

1) When Joe Tritschler was a kid in the 1980s, they used to say "caffeine will stunt your growth." What type of experiment would be required in order to prove that ingesting caffeine as a child causes reduced height in adulthood, and why is stating this conclusion as statistical fact therefore invalid?

designed experiment

(+1)

it would be unethical to have children ingest caffeine for the purpose of this experiment

(+1)

2) Joe Tritschler has three very *energetic* children who like to go to a nearby park. There are nine trees in the vicinity of the playground on which they like to urinate way more frequently than necessary. How many combinations of three trees may be utilized at a time for this purpose if a) it matters which child is on which tree and b) it doesn't?

a) ordered combinations = permutations

$$P\binom{n}{r} = \frac{n!}{(n-r)!} = \frac{9!}{(9-3)!} = \frac{9 \times 8 \times 7 \times \cancel{6!}}{\cancel{6!}} = 504$$

(+1) (11)

b) unordered combinations

(+1)

$$C\binom{n}{r} = \frac{n!}{r!(n-r)!} = \frac{9!}{3!(9-3)!} = \frac{9 \times 8 \times 7 \times \cancel{6!}}{3! \times \cancel{6!}} = 84$$

(+1)  $\hookrightarrow = 6$

3) The following is actual data on low temperature in Dayton, Ohio for the calendar date of February 17 in various years in degrees Fahrenheit:

| Year            | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015      | 2016 | 2017 | 2018 |
|-----------------|------|------|------|------|------|------|------|------|-----------|------|------|------|
| Low Temp Dayton | 16   | 37   | 19.9 | 21.9 | 50.0 | 27.0 | 12.0 | 12.2 | (no data) | 29.1 | 30.2 | 28.2 |

Compute the sample mean, sample variance, sample standard deviation, and sample range, and include a unit with each answer. Draw a histogram displaying the frequency distribution of low temperatures using the following bins: cold, too cold, and stupid-cold.

Hint:  $s^2 = \frac{\sum x_i^2 - \frac{(\sum x_i)^2}{n}}{n-1}$

$$n = 11$$

(+1)

$$\bar{x} = \frac{\sum x_i}{n} = \frac{283.5}{11} = 25.77^\circ\text{F} \quad (+2)$$

$$s^2 = \frac{8577 - \frac{283.5^2}{11}}{10} = 127.0 (\text{°F})^2 \quad (+3)$$

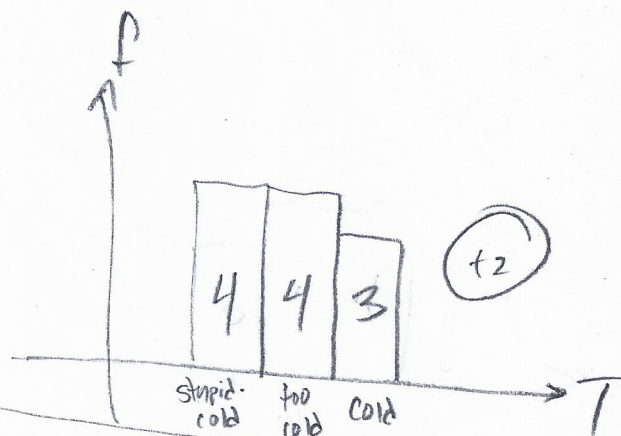
$$s = \sqrt{s^2} = 11.27^\circ\text{F} \quad (+2)$$

$$r = 50 - 12 = 38^\circ\text{F} \quad (+2)$$

cold : 30s or higher  $\rightarrow 3$

too cold : 20s  $\rightarrow 4$

stupid-cold : teens  $\rightarrow 4$



OK if equal width bins from data!  
(very different outcome!)

bin boundaries :  $12 + \frac{38}{3} = 24.7$   
 $24.7 + \frac{38}{3} = 37.3$