What is an experiment?

Study I) How many cups of coffee did you have today?: _____

Study I and II) Take your pulse: _____

Study II) Flip a coin. Circle one: HEADS   TAILS

Tails = Sit   Heads = March in place

45 seconds.

Take your pulse: _____
                Put up your dots! Standing/Marching Difference: Pre/Post Coffee Pre v non-Coffee Pre

Fill in the following:

1) _____ is an experiment because:
   Study I/ Study II

2) This is a controlled experiment because:

3) This could be a paired experiment if:

4) What are blocks you might form?
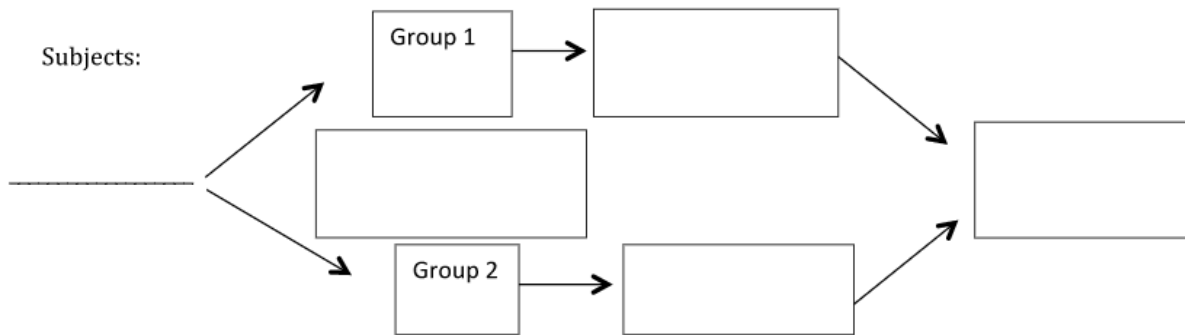
Sketch the dot plot:
Marching:

_____
5   10   15   20   25   30   35
Sitting:

_____
5   10   15   20   25   30   35

Complete:

Subjects:

Group 1 → [ ]	

[ ]

Group 2 → [ ]

[ ]

Complete:

population: _____ **sample/subjects:** _____

factors/treatment: _____ **response:** _____

Sheet with some more data analysis   spreadsheet with data

Now, answer the following Standardized Test Style Question:

A biologist is interested in studying the effect of marching on the heart rates of NYC teenagers. There are 34 teenagers who "volunteered" for this study.

(a) List the treatment that the biologist plans to use in this experiment.

(b) Using the treatments listed in part (a), describe 2 completely randomized designs that will allow the biologist to compare student heart rates. One (i) should make it equally likely that any subject is placed in either treatment group. The other (ii) should ensure that the groups are of equal size.
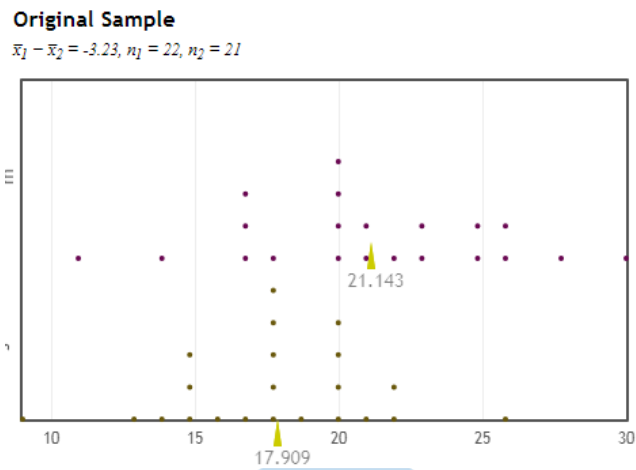
(i)

(ii)

(c) What are the subjects and population in your experiment? What is the response variable?

Subjects: Population:

(d) What is the advantage of a control group in an experiment?

Get a pack of cards. These are the results from a previous class. Their dot plot looks like:

Original Sample

$\bar{x}_1 - \bar{x}_2 = -3.23,\ n_1 = 22,\ n_2 = 21$

21.143

17.909

Does this plot look like the one from our class? YES NO

The difference between marching and standing in the class above was 3.234

Our experimental difference was _____(3.3322)

Shuffle the cards you get with your partner and put into 2 separate piles. (Only one of you has to write and submit the results) Fill in the following (repeat at least 3 times):   SAMPLE V. SAMPLE DISTRIBUTION

Average for first group	Average for second group	Difference

Put your differences on the dot plot on the board.

What does it mean to be statistically significant?

Observational study vs controlled experiment

- How to distinguish between observational studies and controlled experiments? The difference is in who decides on treatment assignment:
  - Controlled experiment: investigators decide assignment to treatment/control groups.
    - The advantage is that causality can be established and you can control for confounding variables.
  - Observational study: subjects assign themselves to the treatment/control groups. The investigator just observes what happens.
    - The advantage is that results may be more generalizable: people act differently in an experimental study.

Association

- Two variables are called associated, if knowing the value of one variable gives you information on the other.

  - Examples:
  - Weight and height of people are associated:
    - If you know that somebody is tall, it is more likely that the person is heavy.
    - Also, if you know that somebody is heavy, it is more likely that the person is tall.
  - Smoking habits and the height of adults are not associated:
    - If you know that somebody is smoking, that gives you no information about her/his height.
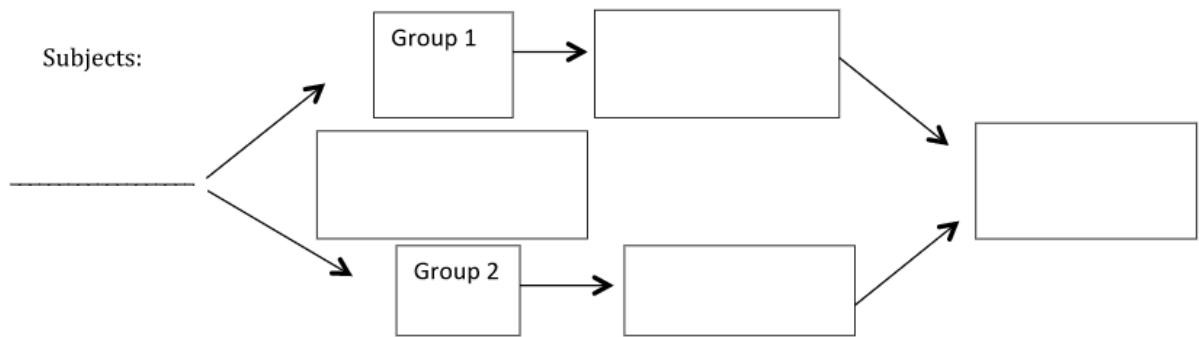   - Also, if you know somebody's height, that gives you no information on whether he/she is a smoker.

In an experiment, the **factor** (also called an independent variable) is an explanatory variable manipulated by the experimenter.
Each factor has two or more **levels** (i.e., different CATEGORICAL values of the factor). Combinations of factor levels are called **treatments**. The table below shows independent variables, factors, levels, and treatments for a hypothetical experiment.

		Cups of coffee		
		0	1	2 or more
Activity	sitting	*Treatment 1*	*Treatment 2*	*Treatment 3*
	marching	*Treatment 4*	*Treatment 5*	*Treatment 6*

In this hypothetical experiment, the researcher is studying the possible effects of activity and coffee on pulse rate. There are two factors - dosage of activity and dosage of coffee. The coffee factor has three levels - 0 cups, 1 cup, and 2 or more cups. The activity factor has 2 levels - sitting and marching. The experiment has six treatments. Treatment 1 is sitting and 0 coffees, Treatment 2 is sitting and 1 coffee, and so on.

If there is only one factor (as in the sitting marching experiment) than factor and treatment are interchangeable.

Subjects:

```
_____      Group 1  →  [          ]
         \                            \
          \   [          ]             →  [          ]
           \                          /
            → Group 2  →  [          ]
```

Complete:

population: _____ **sample/subjects:** _____

factors/treatment: _____ **response:** _____