

14

iii

Because it's not targeting

as specific of ~~a narrow~~ ~~as~~ ~~specified~~ subset of

Students. Students in the phone book can be into wildly different things and you're less likely to pick all the basketballers. Most General representation of a universities student body on that list.

2

a ~~Observational~~ ~~Controlled~~

b Yes because it's a controlled experiment was able to split into groups and

~~Researcher didn't influence groups~~

2 a observational study.

b no, this is only association not definite causation from a study based on a controlled experiment. Researcher didn't influence groups just measured

3 a $70000 = \frac{N}{10}$

$N = 700000$

sub 100000 and add 1000000 to show the changed number.

new $N = 700000 + 900000 = 1600000$

$\bar{x} = \frac{1600000}{10}$

$= \$160000$

b \$55000

$s = \sqrt{\frac{1}{10-1} \sum_{i=1}^{10} (x_i - \bar{x})^2}$

$s_{20000} = \sqrt{\frac{1}{9} \sum_{i=1}^{10} (x_i - 70000)^2}$

$$3c \quad s = 20000$$

$$s^2 = \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2$$

$$= \frac{1}{n-1} \left(\sum_{i=1}^n x_i^2 - n\bar{x}^2 \right)$$

This expansion can be found at
<https://www.thoughtco.com/sum-of-squares-formula-shortcut-3126266>

$$= \frac{\sum_{i=1}^n x_i^2 - \frac{1}{n} \left(\sum_{i=1}^n x_i \right)^2}{n-1}$$

$$= \frac{\sum_{i=1}^n x_i^2 - n\bar{x}^2}{n-1}$$

$$\sum_{i=1}^n x_i^2 = s^2(n-1) + n\bar{x}^2$$

$$\text{orig } \sum_{i=1}^{10} x_i^2 = (20000)^2(9) + 10(30070000)^2 \\ \approx 5.26 \times 10^{10}$$

$$\text{new } \sum_{i=1}^{10} x_i^2 = 5.26 \times 10^{10} - (1 \times 10^3)^2 + (1 \times 10^6)^2 \\ \approx 1.0426 \times 10^{12}$$

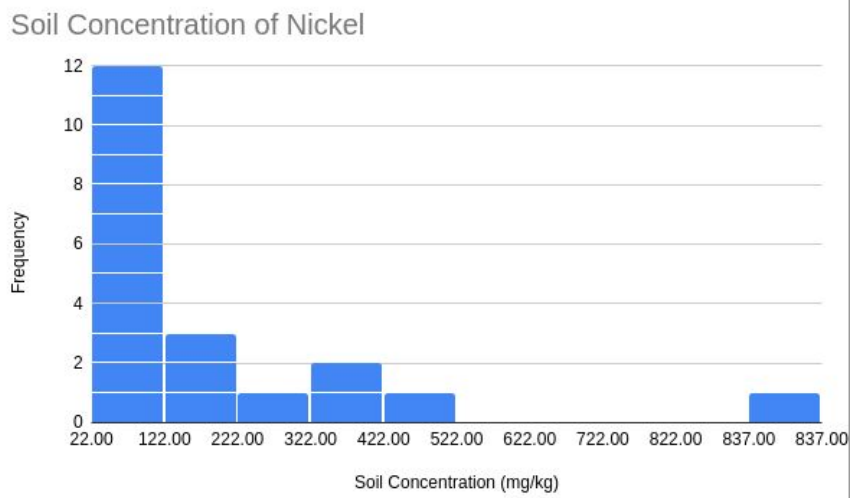
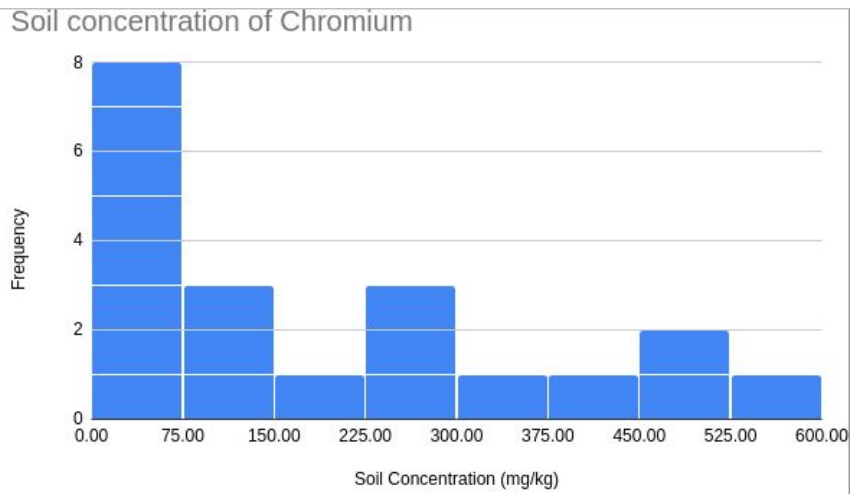
$$\text{new } s^2 = \frac{1}{9} \left(1.0426 \times 10^{12} - 10 \times 160000^2 \right)$$

$$= 8.74 \times 10^{10}$$

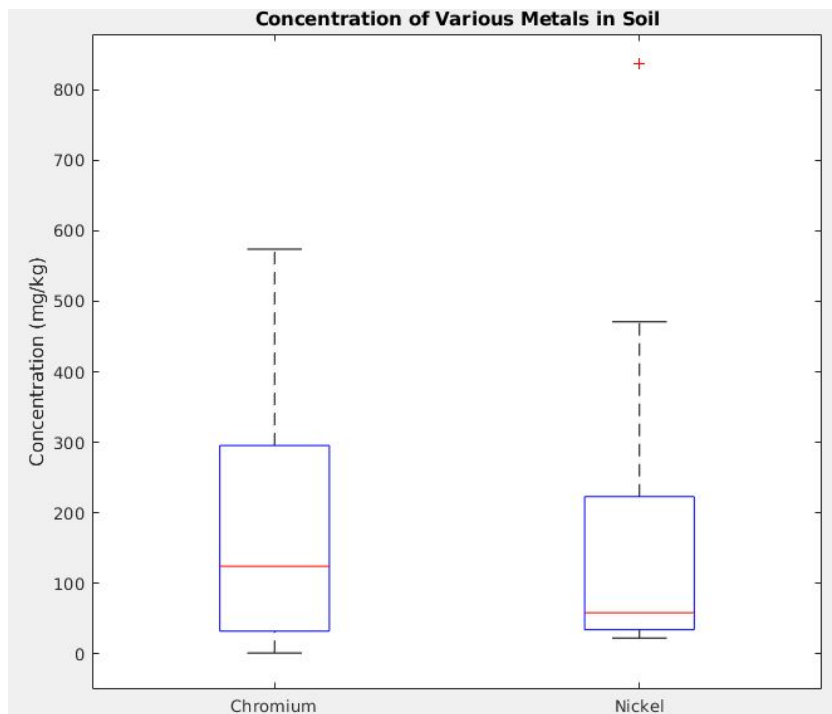
$$s = \sqrt{8.74 \times 10^{10}}$$

$$\approx 295634.91$$

4a



4b



4c

From the comparative boxplots in 4b the following differences can be seen between the two sets:

- The IQR of the nickel plot is smaller than that of the chromium set. I.e. there is more variance in the chromium concentration.
- Nickel has a lower upper quartile than chromium
- Nickel has a lower median than chromium
- Chromium has a lower minimum than nickel
- Excluding the outlier, nickel has a lower maximum than chromium
- Nickel has a lower lower quartile than chromium

5a ~~1, 2, 3~~
 $\{1, 2, 3\}$

b $P(\text{odd number}) = \frac{4}{6}$
 $= \frac{2}{3}$

c no, because there are still the same outcomes of rolling the dice once, just different probabilities.

d yes, 3 has a higher likelihood of showing up over the other faces ~~which means an odd number is more likely to show up than previously~~

~~can treat as a 7 sided dice with faces 1, 1, 1, 2, 2, 3, 3~~
 (probability of landing on 3 is now twice that of landing on the other 5 sides)
 $P(\text{odd}) = \frac{3}{7}$

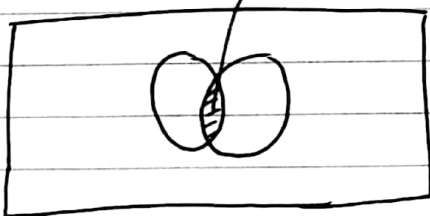
You have changed odds of landing on an odd number.

6a $P(V) = 0.15$ $P(V \cup W) = 0.17$

$P(W) = 0.05$

$P(V \cap W)$ V and W

a

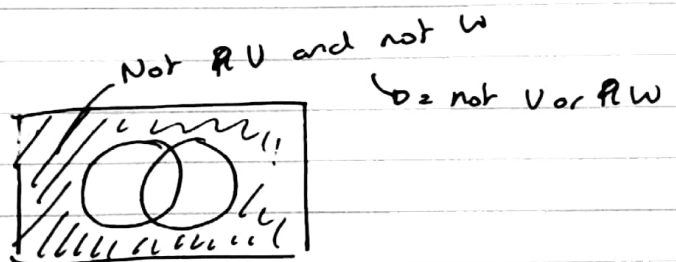


$P(V \cap W) = P(V) + P(W) - P(V \cup W)$

$= 0.15 + 0.05 - 0.17$

$= 0.03$

b $P(\overline{V \cap W}) = 1 - P(V \cap W)$
 $= 1 - 0.03$
 $= 0.97$



c $P(V \cap \overline{W}) = P(V \cup W) - P(W)$
 $= 0.17 - 0.05$
 $= 0.12$

