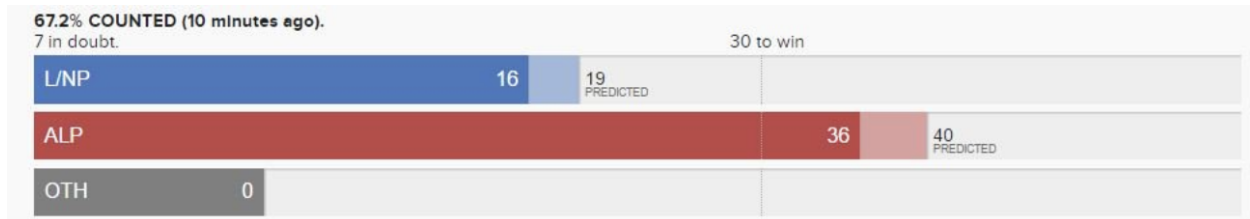


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MAT 121  
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Homework 1

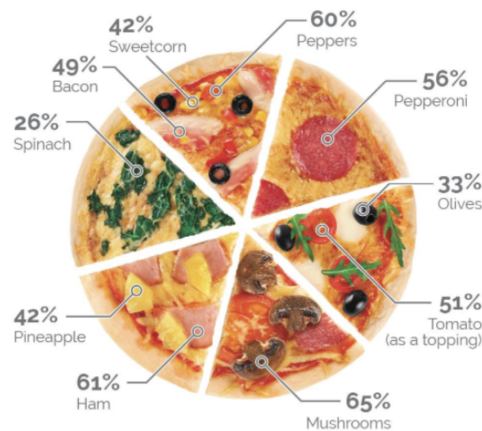
“That’s what I do; I drink and I know things.”  
– Tyrion Lannister, Game of Thrones

**Problem 1:** Explain what (if anything) is problematic with the following graph used to summarize Australian election results:



**Solution.** The bar at the bottom represents 0% but has area. In fact, it is approximately half the size of the bar representing 16%. So one would expect 8% for the bottom most graph. Moreover, the top bar is over half the length of the middle bar, despite the fact its value is not half the value of the middle bar. The graph should keep things in proportion and use a true zero.

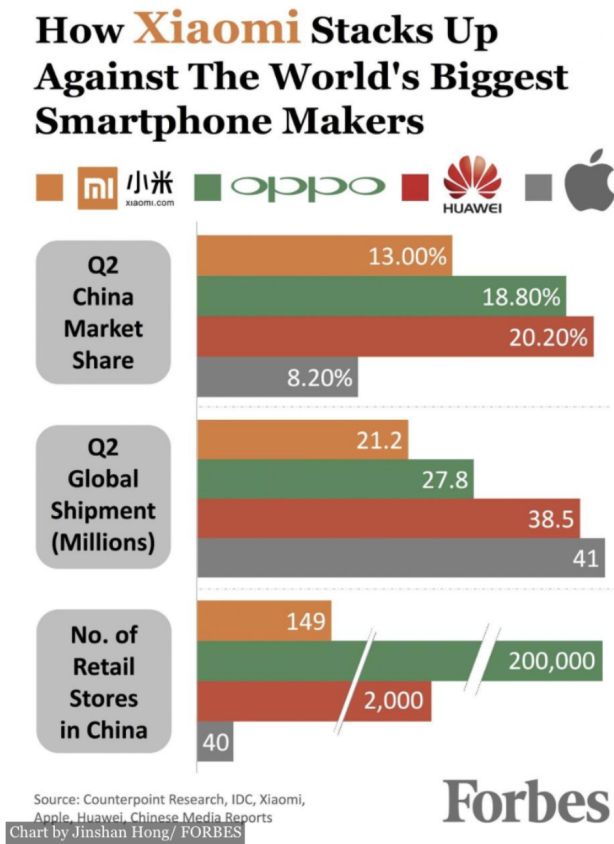
**Problem 2:** Explain what (if anything) is problematic with the following graph used to summarize pizza preferences in the UK.



**Solution.** The percentages total to 485%, which is impossible. The graphic uses all equal area slices, despite not all the percentages being the same.



**Problem 4:** Explain what (if anything) is problematic with the following graph used to compare smartphone makers.



**Solution.** The labeling could be much clearer, as is the case with the individual labels for each bar graph. There is no absolute zero. The bars are not to scale. Even worse, the bottom graphic uses a break to try to put the given company, Xiaomi, at a scale where it seems to be a comparable size to the green and red bars. In reality, it is thousands of times smaller. The labeling could be much clearer. What was wrong with labeling the bars with the company logos?

**Problem 5:** Determine whether the following variables are quantitative or categorical:

- (a) Categorical : College major
- (b) Categorical : Car brand
- (c) Categorical : Phone number
- (d) Quantitative : Grade number
- (e) Quantitative : Speed (mph)
- (f) Quantitative : Income

**Problem 6:** Determine whether the following data is discrete or continuous:

- (a) Continuous : Miles a car drives.
- (b) Continuous : Surface temperature of the Earth.
- (c) Discrete : Number of movies at the movie theatre.
- (d) Discrete : Number of particles in the universe.

**Problem 7:** Determine whether the following are a random sample, a simple random sample, or both.

- (a) In a lecture audience, the student first alphabetically is chosen to come to the front.  
*This is neither a random sample nor a simple random sample.*
- (b) In a lecture hall, three random seat numbers are called and those seated come to the front.  
*This is both a random sample and a simple random sample.*
- (c) In a lecture hall, a random row is chosen to come to the front.  
*This is a random sample but is not a simple random sample.*

**Problem 8:** Determine whether the following measurements are nominal, ordinal, interval, or ratio:

- (a)           *Nominal*           : Wall Color
- (b)           *Ratio*           : Age
- (c)           *Interval*           : Temperature (°F)
- (d)           *Ordinal*           : Likert scale (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)
- (e)           *Ratio*           : Car Price
- (f)           *Nominal*           : Book Genre
- (g)           *Interval*           : SAT Score (Redesigned: 400–1600)
- (h)           *Ordinal*           : Exam Difficulty

**Problem 9:** Determine whether the following samples are random, systematic, convenience, stratified, or cluster:

- (a)           *Convenience*           : A news channel website polls people on a new government policy.
- (b)           *Cluster*           : From a list of large cities in a state, 7 are chosen and tax incomes are taken from every citizen in those cities.
- (c)           *Stratified*           : College students are broken up by gender and then a few from each gender are questioned.
- (d)           *Systematic*           : A phone survey company dials every 5th name in a directory.
- (e)           *Random*           : Names are chosen out of a hat.

**Problem 10:** Define a *matched pairs design* experimental design.

**Solution.** A *matched pairs experimental design* is an experiment in which subjects are paired into groups that share some characteristic. For example, one may do a 'twin study' or a 'before/after study'.

**Problem 11:** In a political poll, 26% (1,911 individuals) stated they had no plans on voting in the coming election. How many people were polled? If the poll were performed on 551 individuals, at least how many people would also have to not have plans to vote to achieve the same percentage?

**Solution.** We know  $\frac{26}{100} = \frac{1911}{N}$  so that  $26N = 191100$ . But then  $N = \frac{191100}{26} = 7350$ . Therefore, 7,350 people participated in the study. For the second question, we know that 26% of 552 is  $0.26 \cdot 551 = 143.26$ . Therefore, at least 144 people have to have no voting plans to achieve at least the same percentage.

**Problem 12:** Convert the following proportions to a percentage or percentages to a proportion:

(a)  $44.7\% = 0.447$

(b)  $0.01 = 1\%$

(c)  $110\% = 1.10$

(d)  $0.05 = 5\%$

(e)  $2.23 = 223\%$

**Problem 13:** Calculate the following to two decimal places:

$$(a) \frac{127.6 - 111.3}{6.9} = \frac{16.3}{6.9} = 2.36$$

$$(b) \frac{56 - 71}{4} = \frac{-15}{4} = -3.75$$

$$(c) \frac{556.3 - 561.2}{\frac{4.2}{\sqrt{2}}} = \frac{-4.9}{\frac{4.2}{1.41421}} = \frac{-4.9}{2.9699} = -1.65$$

**Problem 14:** Solve for  $x$  in the following:

$$\frac{x - 56.3}{4.7} = 2.62$$

**Solution.**

$$\frac{x - 56.3}{4.7} = 2.62$$

$$x - 56.3 = 12.314$$

$$x = 68.614$$