AP Stats Ch 18 - Extra Practice **Name:** Solutions **Per:** ___

37. Tips. A waiter believes the distribution of his tips has a model that is slightly skewed to the right, with a mean of \$9.60 and a standard deviation of \$5.40.

a) Explain why you cannot determine the probability that a given party will tip him at least \$20.

b) Can you estimate the probability that the next 4 parties will tip an average of at least \$15? Explain.

c) Is it likely that his 10 parties today will tip an average of at least \$15? Explain.

a) we can't assume a normal model and aren't given any other probability model or distribution information.

b) NO. A sample size of 4 is not large enough to assume a normal model ($n \geq 25$)

c) we can't do normal model, but we can calculate $\mu_{\bar{x}}$, $\sigma_{\bar{x}}$ and find z-score:

$\mu_{\bar{x}} = \mu = \$9.60$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{5.4}{\sqrt{10}} = \$1.7076$

$z = \frac{15 - 9.60}{1.7076} = 3.16$

so \$15 is unlikely (more than 3 std devs above the mean).

39. More tips. The waiter in Exercise 37 usually waits on about 40 parties over a weekend of work.

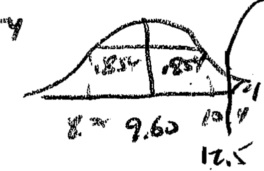
a) Estimate the probability that he will earn at least \$500 in tips.

b) How much does he earn on the best 10% of such weekends?

(a) now we have $n = 40$ (≥ 25) so model is normal (by Central Limit Theorem)

w/ $\mu_{\bar{x}} = \mu = \$9.60$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{5.4}{\sqrt{40}} = \$0.854$

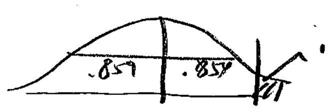


$P(\bar{x} > \$12.5)$

$=$ normalcdf(12.5, 999, 9.60, .854)

$= \boxed{.00034}$

(b)



invNorm(.90, 9.6, .854) = \$10.69 average (per tip)

so 40 tips, at \$10.69 average each

is $(40)(10.69) = \boxed{\$427.78}$

41. IQs. Suppose that IQs of East State University's students can be described by a Normal model with mean 130 and standard deviation 8 points. Also suppose that IQs of students from West State University can be described by a Normal model with mean 120 and standard deviation 10.

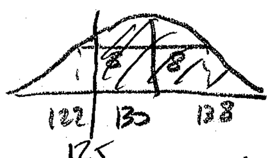
a) We select 1 student at random from East State. Find the probability that this student's IQ is at least 125 points.

b) We select 1 student at random from each school. Find the probability that the East State student's IQ is at least 5 points higher than the West State student's IQ.

c) We select 3 West State students at random. Find the probability that this group's average IQ is at least 125 points.

d) We also select 3 East State students at random. What's the probability that their average IQ is at least 5 points higher than the average for the 3 West Staters?

a)



$P(IQ > 125) = \text{normalcdf}(125, 99999, 130, 8)$

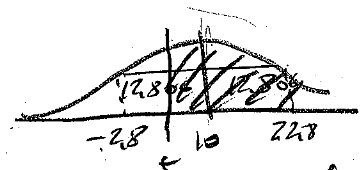
$= \boxed{.734}$

b) $D = E - W$

$\mu_D = \mu_E - \mu_W = 130 - 120 = 10$

$\sigma_D^2 = \sigma_E^2 + \sigma_W^2 = (8)^2 + (10)^2$

$\sigma_D = \sqrt{8^2 + 10^2} = 12.806$



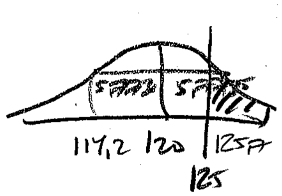
$P(D > 5) = \text{normalcdf}(5, 999, 10, 12.806)$

$= \boxed{.652}$

c) Can use normal w/ $n = 3$ b/c IQ pop is already normal

Sampling model: $\mu_{\bar{x}} = \mu = 120$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{10}{\sqrt{3}} = 5.7735$



$P(\bar{x} > 125) = \text{normalcdf}(125, 9999, 120, 5.7735)$

$= \boxed{.193}$

d) $\mu_{\bar{W}} = 120$ $\quad \mu_{\bar{E}} = 130$

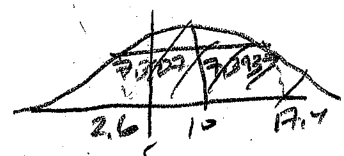
$\sigma_{\bar{W}} = 5.7735$ $\quad \sigma_{\bar{E}} = \frac{\sigma}{\sqrt{n}} = \frac{8}{\sqrt{3}} = 4.618$

$D = \bar{E} - \bar{W}$

$\mu_D = \mu_{\bar{E}} - \mu_{\bar{W}} = 130 - 120 = 10$

$\sigma_D^2 = \mu_{\bar{E}}^2 + \mu_{\bar{W}}^2 = (5.7735)^2 + (4.6188)^2$

$\sigma_D = \sqrt{(5.7735)^2 + (4.6188)^2} = 7.3937$



$P(D > 5) = \text{normalcdf}(5, 999, 10, 7.3937) = \boxed{.751}$

31. AP Stats. The College Board reported the score distribution shown in the table for all students who took the 2004 AP Statistics exam.

L1 Score	L2 Percent of Students
5	12.5
4	22.5
3	24.8
2	19.8
1	20.4

a) Find the mean and standard deviation of the scores.
b) If we select a random sample of 40 AP Statistics students, would you expect their scores to follow a Normal model? Explain.
c) Consider the mean scores of random samples of 40 AP Statistics students. Describe the sampling model for these means (shape, center, and spread).

(a) 1var stats L1, L2:

$\bar{x} = 2.869$

$s = 1.3121$

(b) This is not asking about the sampling distribution, but about the distribution of the sample itself, which has different rules to determine shape (we will learn more about this later, actually w/ n = 40 we can assume the sample is "nearly normal")

(c) $n \geq 25$ so shape is normal

$\mu_{\bar{x}} = \mu = 2.869$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{1.3121}{\sqrt{40}} = .20746$

$\boxed{N(2.869, .20746)}$

(Same mean as population but with less variation due to averaging 40 scores)

33. AP Stats, again. An AP Statistics teacher had 63 students preparing to take the AP exam discussed in Exercise 31. Though they were obviously not a random sample, he considered his students to be "typical" of all the national students. What's the probability that his students will achieve an average score of at least 3?

Conditions

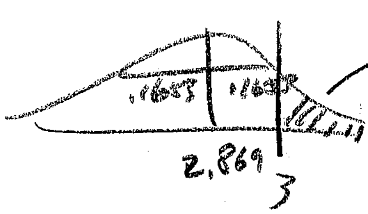
✓ — $n = 64 \geq 25$

✓ — SRS, no but representative

✓ — 63 < 10% of all AP Students

$\mu_{\bar{x}} = 2.869$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{1.3121}{\sqrt{63}} = .1653$



P(score ≥ 3) = normalcdf(3, 999, 2.869, .1653)

$= \boxed{.214}$