AP Statistics
Blocking and Matched Pairs

Name Key
Period _____

Cautions About Experimentation

- Need to treat all the experimental units identically in every way except for the treatments being compared

Double blind experiment: neither the subject nor the people that have contact with them know which treatment the subject received.

- Helps limit response bias

Ex) You are testing a new painkiller. You have 90 volunteers in which 30 try new meds, 30 are on old meds, and 30 are on a placebo. Volunteers don't know which ones they are taking nor do the doctors recording the patients report of pain level. This is so the doctors recording the results do not influence the volunteer responses or take biased notes. Also the volunteers don't imagine that they have less pain just because they know they have the new meds.

Lack of Realism: the subjects, treatments or setting up of an experiment may not realistically duplicate the conditions we really wanted to study.

- The most serious potential weakness of any experiment

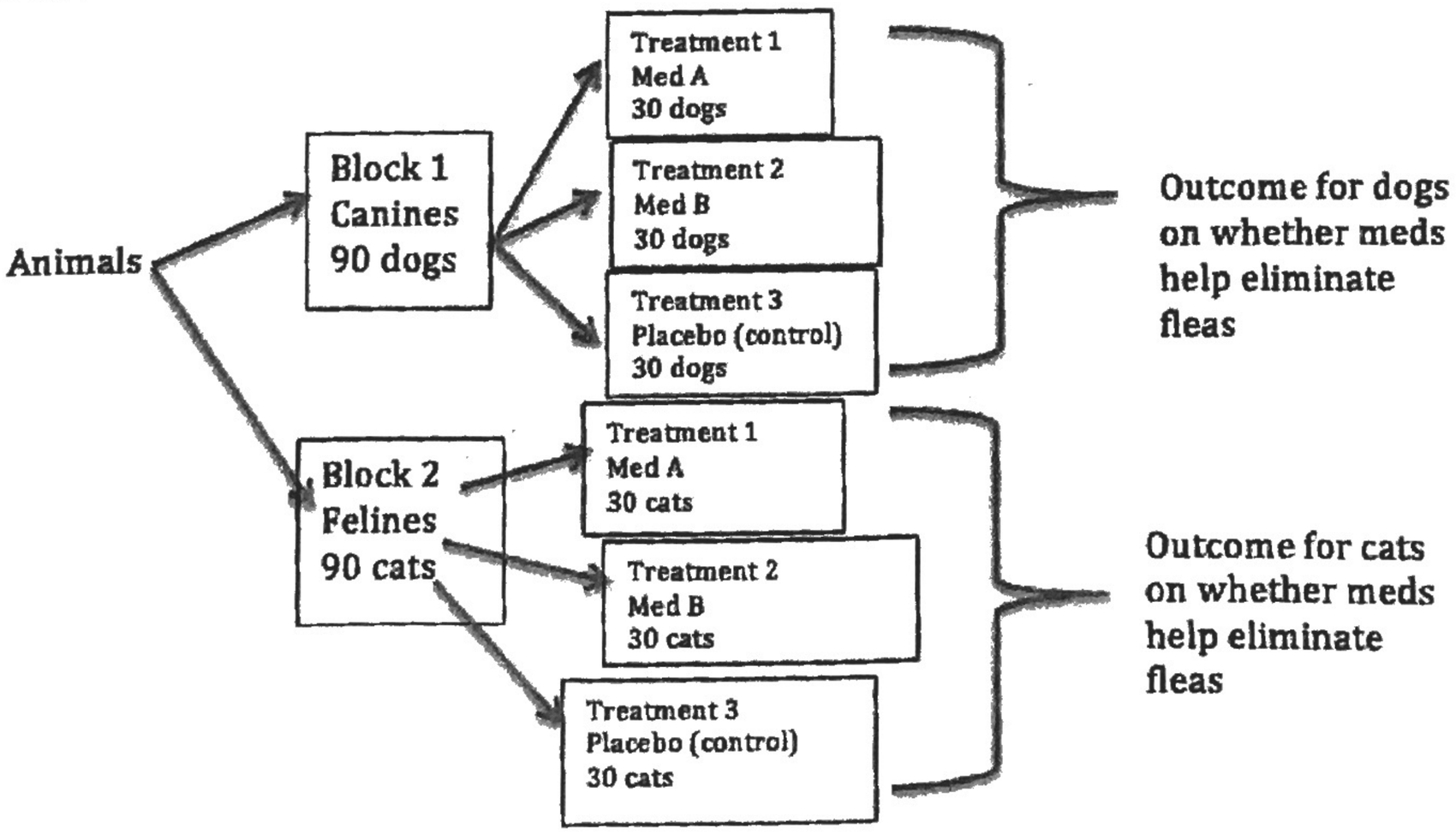
Block Design

Block: a group of experimental units or subjects that are known before the experiment to be similar in some way that is expected to affect the response.

Randomized block design: the random assignment of units to treatments carried out separately within each block.

- Allows us to draw separate conclusions about each block
- Allows us to do the same experiment to different blocks at the same time
- More precise overall conclusions because systematic difference can be removed when we study the overall effects
- Allows us to eliminate some lurking variables before the experiment begins

Example 1: We want to determine if medication helps eliminate fleas on animals? We are given three treatments (med A, med B, placebo) and 180 pets (canines (90) and felines (90)). How would we create this experiment to limit the number of lurking variables that might affect our outcome?

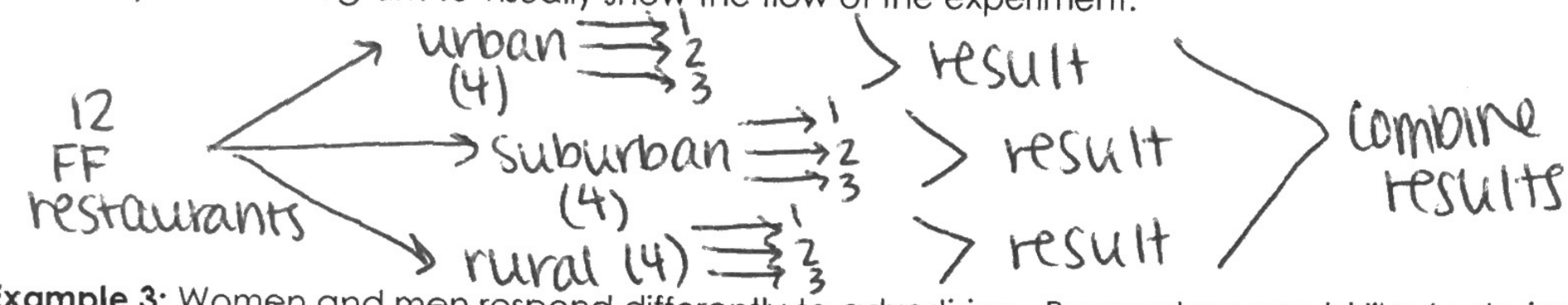


Example 2: A fast food franchise is test marketing 3 new menu items. To find out if they have the same popularity, 12 franchisee restaurants are randomly chosen for participation in the study. In accordance with the randomized block design, each restaurant will be test marketing all 3 new menu items. Furthermore, a restaurant will test market only one menu item per week, and it takes 3 weeks to test market all menu items. The testing order of the menu items for each restaurant is randomly assigned as well.

a) Describe in detail how you would set up the design for this experiment

I would block restaurants by type of location (urban, suburban, rural) so 4 places would be in each group. Then I would roll a die to determine which food menu they would start with for which week (1,2 ⇒ #1; 3,4 ⇒ #2; 5,6 ⇒ #3).

b) Draw a diagram to visually show the flow of the experiment.



3ads

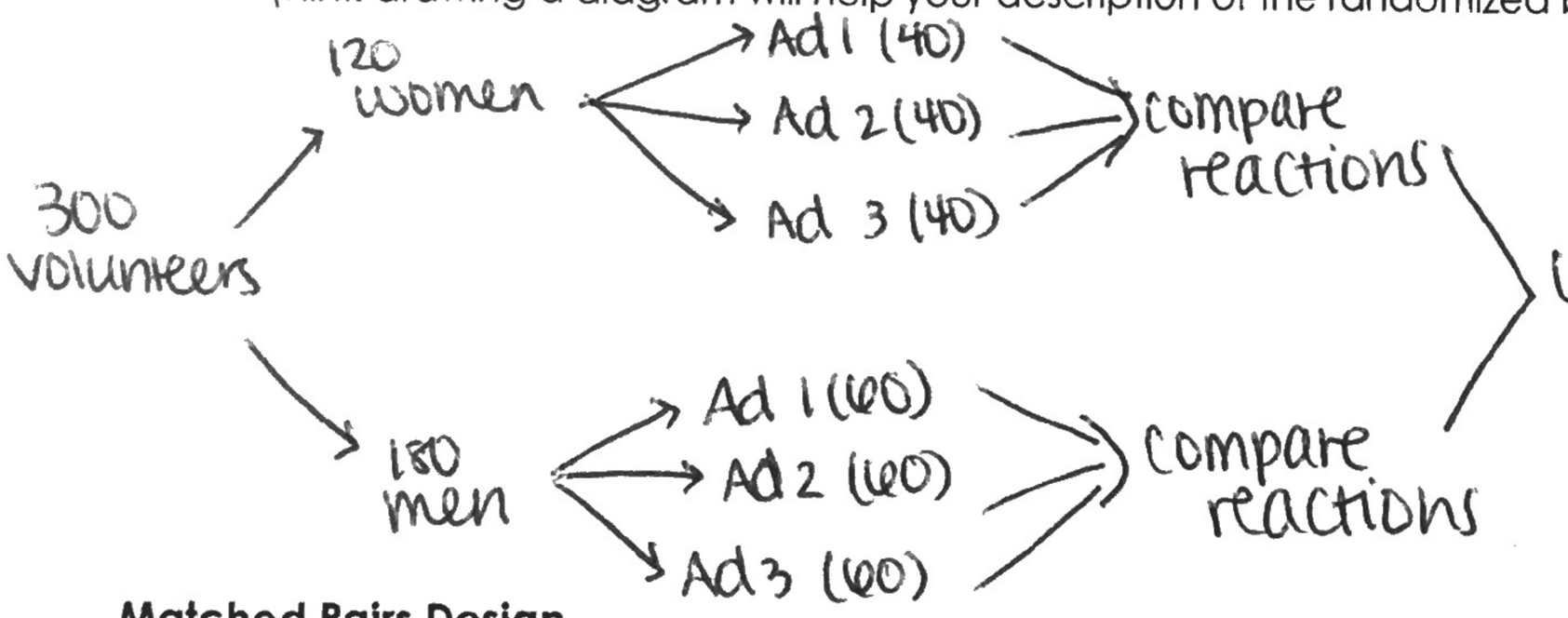
Example 3: Women and men respond differently to advertising. Researchers would like to design and experiment to compare the effectiveness of ~~there~~ their advertisements for the same product.

a) Explain why a randomized block design might be preferable to a completely randomized design for this experiment.

→ completely randomize = men & women are a single pool. It would send subjects to 3 groups without regard to gender. Ignores differences between men & women.

→ randomized block design = considers men & women separately. randomization would occur in both blocks. Allows you to look at men vs. women's reactions separately & gives a more effective overall response to the ad.

b) Outline a randomized block design using 300 volunteers (180 men and 120 women) as subjects. Describe how you would carry out the random assignment required by your design. (Hint: drawing a diagram will help your description of the randomized block design.)



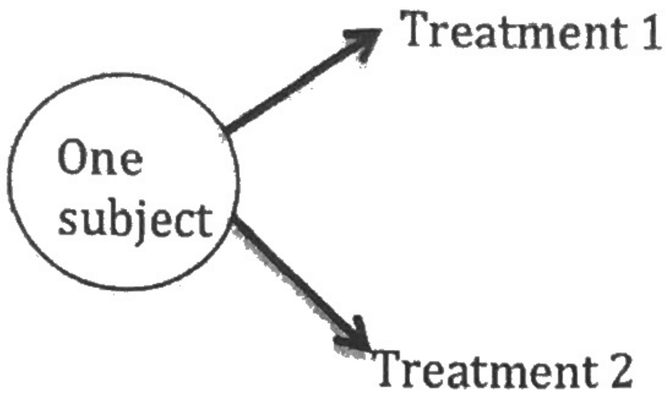
I would block men & women. # women 001-120 1st 40 have Ad 1, 2nd 40 Ad 2, 3rd Ad 3. # men 001-180. 1st 60 get Ad 1, etc. compare women's compare men. report on similarities & differences.

Matched Pairs Design

Matched pairs design: a common form of blocking for comparing just TWO treatments. In some matched pair designs, each subject receives both treatments in random order. In others, the subjects are matched as closely as possible, and one subject in each pair receives a treatment

Two types of Matched Pair Designs

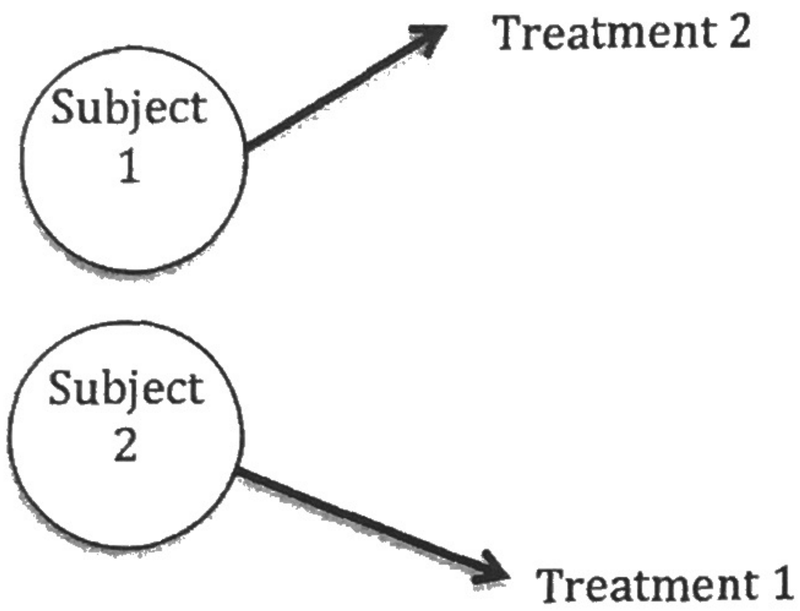
1)



You could have as many subjects doing the same experiment. (sample size can be more than 1). The randomization comes in when you can randomly choose which subject gets which treatment first

Ex) We want to determine which type of rubber tires last the longest. You have 50 volunteers. For each volunteer they will use one of the treatments for 30 days and the other treatment for 30 days. You randomly choose which treatment will be used first for EACH subject.

2)



You can have as many pairs of subjects you want as long as the subjects' characteristics were all the same. The randomization comes in when you select which subject gets what treatment for EACH pair

Ex) You are comparing two different fertilizers and which one works best. You go to the forest and pick out 50 plots of land. You then pair those plots together based on similar characteristics (same sun, on a hill, etc.). Then you randomly choose for each pair, which plot will get treatment 1 and which will get treatment 2

Example 4: A psychologist wants to know if the difficulty of a task influences our estimate of how long we spend working at it. She designs two sets of mazes that subjects can work through on a computer. One set has easy mazes and the other has difficult mazes. Subjects work until told to stop (after 6 minutes, but subjects do not know this). They are then asked to estimate how long they worked. The psychologist has 30 students available to serve as subjects.

a) Describe an experiment using a completely randomized design to learn the effect of difficulty on estimated time.

Randomly assign 15 students to easy mazes and 15 to hard mazes. Row #130 #01-30. 1st 15 go to easy + other 15 go to hard. After experiment compare time estimates of the 2 groups.

b) Describe a randomized block design experimental design using the same 30 subjects.

I would put students in education level groups (elem, middle, high). Once in groups I would # students and pick from row 101 to determine which 5 do easy + which 5 do hard. I would get results from each level and combine my data to give an explanation.

c) Describe a matched pairs experimental design using the same 30 subjects.

Each student does the activity twice, once with each type of maze. Randomly determine which set of mazes is used first by flipping a coin for each subject. Heads = easy. Tails = hard. Then switch. After the experiment, compare each students easy maze times to hard maze times.

d) Which design would be more likely to detect a difference in the effects of the treatments?