A 1. If we wish to compare the average PSAT scores of boys and girls taking AP Statistics at this high school, which would be the best way to gather these data? *(should ask all students if possible)*
   A) census   B) SRS   C) stratified sample
   D) observational study   E) experiment

D 2. A factory has 20 assembly lines producing a popular toy. To inspect a representative sample of 100 toys, quality control staff randomly selected 5 toys from each line's output. Was this a simple random sample?
   A) Yes, because the toys were selected at random.
   B) Yes, because each toy produced had an equal chance to be selected.
   C) Yes, because a stratified sample is a type of simple random sample.
   D) No, because not all combinations of 100 toys could have been chosen.
   E) No, because toys do not come off the assembly line at random.

For D 3. Which is true about sampling?
   ✗ I.   An attempt to take a census will always result in less bias than sampling.
   ✓ II. Sampling error is usually reduced when the sample size is larger.
   ✓ III. Sampling error is the result of random variations and is always present.
   A) I only   B) II only   C) III only   D) II and III   E) all three

C 4. The owner of a car dealership planned to develop strategies to increase sales. He hoped to learn the reasons why many people who visit his car lot do not eventually buy a car from him. For one month he asked his sales staff to keep a list of the names and addresses of everyone who came in to test drive a car. At the end of the month he sent surveys to the people who did not buy the car, asking them why. About one third of them returned the survey, with 44% of those indicating that they found a lower price elsewhere. Which is true?
   ✓ I.   The population of interest is all potential car buyers.
   ✓ II.   This survey design suffered from non-response bias.
   ✗ III.   Because it comes from a sample 44% is a parameter, not a statistic.
   A) I only   B) II only   C) I and II only   D) II and III only   E) I, II, and III

C 5. Does regular exercise decrease the risk of cancer? A researcher finds 200 women over 50 who exercise regularly, pairs each with a woman who has a similar medical history but does not exercise, then follows the subjects for 10 years to see which group develops more cancer. This is a
   A) survey   B) retrospective study   C) prospective study
   D) randomized experiment   E) matched experiment

E 6. Which is important in designing a good experiment?
   ✓ I.   Randomization in assigning subjects to treatments.
   ✓ II.   Control of potentially confounding variables.
   ✓ III.   Replication of the experiment on a sufficient number of subjects.
   A) I only   B) I and II   C) I and III   D) II and III   E) all three

E 7. Can watching a movie temporarily raise your pulse rate? Researchers have 50 volunteers check their pulse rates. Then they watch an action film, after which they take check their pulse rates once more. Which aspect of experimentation is present in this research?
   A) a placebo   B) blinding   C) randomization
   D) a control group   E) none of these

E 8. In an experiment the primary purpose of blocking is to reduce
   A) bias.   B) confounding.   C) randomness.   D) undercoverage.   E) variation.

E 9. To check the effect of cold temperatures on the battery's ability to start a car researchers purchased a battery from Sears and one from NAPA. They disabled a car so it would not start, put the car in a warm garage, and installed the Sears battery. They tried to start the car repeatedly, keeping track of the total time that elapsed before the battery could no longer turn the engine over. Then they moved the car outdoors where the temperature was below zero. After the car had chilled there for several hours the researchers installed the NAPA battery and repeated the test. Is this a good experimental design?
   A) Yes
   B) No, because the car and the batteries were not chosen at random.
   C) No, because they should have tested other brands of batteries, too.
   D) No, because they should have tested more temperatures.
   E) No, because temperature is confounded by brand.

C 10. Twenty dogs and 20 cats were subjects in an experiment to test the effectiveness of a new flea control chemical. Ten of the dogs were randomly assigned to an experimental group that wore a collar containing the chemical, while the others wore a similar collar without the chemical. The same was done with the cats. After 30 days veterinarians were asked to inspect the animals for fleas and evidence of flea bites. This experiment is...
   A) completely randomized with one factor: the type of collar
   B) completely randomized with one factor: the species of animal
   C) randomized block, blocked by species
   D) randomized block, blocked by type of collar
   E) completely randomized with two factors

11. **Public opinion** A member of the City Council has proposed a resolution opposing construction of a new state prison there. The council members decide they want to assess public opinion before they vote on this resolution. Below are some of the methods that are proposed to sample local residents to determine the level of public support for the resolution. Match each with one of the listed sampling techniques.

_8_ a) Place an announcement in the newspaper asking people to call their council representatives to register their opinions. Council members will tally the calls they receive.

_2_ b) Have each council member survey 50 friends, neighbors, or co-workers.

_5_ c) Have the Board of Elections assign each voter a number, then select 400 of them using a random number table.

_3_ d) Go to a downtown street corner, a grocery store, and a shopping mall; interview 100 typical shoppers at each location.

_6_ e) Randomly pick 50 voters from each election district.

_7_ f) Call every 500th person in the phone book.

_4_ g) Randomly pick several city blocks, then randomly pick 10 residents from each block.

_1_ h) Randomly select several city blocks; interview all the adults living on each block.

1	cluster
2	convenience
3	judgment "research uses his own judgment"
4	multistage
5	simple (SRS)
6	stratified
7	systematic
8	voluntary response

12. **Telephone poll** The City Council decides to conduct a telephone poll. Pollsters ask a carefully chosen random sample of adults this question: *"Do you favor the construction of a new prison to deal with the high level of violent crime in our State?"* In what way might the proportion of *"Yes"* answers fail to accurately reflect true public opinion? Explain briefly. What kind of bias is this?

This is response bias. The wording supports one point of view. Poll is likely to overestimate public support for a new prison.

13. **M&Ms** The Mars candy company starts a marketing campaign that puts a plastic game piece in each bag of M&Ms. 25% of the pieces show the letter "M", 10% show the symbol "&", and the rest just say "Try again". When you collect a set of three symbols "M", "&", and "M" you can turn them in for a free bag of candy. About how many bags will a consumer have to buy to get a free one? Use a simulation to find out.

a. Explain how you will use the random numbers listed below to conduct your simulation.

Model: 00-24 = "M"
25-34 = "&"
35-99 = "try again"

Trial: select bags (random digit pairs) until 2 "M" and 1 "&" are found.

Response Variable: number of bags (trials) it takes to get "M & M"

b. Carefully label your simulation for 2 trials.

Trial #	The run					Outcome
1	69074 (M)	91976 (M)	33584 (&)	94138	87637	6 bags
2	48324 (&)	77928 (&)	31249 (& M)	64710 (M)	02295	10 bags

c. State your conclusion.

An average of 8 bags (max of 10 bags) were needed to get "M & M".

14. **Preservative** Leather furniture used in public places can fade, crack, and deteriorate rapidly. An airport manager wants to see if a leather preservative spray can make the furniture look good longer. He buys eight new leather chairs and places them in the waiting area, four near the south-facing windows and the other four set back from the windows as shown. He assigned the chairs randomly to these spots.


```
 1   2   3   4
 C   T   T   C

 T   C   T   C
 5   6   7   8
     WINDOWS
```
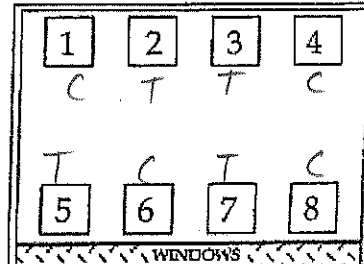
a. Use the random numbers given to decide which chairs to spray. Explain your method clearly.

3 2 2 1 9   0 0 5 9 7   8/6 3 7 4

Model: 1-8 = chair (ignore 0, 9)
2 treatments (preservative or no)
Choose single random digits to pick 4 treatment chairs and block on row.

to pick treatment
1st 4 digits that match a number
treatment group non-window: 3, 2
treatment group window: 5, 7

8 chairs { near window 4 chairs { grp1 — preservative → compare
grp2 — no pres.
away from window 4 chairs { grp3 — preservative → compare
grp4 — no pres.

b. Briefly explain why your assignment strategy is important in helping the manager assess the effectiveness of the leather preservative.

Blocking is needed because we think there might be a difference in preservative effectiveness for chairs near vs. far from the windows. We might even consider also block on position (end or middle).

15. Candy packaging Marketing researchers wonder if the color and type of a candy's packaging may influence sales of the candy. They manufacture test packages for chocolate mints in three colors (white, green, and silver) and three types (box, bag, and roll). Suspecting that sales may depend on a combination of package color and type, the researchers prepare nine different packages, then market them for several weeks in convenience stores in various locations. In this experiment.

   a. what are the experimental units?

   b. how many factors are there?

   c. how many treatments are there?

   d. what is the response variable?

   candy packages

   2: color (3 levels), type (3 levels)

   3 × 3 = 9 treatments

   sales of candy

16. Aggressiveness A recent study evaluated elementary age children for aggressiveness. This study found that the children who played video games were more likely to engage in aggressive or violent play at school. The researchers said the difference was statistically significant.
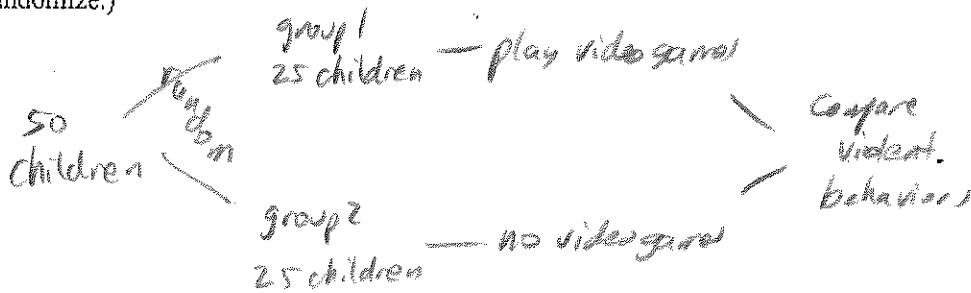
   a. Briefly explain what "statistically significant" means in this context.

   Differences noted in aggressiveness between gamers and non-gamers were larger than what we would expect due to natural (sampling) variation.

   b. The news media reported that this study proved that playing computer games causes children to be aggressive or violent. Briefly explain why this conclusion is not justified.

   Association does not imply causation, so this conclusion is not justified. (For example, maybe only kids who are naturally more violent like to play video games.)

   c. But perhaps it is true. We wonder if playing computer games can lead to aggressive or violent behavior in elementary school children. We find 50 young children whose families volunteer to participate in our research. Design an appropriate experiment. (You need not explain how to randomize.)

   50 children — Random — group 1 25 children — play video games

   group 2 25 children — no video games

   Compare violent behaviors

   At least blind the evaluators: do not allow them to know whether the children they are evaluating were in the games or no games group.