

6. Look back at question #5. If that question shows up on the test and it is NOT MULTIPLE CHOICE, would you still know how to answer the question correctly?

- A) Yup!
- B) No.
- C) Maybe?
- D) Okay, I can take a hint...
- E) Let me look back at #5 one more time...

7. Obtaining a sample of students in a high school by randomly sampling from each grade level is an example of

- A) convenience sampling
- B) cluster sampling
- C) simple random sampling
- D) voluntary response sampling
- E) stratified random sampling
- H) systematic random sampling

8. Describe each of the following as either a *statistic* or a *parameter*. Then write the appropriate symbol for each.

² parameter ¹ μ A) The average number of blue M&M's per bag produced by the M&M/Mars Co.

² statistic ¹ \bar{x} B) The average number of blue M&M's per bag in a random sample of 30 bags.

9. An article on peanut butter in Consumer Reports reported the following scores for various brands:

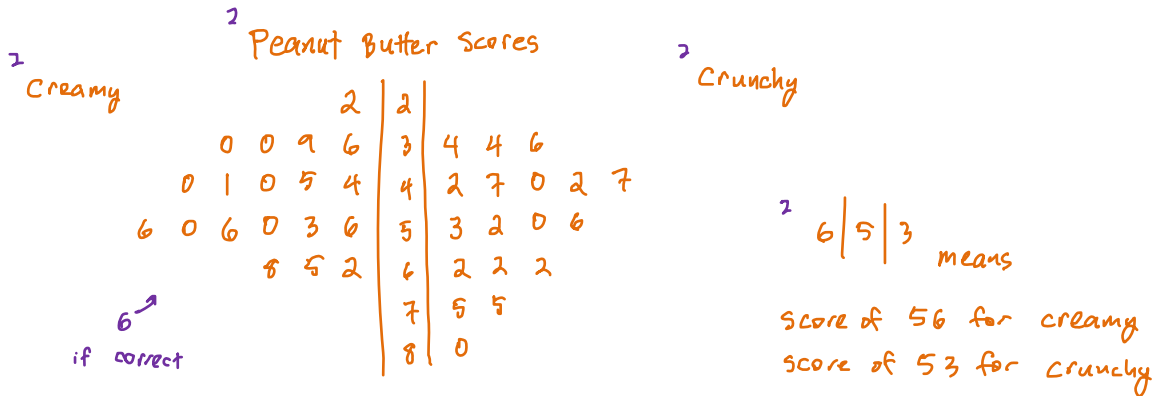
Creamy

56 44 62 36 39 53 50 65 45 22
 40 56 68 41 30 40 50 56 30

Crunchy

62 53 75 42 47 40 34 62 52
 50 34 42 36 75 80 47 56 62

Construct a comparative stem-and-leaf display (*the use of split stems is NOT necessary for this problem*). Then write a few sentences to **compare** the two types of peanut butter.



In general, the distribution of scores for crunchy is higher than the scores for creamy.

Center: Creamy has a slight higher mode (in the 50's) than crunchy (in the 40's).

Shape: Both distributions are unimodal. The distribution for creamy is perhaps skewed slightly to the lower numbers, while the distribution for crunchy is slightly skewed to the higher scores (but one could make the case for "approximately symmetric" for both of these).

Spread: Both distributions have similar spreads, although it appears from the plot that crunchy has a larger spread. Crunchy has a spread of 34-80, and creamy has a spread of 22-68.

10. Madeline and Judy are conducting an experiment to see if students who eat animal crackers before a short memory test will perform better on the test versus students who do not eat any animal crackers. Their subjects will include students in all 4 grade levels in high school, and will also include both males and females. Both of the girls think that performance on this memory test will vary between grade levels (specifically, that the memory scores of 9th and 10th graders will be significantly different than the memory scores of 11th and 12th graders). They also believe that performance on the test will not vary significantly between males and females.

The girls wish to conduct a randomized block experimental study, however they cannot agree on an appropriate blocking variable. Judy thinks that they should block by gender, while Madeline thinks they should block by grade level. **Which girl is correct? Explain.**

Generally, you should block by whichever variable has a LARGER association with the response variable. Since the girls believe that there is MORE of an association between GRADE LEVEL and MEMORY PERFORMANCE, they should choose to block by grade level. So Madeline is correct.

EXPLANATION:

This means that once they separate the subjects by grade level, students in each group will be split up - half will get to eat animal crackers, and half will not.

This way, Madeline and Judy will be able to better compare the difference in scores between students who ate animal crackers versus those who didn't.

The goal in blocking is to create groups that are HOMOGENOUS in some way that associates with the response variable (which is memory performance scores).

Since there is not believed to be a significant difference between males and females (in terms of memory performance), blocking by gender would not help minimize the variability, since both blocks could still contain students of all 4 grades in each block.

11. Sixty people in a mall were interviewed. They were asked about the highest level of education they had completed and whether or not they smoked cigarettes.

a) Approximately what proportion of smokers completed high school only?

about 63%

b) Did a greater number of nonsmokers or smokers complete 4 or more years of college?

We don't know.
(we only have proportions, not counts)

c) Did a greater proportion of nonsmokers or smokers complete 4 or more years of college?

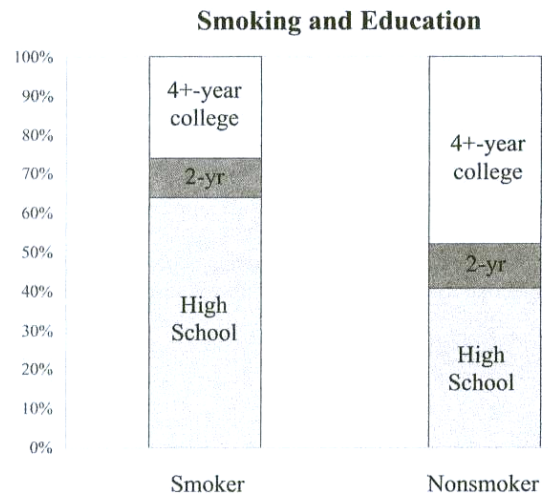
A greater proportion of NON-smokers completed 4+ years of college.

d) For this group of people is there an association between level of education and smoking? Explain.

Yes.

A significantly larger PROPORTION (don't say "number!!!") of smokers only completed up through high school compared to non-smokers.

Also, non-smokers were more likely (proportionally) to complete a 4+ year college than smokers.



12. In a survey of airline travelers, subjects were observed in the coach section of airplanes to determine if men or women are bothered by a seatmate of the opposite gender using the common armrest.

Discontentment Felt When Seat-mate Used Common Armrest: Males and Females

	Bothered (B)	Not Bothered (NB)	Total
Females (F)	19	26	45
Males (M)	38	17	55
Total	57	43	100

a) What is the percent of males who are bothered by a seatmate using the common armrest?

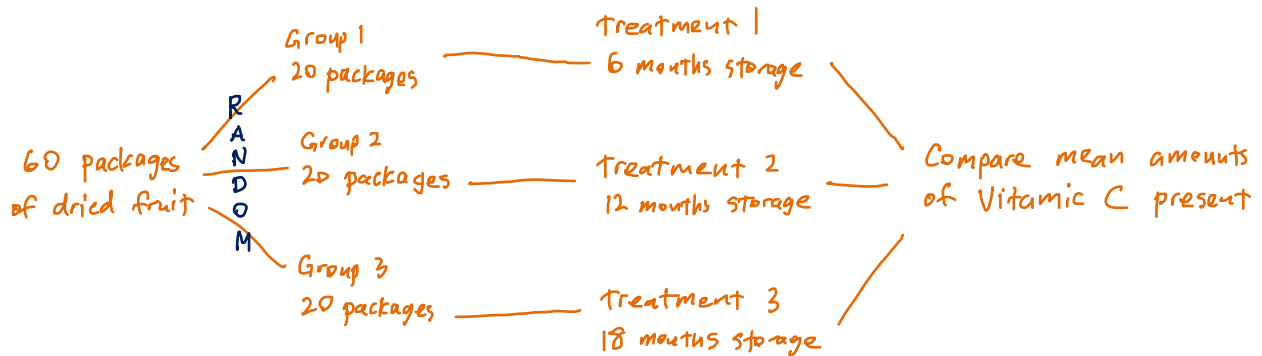
$$\frac{38}{55} \approx 69.1\%$$

b) What is the percent of people surveyed that are bothered?

$$\frac{57}{100} = 57\%$$

13. A nutritionist wants to study the effect of storage time (6, 12, and 18 months) on the amount of vitamin C present in dried fruit when stored for these lengths of time. Vitamin C is measured in milligrams per 100 milligrams of fruit. The researcher has 60 total packages of dried fruit: 30 of them are dried apple, and the other 30 are dried peach.

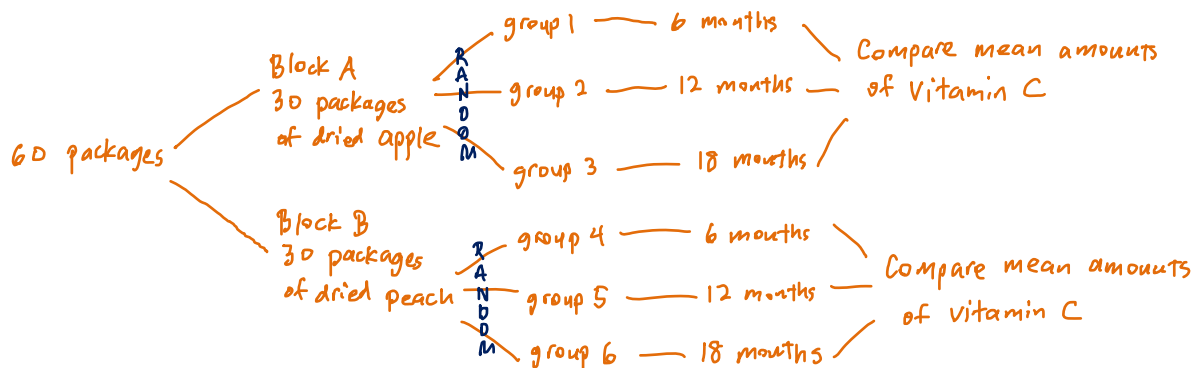
- a) Identify the experimental units: *Packages of dried fruit*
 the explanatory variable(s) or treatment(s): *Storage time of 6 months, 12 months, or 18 months*
 the response variable(s): *amount of vitamin C*
- b) Explain how you would carry out a completely randomized experiment for this study.



Randomization Procedure: Assign each package a number from 1 – 60. Write each number on a slip of paper and put all 60 slips in a hat (make sure each slip of paper is the same size, and be sure to stir the slips in the hat). Without looking, draw 20 slips of paper. The packages of fruit with those numbers are assigned to group 1 (6 months of storage). Draw 20 more slips from the hat and place those packages of fruit into group 2 (12 months of storage). The remaining 20 packages of fruit are placed into group 3 (18 months of storage).

- c) Describe the changes that would be made to your experiment in part (B) by incorporating blocking.

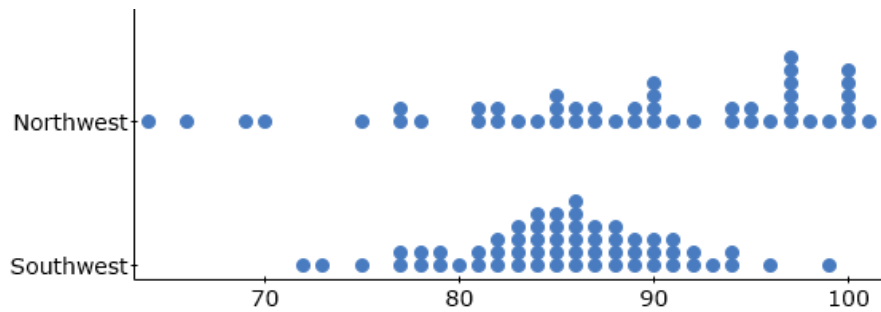
Since the different types of fruit may differ in amounts of Vitamin C, we will block by type of fruit.



- d) Can the nutritionist generalize his/her findings to all types of dried fruit? Explain.

No. Because this experiment was conducted with dried apple and dried peach, we can only generalize the findings to dried apple and dried peach (and not to other types of dried fruit).

14. Temperatures from random samples of cities on a hot summer day from two different regions of the European continent. Write a few sentences to **describe and compare** the distributions of temperatures.



[Student must COMPARE center, shape and spread IN CONTEXT]

The distribution of temperatures for the Southwest has a lower mode (in the mid-80's) than for the Northwest (where most of the temperatures are spread out in the 80's and 90's).

The distribution for the Northwest is skewed to the left, while the distribution of temperatures in the Southwest is roughly symmetric and bell-shaped (approximately normal).

The distribution of temperatures in the Northwest has greater variability (going from the mid-60's up to around 101), while the temperatures in the Southwest range from 72 to 99.

15. The dentists in a dental clinic would like to determine if there is a difference between the number of new cavities in people who eat an apple a day and in people who eat less than one apple a week. They are going to conduct a study with 50 people in each group.

Fifty clinic patients who report that they routinely eat an apple a day and 50 clinic patients who report that they eat less than one apple a week will be identified. The dentists will examine the patients and their records to determine the number of new cavities the patients have had over the past two years. They will then compare the number of new cavities in the two groups.

If the mean number of new cavities for those who ate an apple a day was statistically significantly smaller than the mean number of new cavities for those who ate less than one apple a week, could one conclude that the lower number of new cavities can be attributed to eating an apple a day? Explain.

No, we cannot conclude that eating an apple a day leads to a reduction in the number of new cavities. The patients were not randomly assigned to treatments, therefore this was an observational study (not an experiment). Causal (aka, "cause-and-effect") relationships can only be drawn from well-designed randomized experiments.

OR

The student may state that a possible confounding/lurking variable is responsible for the reduction of new cavities; however this variable **MUST** be linked to eating an apple a day.

FOR INSTANCE, perhaps patients who eat an apple a day also eat well and/or are more conscious about their general health, and perhaps this confounding variable has more to do with a reduction in cavities than just eating an apple.