1. City planners wanted to know how many people lived in a typical housing unit so they compiled data from hundreds of forms that had been submitted in various city offices. Summary statistics are shown in the table.

$\bar{x}$	2.53 people
s	1.40 people
min	1
Q1	1
median	2
Q3	3
max	10

   a. Notice that the minimum occupancy and the first quartile are the same. Explain how this can be.

There must be a large percent of this sample who live by themselves, More than 25% or at least exactly 25% of the people.

   b. The city classifies residences housing 4 or more people as "high occupancy". Would you consider 4 occupants to be unusually high? Explain.

While 4 occupants is in the highest 25% of responents, it is not unusually high. An unusually high value would be rare (like an outlier) and this is not an outlier.

IQR = 2 1.5(2) = 3 Q1-3 = -2 Q1+3 = 6 Since 4 is within the fences, it is not unusually high.

   c. The city bases their garbage disposal fee on the occupancy level of the home or apartment. The annual fee is \$40 plus \$5 per person, so a single occupant pays \$45 and the homes with 10 people pay \$40 +\$5(10) = \$90 a year. What is the median fee paid? And the IQR?

med = 40 + 5(2) = $50

IQR = 5(2)

med $50

IQR $10

   d. What are the mean and standard deviation of the garbage disposal fees?

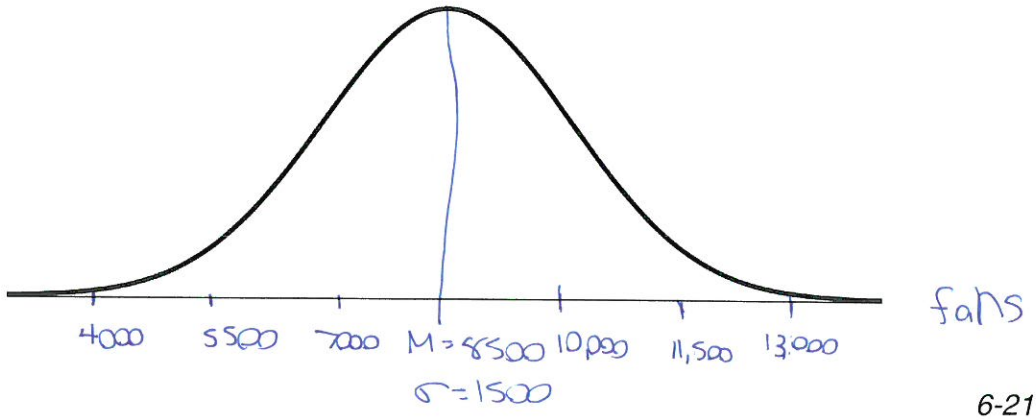
$\bar{x}$ = 40 + 5(2.53)

std dev = 5(1.4) = $7

mean $52.65

std dev $7

2. Owners of a minor league baseball team believe that a Normal model is useful in projecting the number of fans who will attend home games. They use a mean of 8500 fans and a standard deviation of 1500 fans. Draw and clearly label this model.



3. Although most of us buy milk by the quart or gallon, farmers measure daily production in pounds. Guernsey cows average 39 pounds of milk a day with a standard deviation of 8 pounds. For Jerseys the mean daily production is 43 pounds with a standard deviation of 5 pounds. When being shown at a state fair a champion Guernsey and a champion Jersey each gave 54 pounds of milk. Which cow's milk production was more remarkable? Explain.

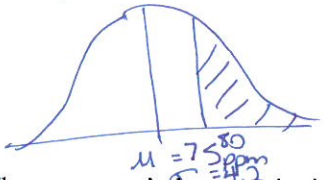
Guernsey
$\mu = 39$
$\sigma = 8$
$z = \frac{54-39}{8} = 1.875$

Jersey
$\mu = 43$
$\sigma = 5$
$z = \frac{54-43}{5} = 2.2$

It was more remarkable for the Jersey cow to give 54 lbs of milk because that was 2.2 standard deviations above the mean, while the Guernsey was only 1.875 std devs. above the mean

4. A company's manufacturing process uses 500 gallons of water at a time. A "scrubbing" machine then removes most of a chemical pollutant before pumping the water into a nearby lake. Legally the treated water should contain no more than 80 parts per million of the chemical, but the machine isn't perfect and it is costly to operate. Since there's a fine if the discharged water exceeds the legal maximum, the company sets the machine to attain an average of 75 ppm for the batches of water treated. They believe the machine's output can be described by a Normal model with standard deviation 4.2 ppm. **(SHOW WORK)**

a. What percent of the batches of water discharged exceed the 80ppm standard?

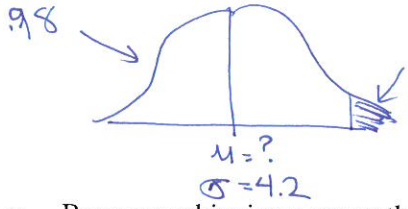


$P(x \geq 80) = P(z \geq 1.19) = 1 - P(z \leq 1.19) = 1 - .8823 = .117$

$z = \frac{80-75}{4.2} = 1.19$

About 11.7%

b. The company's lawyers insist that they not have more than 2% of the water over the limit. To what mean value should the company set the scrubbing machine? Assume the standard deviation does not change.

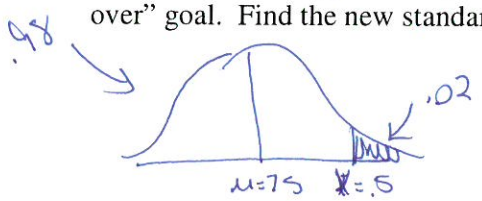


$z = +2.05$

$+2.05 = \frac{80-\mu}{4.2}$

The mean should be 71.39 ppm

c. Because achieving a mean that low would raise the costs too much, they decide to leave the mean set at 75 ppm and try to reduce the standard deviation to achieve the "only 2% over" goal. Find the new standard deviation needed.



$z = 2.05$

$2.05 = \frac{80-75}{\sigma}$

$2.05\sigma = 5$

$\sigma = 12.195$

d. Explain what achieving a smaller standard deviation means in this context.

A smaller standard deviation means that the percent of the pollutant is fairly consistent, very closely clustered around 75ppm.