AP Stats | 9.1–4, 8.37, 38

$\boxed{9.1}$ 7.29% is a statistic (from the sample)

$\boxed{9.2}$ 2.5003 is a parameter (from the whole carload)

2.5009 is a statistic (from the sample of 100)

$\boxed{9.3}$ 48% is a statistic (from the sample of 100)

52% is a parameter (from all of Los Angeles)

$\boxed{9.4}$ 335 g, 289 g both are statistics (from the experimental groups)

$\boxed{8.37}$ P(alcohol related fatality) $= 346/869 = .398$

$n = 25$ $p = .398$ Binomial R.V. • fixed n • indep. • p same • alcohol or no

$B(25, .398)$ $\mu = np = 25(.398) = \boxed{9.95}$

$\sigma = \sqrt{np(1-p)} = \sqrt{25(.398)(.602)} = \boxed{2.447}$

$P(X \le 5) = \text{binomcdf}(25, .398, 5) = \boxed{.0307}$

$\boxed{8.38}$ a) $n = 150$ $p = .5$ • fixed n, • indep., p same, respond or not

$B(150, .5)$

b) $\mu_X = np = 150(.5) = \boxed{75}$

c) $P(X \le 70) = \text{binomcdf}(150, .5, 70) = \boxed{.2313}$

d) $\mu = np$ so $100 = n(.5)$ and $\boxed{n = 200}$

9.9 (a) Large bias and large variability. (b) Small bias and small variability. (c) Small bias, large variability. (d) Large bias, small variability.

9.10 (a) Since the smallest number of total tax returns (i.e., the smallest population) is still more than 100 times the sample size, the variability will be (approximately) the same for all states. (b) Yes, it will change — the sample taken from Wyoming will be about the same size, but the sample in, e.g., California will be considerably larger, and therefore the variability will decrease.

9.14 Assuming that the poll's sample size was less than 780,000 — 10% of the population of New Jersey — the variability would be practically the same for either population. (The sample size for this poll would have been considerably less than 780,000.)

.40 (a) From the probability distribution table: $P(X = 6) = .3087$. (b) From the cumulative distribution table: $P(X \leq 7) = .8764$. (c) $P(X < 7) = P(X \leq 6) = .5811$. (d) $P(5 \leq X \leq 7) = P(X \leq 7) - P(X \leq 4) = .8764 - .0880 = .7884$. (e) $P((X < 3) \text{ or } (X > 6)) = P(X < 3) + P(X > 6) = P(X \leq 2) + P(X \geq 7) = P(X \leq 2) + P(X = 7) + P(X = 8) = .0027 + .2953 + .1236 = .4216$.

APStats 9.13, 12, 8.44

$\boxed{9.13}$ $p = .4$ 0, 1, 2, 3 = yes 4, 5, 6, 7, 8, 9 = no

a) if we use line 101 YNYYY NNYYN YNNNN YNNYY
10 = yes so $\hat{p} = 10/20 = .5$

b) Repeat the simulation and record your findings.
Find the mean of your 10 values of $\hat{p}$.
Is it close to p?

c) If we took all of the possible samples of size 20 the mean would be $p = .4$

d) The mean of the sampling distribution = .5

$\boxed{9.12}$ $p = .2$ 0, 1 = presence of egg masses 2 ... 9 = absence
line 116 YNNNN NNYNN 2 yes $\hat{p} = 2/10 = .2$
b) Stemplot could look like this. Do your own samples.

0.0	00
0.0	55555
0.1	000000
0.1	5555
0.2	00
0.2	5

describe yours
$\mu =$
Shape –

c) $\mu_{\hat{p}} = 0.2$

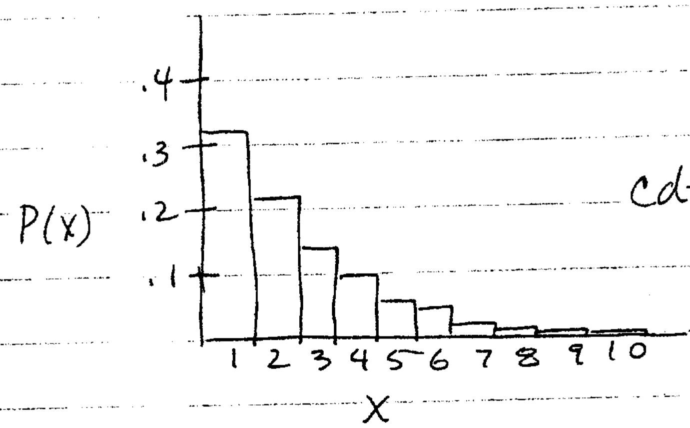
d) $p = .4$ $\mu_{\hat{p}} = .4$

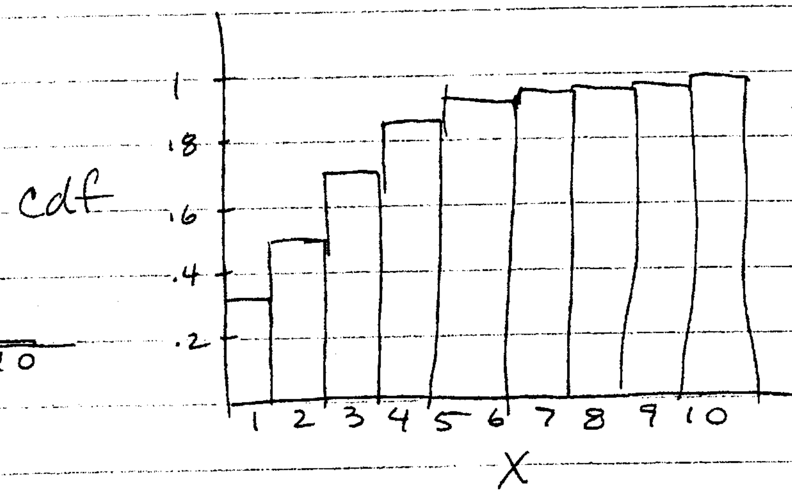
$\boxed{8.44}$ $p = .325$ geometric $(1-p) = .675$
a) $P(X = 1) = .325$
b) $P(X \leq 3) = .325 + .675(.325) + (.675)(.675)(.325)$
$= .69245$ or geometcdf(.325, 3)
c) $P(X > 4) = (.675)^4 = .2076$
d) $\mu_x = 1/p = 1/.325 = 3.077$ about 3 at bats

8.44 cont'd

e)

X	1	2	3	4	5	...	10
P(x)	.325	.219	.148	.100	.067		.009
cdf	.325	.544	.692	.792	.860		.980





AP Stats $\boxed{9.15, 17, 19, 21}$

$\boxed{9.15}$ $p = .15 \quad n = 1540$

a) $\mu_{\hat{p}} = p = \boxed{.15} \quad \sigma_{\hat{p}} = \sqrt{\dfrac{.15(1-.15)}{1540}} = \boxed{.0091}$

b) We know that the population of U.S. adults is larger than 10(1540) = 15400.

c) $np = 1540(.15) = 231 \qquad 231 \geq 10$
$n(1-p) = 1540(1-.15) = 1309 \qquad 1309 \geq 10$


.15

d) $P(.13 \leq \hat{p} \leq .17) = P\left(\dfrac{.13-.15}{.0091} \leq z \leq \dfrac{.17-.15}{.0091}\right)$

Use normalcdf(-2.198, 2.198) $= P(-2.198 \leq z \leq 2.198)$
$= \boxed{.9721}$

e) to make the $\sigma = \frac{1}{2}(\sigma_{\hat{p}})$ make n 4 times

$n = 1540(4) = \boxed{6160}$

$\boxed{9.17}$ $\hat{p} = .15 \qquad \pm 2 \Rightarrow .13$ to $.17$

for $n = 200 \quad \sigma_{\hat{p}} = \sqrt{\dfrac{.15(1-.15)}{200}} = .0252$

$P(.13 \leq \hat{p} \leq .17) = P\left(\dfrac{.13-.15}{.0252} \leq z \leq \dfrac{.17-.13}{.0252}\right)$
$= P(-.7937 \leq z \leq .7937)$

Use normalcdf(-.7937, .7937) $= \boxed{.5726}$

$\boxed{9.17}$ for $n = 800$ $\sigma_{\hat{p}} = \sqrt{\frac{.15(1-.15)}{800}} = .0126$

$$P(.13 \le \hat{p} \le .17) = P\left(\frac{.13-.15}{.0126} \le z \le \frac{.17-.15}{.0126}\right)$$
$$= P(-1.587 \le z \le 1.587)$$
$$= \boxed{.8875}$$

for $n = 3200$ $\sigma_{\hat{p}} = \sqrt{\frac{.15(1-.15)}{3200}} = .0063$

$$P(.13 \le \hat{p} \le .17) = P\left(\frac{.13-.15}{.0063} \le z \le \frac{.17-.15}{.0063}\right)$$
$$= P(-3.175 \le z \le 3.175)$$
$$= \boxed{.9985}$$

Larger sample size gives a more accurate result. The sample proportion, $\hat{p}$, is more likely to be close to the parameter, p.

$\boxed{9.19}$ a) $p = .52$ $n = 500$ a) $\mu_{\hat{p}} = \boxed{.15}$ $\sigma_{\hat{p}} = \sqrt{\frac{.52(.48)}{500}} = \boxed{.0223}$

b) $np = 500(.52) = 260$
$n(1-p) = 500(.48) = 240$ } both ≥ 10

$$P(\hat{p} \ge .50) = P\left(z \ge \frac{.50-.52}{.0223}\right) = P(z \ge -.8969)$$
$$= \boxed{.8151}$$

The probability that at least half of the numbers are unlisted is 81.5%

$\boxed{9.21}$ According to "Rule of Thumb" #2

- in the telephone problem $np = 260$ $n(1-p) = 240$
- in the mail order problem $np = .9(100)$ $n(1-p) = .1(100)$

$= 90$ $= 10$

The normal approximation is more accurate in the telephone problem. The rule is just barely satisfied in the mail order problem.

AP Stats $\boxed{9.23, 24, 25}$

$\boxed{9.23}$ a) $p = .75$

$\sigma_{\hat{p}} = \sqrt{\frac{.75(.25)}{100}} = .0433$

$np = 100(.75) = 75$
$n(1-p) = 100(.25) = 25$ ≥ 10

$P(\hat{p} \leq .70)$

$P\left(z \leq \frac{.70 - .75}{.0433}\right)$

$P(z \leq -1.155)$
$= \boxed{.1240}$

normalcdf(-1000, -1.155)

b) $P(\hat{p} \leq .70)$
$= P\left(z \leq \frac{.70 - .75}{\sqrt{\frac{.75(.25)}{250}}}\right) = P(z \leq -1.8257)$
$= \boxed{.0339}$

c) To reduce by half 4(100) or 400 questions

d) The answer is the same for Laura.

$\boxed{9.24}$ $p = .04$ a) $\mu = np = 2000(.04) = \boxed{80}$

$\sigma_{\hat{p}} = \sqrt{\frac{.04(.96)}{2000}}$
$= .0044$

b) $P\left(\hat{p} \geq \frac{75}{2000}\right) = P\left(z \geq \frac{.0375 - .04}{.0044}\right) = P(z \geq -.568)$
$= .7150$

The probability that the group will have at least 75 heart attacks is 71.5%.

$\boxed{9.25}$ a) $np = 15(0.3) = 4.5$ This is less than 10

b) The population is 316

$10 \cdot n = 10 \cdot 50 = 500$

The population is not at least 10 times the sample size.

AP Stats $\boxed{9.26, 27, 28, 29}$

$\boxed{9.26}$ $\mu = -3.5\%$ $\sigma = 26\%$ (9.9a)

9.9b $\mu = \boxed{-3.5\%}$ $\sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}} = \dfrac{26}{\sqrt{5}} = \boxed{11.628}$

$\boxed{9.27}$ ACT $N(18.6, 5.9)$ $n = 76$ $\sigma = \dfrac{5.9}{\sqrt{76}}$

Normality is not necessary. $= \boxed{.6768}$

$\boxed{9.28}$ $\mu = 40.125$
$\sigma = .002$
$n = 4$

$\mu_{\bar{x}} = \boxed{40.125}$
$\sigma_{\bar{x}} = \dfrac{.002}{\sqrt{4}} = \boxed{.001}$

Normality is not necessary.

$\boxed{9.29}$ $\sigma = .08$
$n = 3$

$\sigma_{\bar{x}} = \dfrac{.08}{\sqrt{3}} = \boxed{.04619}$

AP Stats $\boxed{9.30, 31, 32, 35}$

$\boxed{9.30}$ $\mu = 18.6$ a) $P(X \geq 21) = P\left(z \geq \frac{21-18.6}{5.9}\right)$
$\sigma = 5.9$
$n = 1$ $= P(z \geq .4068)$
$= \boxed{0.3421}$

b) $n = 50$ $P(x \geq 21)$
$P\left(z \geq \frac{21-18.6}{5.9/\sqrt{50}}\right) = P(z \geq 2.8764)$
$= \boxed{.0020}$

$\boxed{9.31}$ $\mu = 298$ a) $P(X < 295) = P\left(z < \frac{295-298}{3}\right)$
$\sigma = 3$
$P(z < -1) = \boxed{.1587}$

b) $n = 6$ $P(X < 295) = P\left(z < \frac{295-298}{3/\sqrt{6}}\right)$
$= P(z < -2.45) = \boxed{.0071}$

$\boxed{9.32}$ $n = 3$
$\sigma = .08$ a) $N(123, .08/\sqrt{3}) = N(123, .0462)$
$\mu = 123$
b) $P(X \geq 124) = P\left(z \geq \frac{124-123}{.08/\sqrt{3}}\right)$
$= P(z \geq 21.65)$
essentially zero

$\boxed{9.35}$ If the company sells many policies they will lose a lot of money on a few but gain a small amount on many policies. Overall, the company will almost certainly make money.

AP Stats 9.37, 38, 39, 40

$\boxed{9.37}$ $\mu = 2.2$
$\sigma = 1.4$
$n = 52$

a) $\sigma_{\bar{x}} = \frac{1.4}{\sqrt{52}} = \boxed{.1941}$

$N(2.2, .1941)$

b) $P(X < 2)$
$P\left(z < \frac{2 - 2.2}{.1941}\right)$
$P(z < -1.0304)$
$\boxed{0.1514}$

c) $\frac{100}{52} = 1.923 \frac{\text{accidents}}{\text{week}}$

$P(X \le 1.923)$
$P\left(z \le \frac{1.923 - 2.2}{.1941}\right)$
$P(z \le -1.427) = \boxed{.0768}$

$\boxed{9.38}$ $N(3.8, .2)$ a) $P(X < 3.5) = P\left(z < \frac{3.5 - 3.8}{.2}\right)$
$= P(z < -1.5) = \boxed{.0668}$

b) $n = 4$ $P(X < 3.5) = P\left(z < \frac{3.5 - 3.8}{.2/\sqrt{4}}\right) = P(z < -3)$
$= \boxed{.0013}$

$\boxed{9.39}$ $P(X > L) = 0.01$
$P(z > ?) = 0.01$

from table A z must be approx. 2.33

$$\frac{L - 1.4}{.3/\sqrt{125}} = 2.33$$

$$L = 1.4625$$

$\boxed{9.40}$ $N(13.6, 3.1)$ $\quad P(Z < ?) = 0.05$

$n=22$

$Z = -1.645$

$$\frac{L - 13.6}{3.1/\sqrt{22}} = -1.645$$

$L = 12.513$