6.3 Additional Properties of the Binomial Distribution

Essential Questions:

How do you create a histogram to display binomial distributions?

Focus Points:

- Make histograms for binomial distributions.
- Compute μ and σ for a binomial distribution

Nov 30-11:39 AM

GRAPHING A BINOMIAL DISTRIBUTION

remember this tells us the probability of r successes out of n trials!!

1. Place r values on the horizontal axis.
2. Place P(r) values on the vertical axis.
3. Construct a bar over each r value extending from r - 0.5 to r + 0.5. The height of the corresponding bar is P(r).

Dec 4-10:57 AM

Example 1: Zippy's

A waiter at Zippy's has learned from long experience that the probability that a lone diner will leave a tip is only 0.7. During one lunch hour, the waiter serves six people who are dining by themselves. Make a graph of the binomial probability distribution that shows the probabilities that 0, 1, 2, 3, 4, 5, or all 6 lone diners will leave tips.

n = 6

p = .7

q = 1 − .7 = .3

n = 6 diners/trials

p = 0.7 probability of leaving a tip

q = 1 - 0.7 probability they will not leave a tip

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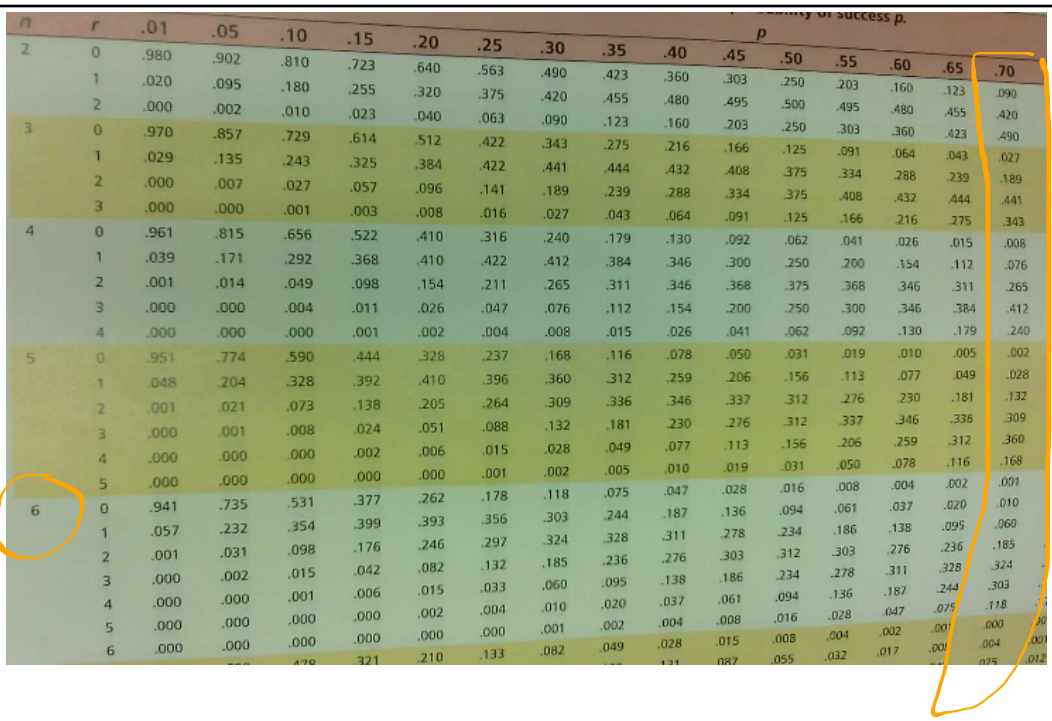

n	r	.01	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70
									p							
2	0	.980	.902	.810	.723	.640	.563	.490	.423	.360	.303	.250	.203	.160	.123	.090
	1	.020	.095	.180	.255	.320	.375	.420	.455	.480	.495	.500	.495	.480	.455	.420
	2	.000	.002	.010	.023	.040	.063	.090	.123	.160	.203	.250	.303	.360	.423	.490
3	0	.970	.857	.729	.614	.512	.422	.343	.275	.216	.166	.125	.091	.064	.043	.027
	1	.029	.135	.243	.325	.384	.422	.441	.444	.432	.408	.375	.334	.288	.239	.189
	2	.000	.007	.027	.057	.096	.141	.189	.239	.288	.334	.375	.408	.432	.444	.441
	3	.000	.000	.001	.003	.008	.016	.027	.043	.064	.091	.125	.166	.216	.275	.343
4	0	.961	.815	.656	.522	.410	.316	.240	.179	.130	.092	.062	.041	.026	.015	.008
	1	.039	.171	.292	.368	.410	.422	.412	.384	.346	.300	.250	.200	.154	.112	.076
	2	.001	.014	.049	.098	.154	.211	.265	.311	.346	.368	.375	.368	.346	.311	.265
	3	.000	.000	.004	.011	.026	.047	.076	.112	.154	.200	.250	.300	.346	.384	.412
	4	.000	.000	.000	.001	.002	.004	.008	.015	.026	.041	.062	.092	.130	.179	.240
5	0	.951	.774	.590	.444	.328	.237	.168	.116	.078	.050	.031	.019	.010	.005	.002
	1	.048	.204	.328	.392	.410	.396	.360	.312	.259	.206	.156	.113	.077	.049	.028
	2	.001	.021	.073	.138	.205	.264	.309	.336	.346	.337	.312	.276	.230	.181	.132
	3	.000	.001	.008	.024	.051	.088	.132	.181	.230	.276	.312	.337	.346	.336	.309
	4	.000	.000	.000	.002	.006	.015	.028	.049	.077	.113	.156	.206	.259	.312	.360
	5	.000	.000	.000	.000	.000	.001	.002	.005	.010	.019	.031	.050	.078	.116	.168
6	0	.941	.735	.531	.377	.262	.178	.118	.075	.047	.028	.016	.008	.004	.002	.001
	1	.057	.232	.354	.399	.393	.356	.303	.244	.187	.136	.094	.061	.037	.020	.010
	2	.001	.031	.098	.176	.246	.297	.324	.328	.311	.278	.234	.186	.138	.095	.060
	3	.000	.002	.015	.042	.082	.132	.185	.236	.276	.303	.312	.303	.276	.236	.185
	4	.000	.000	.001	.006	.015	.033	.060	.095	.138	.186	.234	.278	.311	.328	.324
	5	.000	.000	.000	.000	.002	.004	.010	.020	.037	.061	.094	.136	.187	.244	.303
	6	.000	.000	.000	.000	.000	.000	.001	.002	.004	.008	.016	.028	.047	.075	.118
													.004	.002	.001	.000
													.032	.017	.008	.004

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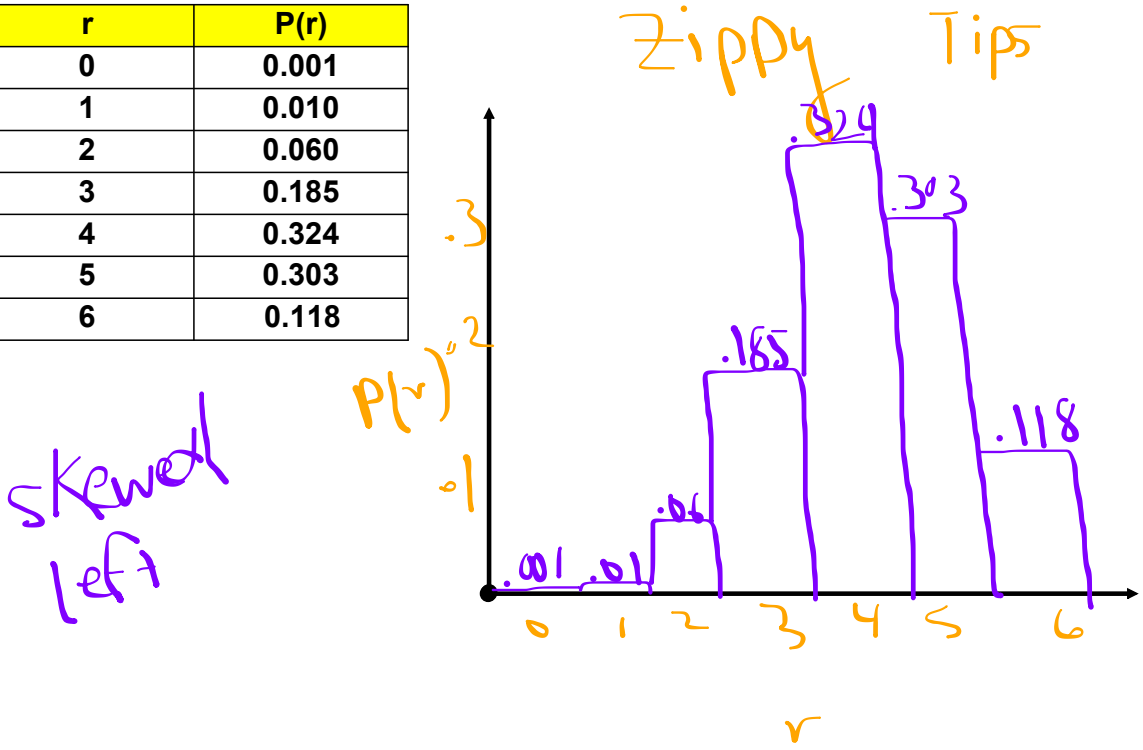
r	P(r)
0	0.001
1	0.010
2	0.060
3	0.185
4	0.324
5	0.303
6	0.118



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Mean and Standard Deviation for Binomials

$$\mu = np$$

$$\sigma = \sqrt{npq}$$

*mean is the expected number of successes for the random variable r

* the standard deviation for random variable r

where

r is a random variable representing the number of successes in a binomial distribution,

n is the number of trials,

p is the probability of success on a single trial, and

q = 1 - p is the probability of failure on a single trial.

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Example 2: Zippy's μ and σ

Compute the mean and standard deviation for the distribution for the probabilities of lone diners tipping at Zippy's.

n = 6, p = 0.7, q = 0.3

$\mu = np$

$\sigma = \sqrt{npq}$

$\mu = 6(.7) = 4.2$

$\sigma = \sqrt{6(.7)(.3)} \approx 1.122$

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Unusual Values

For a binomial distribution, it is unusual for the number of successes r to be higher/lower than $\mu \pm 2.5\sigma$

Dec 4-3:05 PM

6.3 Additional Properties of the Binomial Distribution with work

HW: pg. 274: 1, 3, 7, 9, 13, 17, 19

1. The average number of successes.

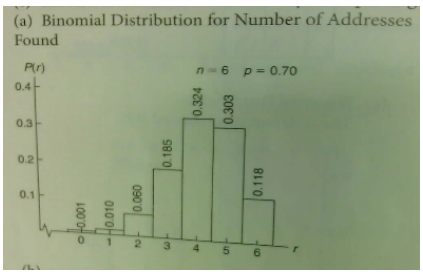
3. a) $\mu = 1.6$; $\sigma \approx 1.13$ b) Yes, 5 successes is more than 2.5σ above the expected value.

$P(r \geq 5) = 0.010$

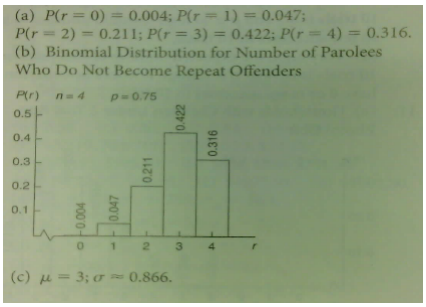
7. a) Symmetrical b) Skewed right. c) Skewed left d) Mirror images.

e) Skewed left

9. a) Skewed left. b) $\mu = 8.5$ c) Very low; the expected number of successes in 10 trials is 8.5 and p is so high it would be unusual to have so few successes in 10 trials.

13. 

b) $\mu = 4.2$; $\sigma \approx 1.122$

17. 

19. a) 0.262

b) 0.738

c) $\mu = 1.2$;

$\sigma \approx 0.98$

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