Advanced Placement AAP Review will be held in room 315 and 312 on Tuesdays and Thursdays.

The week of April 6th we will be reviewing Gathering Data

The session will begin in room 315 with a brief review of the weekly topic.

Instruction will be from 3:15 pm to 3:30 pm

Once we have reviewed the topic you may begin practicing the questions in your review packet.

Answers will be posted in room 315 and 312 all week and will be posted on line after 3:00 pm on Friday the week of review.

If you have difficulty with a question look at the detailed answer postings BEFORE you ask your teacher for help.

Get a hint....DON’T COPY THE ANSWER!!! THAT IS NOT HELPFUL!!

When you have completed a question...REFLECT!!!! Ask yourself what skill you used to solve that problem and write that down!!

Once we have completed the weekly review, keep it to study from as we get closer to the exam.
Gathering Data

Brief Review

This unit is all about the APPROPRIATE way to collect data. If you don’t collect data in an appropriate way it is not at all useful.

This unit is full of vocabulary…one of the objectives of the College Board is to make sure you know and can use “the vocabulary of statistics!!”

Know the difference between an Experiment and an Observational Study…the vocabulary word they are looking for is RANDOM placement into TREATMENT groups.

When you talk about BIAS…don’t worry about using words like undercoverage and Non-Response as much as you talk about the groups in the population that will be over-represented and under-represented in your sample as a result of the bias.

Recall there is a difference between bias that comes from the sampling TECHNIQUE and bias that results from the QUESTION. Questioning bias is known as RESPONSE bias.

Make sure you can run a simulation and design an experiment. Make sure you know how to create a plan for random selection, ignore repeats if you need to??? This is where we used THE HAT! But make sure you can do it with or without THE HAT!

A well designed experiment with random placement into treatment groups can show CAUSE and EFFECT.

Here is a list of vocabulary I found on the internet.

biased

any systematic failure of a sampling method to represent its population

block

a subdivision of the population
census

a sample that consists of the entire population

cluster

sampling design in which entire groups are chosen at random

completely randomized

type of experiment in which all experimental units have an equal chance of receiving any treatment

confounding

when the levels of one factor are associated with the levels of another factor so their effects cannot be separated

control

aspects of the experiment that we know may have an effect on the response, but that are not the factors being studied

control group

experimental units assigned to a baseline treatment level

convenience

sampling design where individuals are chosen based on who is easily available

double blind

neither the subjects nor the people who have contact with them know which treatment a subject has received

experimental units

individuals on which an experiment is done

experiments

study in which subjects are randomly assigned to treatments
**factor**
variable whose levels are controlled by the experimenter

**heterogeneous**
not similar in makeup

**homogeneous**
similar in makeup

**level**
specific values that the experimenter chooses a factor

**matched pairs**
type of study in which subjects who are similar in ways not under study may be grouped together and then compared with each other on the variables of interest

**multistage**
sampling schemes that combine several sampling methods

**nonresponse**
type of bias that is problematic because the intended sample is incomplete

**observational study**
study based on data in which no treatments have been assigned to subjects

**outcome**
an individual result of a component of a simulation

**placebo**
treatment known to have no effect, administered so that all groups experience the same conditions
placebo effect
the tendency of many human subjects to show a response even when administered a fake treatment

population
the entire group of individuals or instances about whom we hope to learn

prospective
observational study in which subjects are followed to observe future outcomes

random behavior
an occurrence for which we know what outcomes could happen, but not which particular values will happen

randomization
process by which each individual is given a fair chance of selection

response
type of bias that is problematic because false information may be given

retrospective
observational study in which subjects are selected and then their previous conditions or behaviors are determined

sample
a (representative) subset of a population, examined in hope of learning about a population

sample survey
a study that asks questions of a sample drawn from some population in the hope of learning something about the entire population

sampling frame
a list of individuals from whom the sample is drawn
**sampling variability**

the natural tendency of randomly drawn samples to differ, one from another

**simple random**

sampling design in which each set of n elements in the population has an equal chance of selection

**simulation**

models random events by using random numbers to specify outcomes with relative frequencies that correspond to the true real-world relative frequencies we are trying to model

**single blind**

when either the subjects or the people who have contact with them do not know which treatment a subject has received

**statistically significant**

when an observed difference is too large to believe that it is likely to have occurred naturally

**strata**

when groups of experimental units are similar, they are gathered into these groups

**stratified**

sampling design in which the population is divided into several strata, and random samples are then drawn from each stratum

**subjects**

people who are studied

**systematic**

sample drawn by select an individual from a list and then each of the next N individuals from the sampling frame

**treatment**

the process or intervention applied to randomly assigned experimental units
**trial**

the sequence of several components representing events that we are pretending will take place

**undercoverage**

type of bias that is problematic because some groups are not represented in the sample

**voluntary response**

sampling design where individuals can choose on their own whether to participate in the sample

**voluntary response**

type of bias that is problematic because those who volunteer tend to have strong negative opinions

**wording bias**

a type of response bias where the question is posed to achieve a desired result
7. A certain county has 1,000 farms. Corn is grown on 100 of these farms but on none of the others. In order to estimate the total farm acreage of corn for the county, two plans are proposed.

Plan I:  
(a) Sample 20 farms at random.
(b) Estimate the mean acreage of corn per farm in a confidence interval.
(c) Multiply both ends of the interval by 1,000 to get an interval estimate of the total.

Plan II:  
(a) Identify the 100 corn-growing farms.
(b) Sample 20 corn-growing farms at random.
(c) Estimate the mean acreage of corn for corn-growing farms in a confidence interval.
(d) Multiply both ends of the interval by 100 to get an interval estimate of the total.

On the basis of the information given, which of the following is the better method for estimating the total farm acreage of corn for the county?

(A) Choose plan I over plan II.
(B) Choose plan II over plan I.
(C) Choose either plan, since both are good and will produce equivalent results.
(D) Choose neither plan, since neither estimates the total farm acreage of corn.
(E) The plans cannot be evaluated from the information given.

8. Which of the following can be used to show a cause-and-effect relationship between two variables?

(A) A census
(B) A controlled experiment
(C) An observational study
(D) A sample survey
(E) A cross-sectional survey

9. To check the effect of cold temperature on the elasticity of two brands of rubber bands, one box of Brand A and one box of Brand B rubber bands are tested. Ten bands from the Brand A box are placed in a freezer for two hours and ten bands from the Brand B box are kept at room temperature. The amount of stretch before breakage is measured on each rubber band, and the mean for the cold bands is compared to the mean for the others. Is this a good experimental design?

(A) No, because the means are not proper statistics for comparison.
(B) No, because more than two brands should be used.
(C) No, because more temperatures should be used.
(D) No, because temperature is confounded with brand.
(E) Yes
18. The Physicians' Health Study, a large medical experiment involving 22,000 male physicians, attempted to determine whether aspirin could help prevent heart attacks. In this study, one group of about 11,000 physicians took an aspirin every other day, while a control group took a placebo. After several years, it was determined that the physicians in the group that took aspirin had significantly fewer heart attacks than the physicians in the control group. Which of the following statements explains why it would not be appropriate to say that everyone should take an aspirin every other day?

I. The study included only physicians, and different results may occur in individuals in other occupations.
II. The study included only males and there may be different results for females.
III. Although taking aspirin may be helpful in preventing heart attacks, it may be harmful to some other aspects of health.

(A) I only
(B) II only
(C) III only
(D) II and III only
(E) I, II, and III

27. The student government at a high school wants to conduct a survey of student opinion. It wants to begin with a simple random sample of 60 students. Which of the following survey methods will produce a simple random sample?

(A) Survey the first 60 students to arrive at school in the morning.
(B) Survey every 10th student entering the school library until 60 students are surveyed.
(C) Use random numbers to choose 15 each of first-year, second-year, third-year, and fourth-year students.
(D) Number the cafeteria seats. Use a table of random numbers to choose seats and interview the students until 60 have been interviewed.
(E) Number the students in the official school roster. Use a table of random numbers to choose 60 students from this roster for the survey.

Workshop Materials:

2. Under which of the following conditions is it preferable to use stratified random sampling rather than simple random sampling?

(A) The population can be divided into a large number of strata so that each stratum contains only a few individuals.
(B) The population can be divided into a small number of strata so that each stratum contains a large number of individuals.
(C) The population can be divided into strata so that the individuals in each stratum are as much alike as possible.
(D) The population can be divided into strata so that the individuals in each stratum are as different as possible.
(E) The population can be divided into strata of equal sizes so that each individual in the population still has the same chance of being selected.
9. Each person in a simple random sample of 2,000 received a survey, and 317 people returned their survey. How could nonresponse cause the results of the survey to be biased?

(A) Those who did not respond reduced the sample size, and small samples have more bias than large samples.
(B) Those who did not respond caused a violation of the assumption of independence.
(C) Those who did not respond were indistinguishable from those who did not receive the survey.
(D) Those who did not respond represent a stratum, changing the simple random sample into a stratified random sample.
(E) Those who did respond may differ in some important way from those who did not respond.

16. George and Michelle each claimed to have the better recipe for chocolate chip cookies. They decided to conduct a study to determine whose cookies were really better. They each baked a batch of cookies using their own recipe. George asked a random sample of his friends to taste his cookies and to complete a questionnaire on their quality. Michelle asked a random sample of her friends to complete the same questionnaire for her cookies. They then compared the results. Which of the following statements about this study is false?

(A) Because George and Michelle have a different population of friends, their sampling procedure makes it difficult to compare the recipes.
(B) Because George and Michelle each used only their own respective recipes, their cooking ability is confounded with the recipe quality.
(C) Because George and Michelle each used only the ovens in their houses, the recipe quality is confounded with the characteristics of the oven.
(D) Because George and Michelle used the same questionnaire, their results will generalize to the combined population of their friends.
(E) Because George and Michelle each baked one batch, there is no replication of the cookie recipes.
2002 Exam:

1. Which of the following is a key distinction between well designed experiments and observational studies?
   (A) More subjects are available for experiments than for observational studies.
   (B) Ethical constraints prevent large-scale observational studies.
   (C) Experiments are less costly to conduct than observational studies.
   (D) An experiment can show a direct cause-and-effect relationship, whereas an observational study cannot.
   (E) Tests of significance cannot be used on data collected from an observational study.

4. Suppose that 30 percent of the subscribers to a cable television service watch the shopping channel at least once a week. You are to design a simulation to estimate the probability that none of five randomly selected subscribers watches the shopping channel at least once a week. Which of the following assignments of the digits 0 through 9 would be appropriate for modeling an individual subscriber’s behavior in this simulation?
   (A) Assign “0, 1, 2” as watching the shopping channel at least once a week and “3, 4, 5, 6, 7, 8, and 9” as not watching.
   (B) Assign “0, 1, 2, 3” as watching the shopping channel at least once a week and “4, 5, 6, 7, 8, and 9” as not watching.
   (C) Assign “1, 2, 3, 4, 5” as watching the shopping channel at least once a week and “6, 7, 8, 9, and 0” as not watching.
   (D) Assign “0” as watching the shopping channel at least once a week and “1, 2, 3, 4, and 5” as not watching; ignore digits “6, 7, 8, and 9.”
   (E) Assign “3” as watching the shopping channel at least once a week and “0, 1, 2, 4, 5, 6, 7, 8, and 9” as not watching.

9. A volunteer for a mayoral candidate’s campaign periodically conducts polls to estimate the proportion of people in the city who are planning to vote for this candidate in the upcoming election. Two weeks before the election, the volunteer plans to double the sample size in the polls. The main purpose of this is to
   (A) reduce nonresponse bias
   (B) reduce the effects of confounding variables
   (C) reduce bias due to the interviewer effect
   (D) decrease the variability in the population
   (E) decrease the standard deviation of the sampling distribution of the sample proportion

15. A high school statistics class wants to conduct a survey to determine what percentage of students in the school would be willing to pay a fee for participating in after-school activities. Twenty students are randomly selected from each of the freshman, sophomore, junior, and senior classes to complete the survey. This plan is an example of which type of sampling?
   (A) Cluster
   (B) Convenience
   (C) Simple random
   (D) Stratified random
   (E) Systematic
16. Jason wants to determine how age and gender are related to political party preference in his town. Voter registration lists are stratified by gender and age-group. Jason selects a simple random sample of 50 men from the 20 to 29 age-group and records their age, gender, and party registration (Democratic, Republican, neither). He also selects an independent simple random sample of 60 women from the 40 to 49 age-group and records the same information. Of the following, which is the most important observation about Jason's plan?

(A) The plan is well conceived and should serve the intended purpose.
(B) His samples are too small.
(C) He should have used equal sample sizes.
(D) He should have randomly selected the two age groups instead of choosing them nonrandomly.
(E) He will be unable to tell whether a difference in party affiliation is related to differences in age or to the difference in gender.

22. A study of existing records of 27,000 automobile accidents involving children in Michigan found that about 10 percent of children who were wearing a seatbelt (group SB) were injured and that about 15 percent of children who were not wearing a seatbelt (group NSB) were injured. Which of the following statements should NOT be included in a summary report about this study?

(A) Driver behavior may be a potential confounding factor.
(B) The child's location in the car may be a potential confounding factor.
(C) This study was not an experiment, and cause-and-effect inferences are not warranted.
(D) This study demonstrates clearly that seat belts save children from injury.
(E) Concluding that seat belts save children from injury is risky, at least until the study is independently replicated.

25. A new medication has been developed to treat sleep-onset insomnia (difficulty in falling asleep). Researchers want to compare this drug to a drug that has been used in the past by comparing the length of time it takes subjects to fall asleep. Of the following, which is the best method for obtaining this information?

(A) Have subjects choose which drug they are willing to use, then compare the results.
(B) Assign the two drugs to the subjects on the basis of their past sleep history without randomization, then compare the results.
(C) Give the new drug to all subjects on the first night. Give the old drug to all subjects on the second night. Compare the results.
(D) Randomly assign the subjects to two groups, giving the new drug to one group and no drug to the other group, then compare the results.
(E) Randomly assign the subjects to two groups, giving the new drug to one group and the old drug to the other group, then compare the results.
2. In which of the following situations would it be most difficult to use a census?

(A) To determine what proportion of licensed bicycles on a university campus have lights
(B) To determine what proportion of students in a high school support wearing uniforms
(C) To determine what proportion of registered students enrolled in a college are employed more than 20 hours each week
(D) To determine what proportion of single-family dwellings in a small town have two-car garages
(E) To determine what proportion of fish in Lake Michigan are bass

9. A television news editor would like to know how local registered voters would respond to the question, "Are you in favor of the school bond measure that will be voted on in an upcoming special election?" A television survey is conducted during a break in the evening news by listing two telephone numbers side by side on the screen, one for viewers to call if they approve of the bond measure, and the other to call if they disapprove. This survey method could produce biased results for a number of reasons. Which one of the following is the most obvious reason?

(A) It uses a stratified sample rather than a simple random sample.
(B) People who feel strongly about the issue are more likely to respond.
(C) Viewers should be told about the issues before the survey is conducted.
(D) Some registered voters who call might not vote in the election.
(E) The wording of the question is biased.

14. A researcher wishes to test a new drug developed to treat hypertension (high blood pressure). A group of 40 hypertensive men and 60 hypertensive women is to be used. The experimenter randomly assigns 20 of the men and 30 of the women to the placebo and assigns the rest to the treatment. The major reason for separate assignment for men and women is that

(A) it is a large study with 100 subjects
(B) the new drug may affect men and women differently
(C) the new drug may affect hypertensive and nonhypertensive people differently
(D) this design uses matched pairs to detect the new-drug effect
(E) there must be an equal number of subjects in both the placebo group and the treatment group.

20. Which of the following is NOT a characteristic of stratified random sampling?

(A) Random sampling is part of the sampling procedure.
(B) The population is divided into groups of units that are similar on some characteristic.
(C) The strata are based on facts known before the sample is selected.
(D) Each individual unit in the population belongs to one and only one of the strata.
(E) Every possible subset of the population, of the desired sample size, has an equal chance of being selected.
31. Automobile brake pads are either metallic or nonmetallic. An experiment is to be conducted to
determine whether the stopping distance is the same for both types of brake pads. In previous studies, it
was determined that car size (small, medium, large) is associated with stopping distance, but car type
(sedan, wagon, coupe) is not associated with stopping distance. The experiment would be best done

(A) by blocking on car size
(B) by blocking on car type
(C) by blocking on stopping distance
(D) by blocking on brake pad type
(E) without blocking

35. A group of students has 60 houseflies in a large container and needs to assign 20 to each of the
three groups labeled A, B, and C for an experiment. They can capture the flies one at a time when the
flies enter a side chamber in the container that is baited with food. Which of the following methods
will be most likely to result in three comparable groups of 20 houseflies each?

(A) Label the first 20 flies caught as Group A, the second 20 caught as group B, and the third 20 caught
as group C.
(B) Write the letters A, B, and C on separate slips of paper. Randomly pick one of the slips of paper
and assign the first 20 flies caught to that group. Pick another slip and assign the next 20 flies
captured to that group. Assign the remaining flies to the remaining group.
(C) When each fly is caught, roll a die. If the die shows an even number, the fly is labeled A. If the
die shows an odd number, the fly is labeled B. When 20 flies have been labeled A and 20 have
been labeled B, the remaining flies are then labeled C.
(D) Place each fly in its own numbered container (numbered from 1 to 60) in the order that it was
captured. Write the numbers from 1 to 60 on slips of paper, put the slips in a jar, and mix them
well. Pick 20 numbers out of the jar. Assign the flies in the containers with those numbers to
group A. Pick 20 more numbers and assign the flies in the containers with those numbers to
group B. Assign the remaining 20 flies to group C.
(E) When each fly is caught, roll a die. If the die shows a 1 or 2, the fly is labeled A. If the die shows
a 3 or 4, the fly is labeled B. If the die shows a 5 or 6, the fly is labeled C. Repeat this process
for all 60 flies.
2. An administrator at a large university wants to conduct a survey to estimate the proportion of students who are satisfied with the appearance of the university buildings and grounds. The administrator is considering three methods of obtaining a sample of 500 students from the 70,000 students at the university.

(a) Because of financial constraints, the first method the administrator is considering consists of taking a convenience sample to keep the expenses low. A very large number of students will attend the first football game of the season, and the first 500 students who enter the football stadium could be used as a sample. Why might such a sampling method be biased in producing an estimate of the proportion of students who are satisfied with the appearance of the buildings and grounds?

(b) Because of the large number of students at the university, the second method the administrator is considering consists of using a computer with a random number generator to select a simple random sample of 500 students from a list of 70,000 student names. Describe how to implement such a method.

(c) Because stratification can often provide a more precise estimate than a simple random sample, the third method the administrator is considering consists of selecting a stratified random sample of 500 students. The university has two campuses with male and female students at each campus. Under what circumstance(s) would stratification by campus provide a more precise estimate of the proportion of students who are satisfied with the appearance of the university buildings and grounds than stratification by gender?
Free Response 2011 #3

3. An apartment building has nine floors and each floor has four apartments. The building owner wants to install new carpeting in eight apartments to see how well it wears before she decides whether to replace the carpet in the entire building.

The figure below shows the floors of apartments in the building with their apartment numbers. Only the nine apartments indicated with an asterisk (*) have children in the apartment.

<table>
<thead>
<tr>
<th>11*</th>
<th>12</th>
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<tbody>
<tr>
<td>1st Floor</td>
<td>21</td>
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<td>14</td>
<td>22*</td>
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<tr>
<td>24</td>
<td>23*</td>
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<td>31</td>
<td>32</td>
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<tr>
<td>3rd Floor</td>
<td>33</td>
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<tr>
<th>41</th>
<th>42</th>
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<tbody>
<tr>
<td>4th Floor</td>
<td>51*</td>
</tr>
<tr>
<td>44</td>
<td>5th Floor</td>
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<td>43</td>
<td>54</td>
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<tr>
<td>61</td>
<td>6th Floor</td>
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<tbody>
<tr>
<td>7th Floor</td>
<td>81</td>
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<td>74*</td>
<td>82</td>
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<td>84*</td>
<td>83</td>
</tr>
<tr>
<td>91</td>
<td>9th Floor</td>
</tr>
<tr>
<td>94</td>
<td>92*</td>
</tr>
</tbody>
</table>

* = Children in the apartment

(a) For convenience, the apartment building owner wants to use a cluster sampling method, in which the floors are clusters, to select the eight apartments. Describe a process for randomly selecting eight different apartments using this method.

(b) An alternative sampling method would be to select a stratified random sample of eight apartments, where the strata are apartments with children and apartments with no children. A stratified random sample of size eight might include two randomly selected apartments with children and six randomly selected apartments with no children. In the context of this situation, give one statistical advantage of selecting such a stratified sample as opposed to a cluster sample of eight apartments using the floors as clusters.
Free Response 2011 Form B #2

2. People with acrophobia (fear of heights) sometimes enroll in therapy sessions to help them overcome this fear. Typically, seven or eight therapy sessions are needed before improvement is noticed. A study was conducted to determine whether the drug D-cycloserine, used in combination with fewer therapy sessions, would help people with acrophobia overcome this fear.

Each of 27 people who participated in the study received a pill before each of two therapy sessions. Seventeen of the 27 people were randomly assigned to receive a D-cycloserine pill, and the remaining 10 people received a placebo. After the two therapy sessions, none of the 27 people received additional pills or therapy. Three months after the administration of the pills and the two therapy sessions, each of the 27 people was evaluated to see if he or she had improved.

(a) Was this study an experiment or an observational study? Provide an explanation to support your answer.

(b) When the data were analyzed, the D-cycloserine group showed statistically significantly more improvement than the placebo group did. Based on this result, would the researchers be justified in concluding that the D-cycloserine pill and two therapy sessions are as beneficial as eight therapy sessions without the pill? Justify your answer.

(c) A newspaper article that summarized the results of this study did not explain how it was determined which people received D-cycloserine and which received the placebo. Suppose the researchers allowed the therapists to choose which people received D-cycloserine and which received the placebo, and no randomization was used. Explain why such a method of assignment might lead to an incorrect conclusion.
Free Response 2010 #1

1. Agricultural experts are trying to develop a bird deterrent to reduce costly damage to crops in the United States. An experiment is to be conducted using garlic oil to study its effectiveness as a nontoxic, environmentally safe bird repellant. The experiment will use European starlings, a bird species that causes considerable damage annually to the corn crop in the United States. Food granules made from corn are to be infused with garlic oil in each of five concentrations of garlic — 0 percent, 2 percent, 10 percent, 25 percent, and 50 percent. The researchers will determine the adverse reaction of the birds to the repellant by measuring the number of food granules consumed during a two-hour period following overnight food deprivation. There are forty birds available for the experiment, and the researchers will use eight birds for each concentration of garlic. Each bird will be kept in a separate cage and provided with the same number of food granules.

(a) For the experiment, identify

   i. the treatments
   ii. the experimental units
   iii. the response that will be measured