2	3	4
$P(Y)$	$1/2$	$1/4$	$1/8$	$1/16$

$\Rightarrow$ sum $\neq 1$
This is not a valid distribution

Since the outcome BBBB is not included in the way Y is defined. ($Y = \#$ children until a girl is produced)

$Z = \#$ children

Z	1	2	3	4
	$1/2$	$1/4$	$1/8$	$1/16 + 1/16$

d) $\mu_Z = 1(1/2) + 2(1/4) + 3(1/8) + 4(1/16) + 4(1/16) = \boxed{1.875}$
(if we include the BBBB outcome as well as BBBG)

e) $P(X > 1.875) = P(2) + P(3) + P(4) = \frac{1}{4} + \frac{1}{8} + \frac{2}{16} = \boxed{.5}$

f) P(having a girl) = P(not having 4 Boys)
$= 1 - 1/16 = 15/16 = .9375$