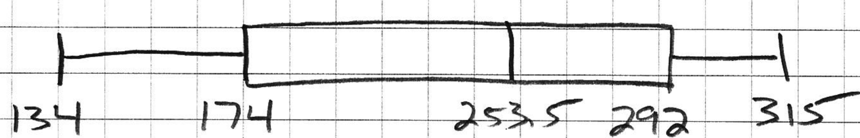
AP Stats 2019 FRQs

1. a. The distribution of room sizes is bimodal, with centers at about 150-200 ft^2, and 250-300 ft^2. There are no outliers, and distribution is symmetric. The median of the distribution is around 250 ft^2. The distribution of room sizes ranges from around 100 ft^2 to 350 ft^2.

   b. To check for outliers, we will calculate the upper and lower fences.

$$\text{Upper Fence} = Q3 + 1.5\,IQR$$
$$= 292 + 1.5(292-174) = 469\ ft^2$$
$$\text{Lower Fence} = Q1 - 1.5\,IQR$$
$$= 174 - 1.5(292-174) = -3\ ft^2$$

The minimum room size of 134 ft^2 is higher than the lower fence, and the maximum room size of 315 ft^2 is less than the upper fence. Therefore there are no outliers in the distribution of room sizes.



   c. The bimodal nature of the distribution of room sizes is apparent in the histogram but not the boxplot.

AP Stats 2019 FRQs

2. a.

Treatments: 0, 1.25, 2.5, and 3.75 $^{m1}/_{L}$

Experimental Units: The 20 individual containers

Response Variable: the number of insects alive one week after spraying.

b. This experiment does have a control group: the containers receiving 0 $^{m1}/_{L}$ of fungus mixture.

c. I would assign each container a number between 1 and 20. Using two digit random numbers, I would generate 5 random numbers, skipping repeats. The containers with these five numbers would receive the first treatment. I would repeat this process for the remaining containers until each treatment was randomly applied to five containers.

AP Stats 2019 FRQs

3.

a. i) $P(\text{Never and Woman}) = \underline{\underline{0.0636}}$

ii) $P(\text{Never or Woman}) = P(\text{Never}) + P(\text{Woman}) - P(\text{Never and Woman})$

$= 0.1200 + 0.5300 - 0.0636$

$= \underline{\underline{0.5864}}$

$P(\text{Never or Woman}) = 0.5864$

iii) $P(\text{Never} \mid \text{Woman}) = \dfrac{P(\text{Never and Woman})}{P(\text{Woman})} = \dfrac{0.0636}{0.5300}$

$P(\text{Never} \mid \text{Woman}) = 0.12$

b. For independence:

$P(\text{Woman}) = P(\text{Woman} \mid \text{Never})$

$P(\text{Woman}) = 0.53$

$P(\text{Woman} \mid \text{Never}) = \dfrac{0.0636}{0.1200} = 0.53$

Because $P(\text{Woman}) = P(\text{Woman} \mid \text{Never})$, we can conclude being a person who answers "Never" and being a woman are independent.

C. $P(\text{Medicine}) = 0.54$

X = # who take prescribed medicine out of 5.

Binomial, $p = 0.54$, $n = 5$

$P(X \geq 4) = P(X=4) + P(X=5)$

$= \binom{5}{4}(0.54)^4(0.46)^1 + \binom{5}{5}(0.54)^5(0.46)^0$

$= 0.1956 + 0.0459$

$= 0.2415$

AP Stats 2019 FRQs

4.

$H_0: p_{2017} - p_{2014} = 0$ p_{2017} = prop. plants resistant in 2017

$H_a: p_{2017} - p_{2014} > 0$ p_{2014} = prop. plants resistant in 2014.

<u>Assumptions / Conditions</u>

- Both samples were random
- samples < 10% of all plants
- For both samples, np and nq are more than 10.

$$
\begin{aligned}
2017:&\ np = (52)(0.385) = 20 \\
&\ nq = (52)(1-0.385) = 32 \\
2014:&\ np = (61)(0.197) = 12 \\
&\ nq = (61)(1-0.197) = 49
\end{aligned}
$$

Because conditions are met, we will conduct a two proportion z hypothesis test.

z test statistic = 2.210
p-value = 0.0136

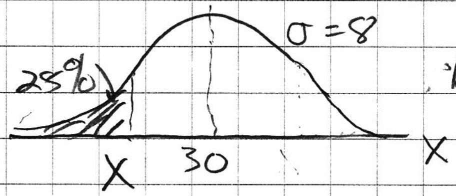
Note: As long as we state what test we are conducting, in this case a 2-prop z-test, we can use technology to get the test statistic and p-value.

<u>Conclusion</u>: Because the p-value is less than $\alpha = 0.05$, we reject the null hypothesis. We have evidence that there has been an increase in proportion of Kochia plants from 2014 to 2017 that are resistant to glyphosphate.

AP Stats 2019 FRQ's

5.

a.



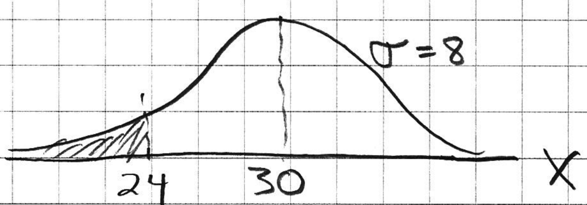
X= months of battery life

z for the 25th percentile = −0.6745

$X = 30 + (-0.6745)(8) = 24.604$ months

We expect at about 24.6 months 25% of the phones have failed.

b.



$P(X \leq 24) = 0.2266$

c.

$$\text{Expected Gain} = (-150)(0.2266) + (50)(1-0.2266)$$
$$= -33.99 + 38.67$$
$$= \$4.68$$

For each warranty purchased, the expected gain is \$4.68

AP Stats 2019 FRQ's

6.

a. The population is all one-bedroom apartments in this city that are voluntarily posted to the website.

b. Because the distribution of rental prices are skewed to the right, the mean price will be higher than the median. The median price will be a better "typical" value, so if Emma uses the mean as "typical", the disadvantage is Emma will over-estimate the typical rental price.

c. To create a theoretical sampling distribution of median rental prices for samples of size 50, one would have to randomly sample 50 one-bedroom apartments and record the median. This sampling and recording of sample medians would have to be repeated many times until all combinations of 50 have been sampled. Those medians of all the samples would be the sampling distribution of medians for samples of size 50.

d. The 5th percentile would occur at the (0.05)(1500) or 75th lowest median, which occurs at rental price of \$2500.

The 95th percentile would be at the 75th from the highest median, which is at \$2950.

e. The percentage of bootstrap medians equal to or between \$2500 to \$2950 is 14,404/15,000 or 96.0%

f. Based on the bootstrap process, we are 96% confident the true median of rental prices is between \$2500 and \$2950.