Research Methods

1. Which of the following radiological techniques would not allow visualization of changes in the brain while it processes information?

    A. CT
    B. fMRI
    C. PET
    D. EEG

2. With the new exam, AAMC reduced the emphasis of benchtop synthetic organic chemistry on the MCAT and increased the emphasis on the portion of organic chemistry most relevant in biochemistry. Concerns that achievement in synthetic organic chemistry are only weakly predictive of success in medical school most specifically argue against the old MCAT's

    A. face validity
    B. criterion validity
    C. construct validity
    D. content validity

3. Which of the following most directly improves the external validity as opposed to the internal validity of an experiment?

    A. assignment of subjects to a treatment and control groups by a random procedure
    B. random selection of test subjects
    C. controls for maturation of test subjects during the course of the experiment
    D. retrospective pretesting

4. Random assignment in combination with double blind experimental procedure will help address concerns regarding

    A. sampling error
    B. pre-test effects
    C. selection bias
    D. reactivity

5. Which types of reactivity in experimental procedures may be the result of stereotyping?

    I. Rosenthal effect
    II. Pygmalian effect
    III. Experimenter effect
    IV. Hawthorne effect

    A. I only
    B. II, and III
    C. I, II and III
    D. I, II, III and IV

6. For which of the following hypotheses would testing by experimental procedure be nearly impossible?

    A. Meditation prior to instruction lengthens attention span.
    B. Trauma in early childhood leads to decreased frontal lobe function.
    C. Increased consumption of root vegetables alleviates color blindness.
    D. Dark clothing decreases the persuasiveness of a person's arguments.

7. The following set of four numbers {0,6,8,14} has a mean value of 7. What is the standard deviation of this distribution?

    A. 3.0
    B. 3.5
    C. 5.0
    D. 7.0

8. What is the median of this distribution?
    8, 2, 5, 6, 8, 7

    A. 5.0
    B. 6.0
    C. 6.5
    D. 8.0

9. In addition to being one of the greatest centers of all time, Shaquille O'Neal was famous for his incredibly low free throw percentage, 52.7% in his career. Wilt Chamberlain had the same problem. If we were to graph the distribution of the free throw percentage of the ten greatest NBA players of all time the graph would be

A. Gaussian
B. normal
C. negatively skewed
D. positively skewed

10. Consider a researcher attempting to assess the effectiveness of an over-the-counter analgesic from population data in which drug usage was a patient's choice. Data show that gender differences influence a patient's choice of a particular analgesic as well as their chances of experiencing relief from symptoms. In this scenario, gender is a(n)

A. independent variable
B. dependent variable
C. confounding variable
D. control variable

11. Agnes, a volunteer at the animal shelter, hypothesizes that visitors are more likely to adopt a pet when they visit the shelter accompanied by children. She tests her hypothesis by observing visitors for two weeks and recording data. What research method is she using?

A. anecdotal evidence
B. naturalistic observation
C. statistical survey
D. field experiment

12. Which of the following is an example of a random sampling method?

   I. Arranging a list of volunteers in alphabetical order and selecting every 3rd volunteer
   II. Using a computer to randomly assign 1/3 of a group of volunteers each to a separate experimental condition
   III. Pulling the names of twenty volunteers out of a hat to serve as experimental subjects
   IV. Dividing a population into smaller groups based on shared characteristics and choosing a sample from each group using a random number generator

A. III only
B. III and IV
C. I, II and IV
D. I, II, III and IV

13. To test the effects of a potential molecular targetted therapy on seizure frequency in pediatric epilepsy patients, the Watkins lab first randomly selected a sample of 100 patients and then divided them into a control group and experimental group. However, the original sample was more racially homogeneous than the general population. This may affect the results by introducing a

A. bias
B. confounding variable
C. nonsampling error
D. stereotype threat

14. An increase in shark attacks has been observed to coincide with an increase in ice cream sales. This corresponds to

    A. stochastic coincidence
    B. shark attacks increasing ice cream consumption by an unknown mechanism
    C. positive correlation between shark attacks and ice cream sales
    D. a statistically insignificant artefact

15. Which of the following is <u>not</u> a right or practice typically ensured for human research subjects through the ethical guidelines enforced by Institutional Review Boards?

    A. informed consent
    B. confidentiality
    C. lack of deception
    D. post-study debriefing

16. A study is conducted whether people react positively or negatively to a series of images. They use a left-hand clicker for positive, and a right-hand clicker for negative. The tendency for left-handed people to be more inclined to click left and vice-versa is a(n)

    A. positive correlation
    B. negative correlation
    C. confounding variable
    D. extraneous variable

17. A study was conducted at an elementary school to measure whether playing music in the cafeteria during lunch would positively affect afternoon math class assignment productivity. Music was played on Mondays and Tuesdays. On Thursdays and Fridays music was not played. Total number of assignment questions completed were recorded. In this study, the day of the week was

    A. the independent variable
    B. the dependent variable
    C. a confounding variable
    D. an extraneous variable

18. When the observed result obtained by statistical sampling is different than the result specified by the null hypothesis, what is the likelihood of obtaining at least as extreme a result assuming the null hypothesis were actually true?

    A. p-value
    B. significance level
    C. confidence level
    D. confidence interval

19. Bill's score on the psychology & sociology section of the MCAT was one standard deviation above the mean. What was his approximate percentile score on that section?

    A. 57%
    B. 75%
    C. 85%
    D. 95%

20. Many premedical students expressed the belief that the old MCAT (pre-2015) placed too great an emphasis on certain scientific topics, including synthetic bench-top organic chemistry, given current medical school curriculum. The popularity of this opinion decisively argues that the old exam had a problem in terms of its

    A. face validity
    B. construct validity
    C. content validity
    D. concurrent validity

21. The Thematic Apperception Test (TAT) is a type of psychological test in which an individual views ambiguous scenes of people, and is asked to describe various aspects of the scene. For example, the subject may be asked to describe what led up to the scene, the emotions of the characters, and what might happen afterwards. The TAT is an example of a(n)

    A. projective test
    B. self-report test
    C. interest test
    D. direct observation test

22. In order to measure the degree of anger manifested in a subject's response to an experimental treatment, a social-psychology investigator defines the measurement of anger in terms of how loudly the subject speaks compared to his normal tone. Measuring anger in terms of objective empirical data is an example of

    A. multi-dimensional scaling
    B. psychophysical coding
    C. subjective coding
    D. operationalization

23. A large scale study of high school students sought to describe the relationship between television viewing habits and academic success in high school. The study found that self-reported weekly average viewing hours and SAT scores had a correlation coefficient of –0.35. From this we can conclude that

    A. greater television viewing has a weak tendency to lower SAT scores in high school
    B. parental restrictions on television viewing for high school students correlates with higher SAT scores
    C. greater television viewing hours are associated with lower SAT scores
    D. it is possible for a teenager to watch a great deal of television during their high school years and still score a perfect SAT score

24. Random selection of individuals from two demographically similar communities allowed researchers to compare drinking habits with or without a public health campaign. Which of the following choices best describes the study?

    A. quasi-experiment
    B. naturalistic observation
    C. survey
    D. controlled observation

25. The internal validity of a longitudinal study investigating the effects of aging on various attitudes towards the criminal justice system will have inevitable problems due to which of the following confounding variables?

    A. time-of-testing
    B. gender of study participants
    C. demographic shifts of study participants during the study
    D. personality traits of study participants

26. A study with a significance level of 5% found conclusions with a *p*-level of 0.04 that a measure of self-esteem was positively correlated (+0.60) with how often people initiate conversations. In other words.

    A. There would be a 4% chance of finding this correlation even if there were no relationship between the two variables.
    B. The findings were not significant.
    C. The conclusions have a 95% chance of of being correct.
    D. 60% (+/– 5%) of outgoing people have positive self-esteem.

27. In a balanced placebo design

    A. half of participants receive the active drug and half receive the placebo with neither being told which they are receiving
    B. half of the participants informed they are receiving the placebo are actually receiving the active drug
    C. neither the researchers nor the participants are aware which participant is receiving the placebo or the active drug
    D. groups receive different information of possible side effects of the active drug in a controlled way in order to measure harmful nocebo effects

28. Googling the principle investigator, a research subject in a social psychology experiment learns that the researcher often employs deception with subjects. The participant then reveals what they found to other participants in the waiting area. This presents a challenge to the internal validity of the study and may lead to significant

    A. experimenter-expectancy effects
    B. demand characteristics
    C. confirmation bias
    D. Rosenthal effects

29. Cancerous tissue often shows up at bright spots on PET scans because cancerous tissue

    A. tends to have a higher radiographic density compared to normal tissue
    B. accumulates the fluorescent antibody linked labels used in PET radiography
    C. tends to have a higher metabolic rate than normal tissue
    D. has a higher concentration of free radicals compared to normal tissue.

30. Which of the following is an advantage of MRI over CT for brain imaging?

    I. More suited for soft tissue evaluation
    II. MRI machines do not emit ionizing radiation
    III. Higher resolution images
    IV. CT requires contrast agents

    A. I only
    B. II only
    C. I and II
    D. I, II, III, and IV

31. A observational study was conducted in which data was collected. A graph of the data resembles the one shown below:
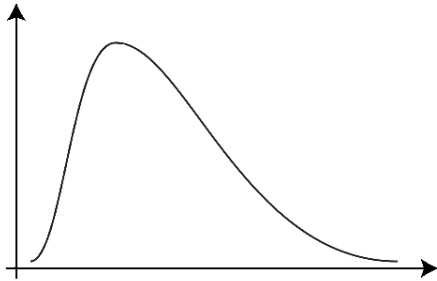
The data may be described as

A. positively skewed with a mean higher than the mode
B. positively skewed with a mean lower than the mode
C. negatively skewed with a mean higher than the mode
D. negatively skewed with a mean lower than the mode

32. In many states, school districts employ a screening based on standardized testing to govern invitations to participate in gifted enrichment programs. For example, one particular district invited elementary students possessing a measured IQ of at least 115. Which of the following is most likely to best describe the graph of the distribution of the IQ measurements of students invited to participate within this district?

A. a Gaussian distribution
B. negatively skewed
C. sigmoidal
D. positively skewed

33. Neurons do not have internal reserves of energy in the form of sugar and oxygen, so their firing causes a need for more energy to be brought in quickly. Through a process called the hemodynamic response, blood releases oxygen to them at a greater rate than to inactive neurons. This causes a change of the relative levels of oxyhemoglobin and deoxyhemoglobin. Detection of these relative levels serves as the basis for which of the following brain imaging methods?

A. PET
B. CT
C. MEG
D. fMRI

34. EEG is not a first-line method in medicine for the diagnosis of

A. brain tumor
B. sleep disorder
C. epiplepsy
D. coma

35. A survey given to two groups of native Californians show that for this particular population the mean estimate of the total annual number of murders to occur in Chicago exceeds their mean estimate of the number of murders to occur in the state of Illinois. These paradoxical results most likely occurred due to

A. base rate fallacy
B. the availability heuristic
C. illusory correlation
D. the Hawthorne effect

36. Researcher Jane Goodall pioneered the study of chimpanzees in their natural habitat. The major disadvantage for research findings in this type of study is

  A. it is difficult to generalize the findings
  B. they have low internal validity
  C. correlation doesn't imply causation
  D. experimenter expectancy effects

37 Analyses were performed to determine the relationship between MCAT composite scores and USMLE Step 1 from five graduating classes (2011–2015) at the University of Minnesota Medical School (N=1,065). The multiple linear regression analyses were both significant (p<0.001). The three MCAT component scores together explained 17.7% of the variance in Step 1 scores. What is the value of the correlation between composite MCAT scores and USMLE Step 1 scores?

  A. +0.10
  B. +0.18
  C. +0.31
  D. +0.42

38. Which of the following is a method for research design that minimizes the Hawthorne effect?

  A. double blind procedure
  B. covert observation
  C. random selection
  D. random assignment

39. Which of followng measures of central tendency is most sensitive to extreme outliers?

  A. mean
  B. mode
  C. median
  D. standard deviation

40. A researcher sets out to test the hypothesis that meditation practice over time increases scores on a set of specific measures of cognitive performance. She randomly selects fifty first year graduate students from the subject pool and randomly assigns half of them to an experimental group to receive weekly meditation training given by her and half to receive no training. She measures both groups' cognitive performance at the start of the study and again after a two month period. On the basis of her findings, she concludes that "meditation increases cognitive performance." What is wrong with this study?

  I.   Risk of experimenter-expectancy effect
  II. Lack of an independent variable
  III. No controls for placebo effect
  IV. Risk of Rosenthal effect

  A. III only
  B. I and II
  C. I, III and IV
  D. I, II, III and IV

41. Which of the following functional brain scanning methods combine good spatial resolution with excellent temporal resolution?

  A. EEG
  B. PET
  C. fMRI
  D. MEG

42. A cumulative final exam in physics only included material from the final two weeks of the semester. The exam did not reflect the overall learning goals and objectives of the course. The exam has low

  A. internal validity
  B. face validity
  C. criterion validity
  D. content validity

43. A bathroom scale consistently measures ten pounds heavy. The measurements of this scale are

    I. reliable
   II. unreliable
  III. valid
  IV. not valid

  A. I only
  B. II only
  C. I and III
  D. I and IV

44. When the null hypothesis is true and you reject it, you make a type I error. When the null hypothesis is false and you fail to reject it, you make a type II error. Which of the following decreases the chance of making a type I error while increasing the chance of making a type II error?

  A. lowering significance level
  B. increasing sample size
  C. double blind research design
  D. random assignment

45. Which of the following is the most effective method to find conclusions within a group of similar studies least contaminated with publication bias?

  A. restrict focus to the largest studies
  B. use meta-analysis to derive a pooled estimate
  C. select studies with a similar significance level
  D. include journal articles where the null hypothesis was confirmed

46. Linear regression analysis was conducted on a large sample of randomly selected ratings data from ratemyprofessor.com. Analysis concluded that 'clarity' was significantly correlated with 'hotness'. This is a likely result of

  A. the leniency effect
  B. the error of central tendency
  C. the halo effect
  D. an illusory correlation

47. Randomly selected participants in a weight loss study were given a choice to participate in either a mediterranean style calorie restricted program or an Atkins style carbohydrate restricted plan. At the end of six months, the average weight loss of the two groups was compared. This study is a

  A. quasi-experiment
  B. case study
  C. cohort study
  D. case-control study

48. Melanie's cumulative MCAT score is in the 97th percentile. What is her approximate z score?

  A. –3.0
  B. +2.0
  C. +2.5
  D. +3.0

49. Double-blind procedures control for which of the following?

I.   Experimenter expectancy
II. Demand characteristics
III. Placebo effect
IV. Hawthorne effect

A.   III only
B.   I and II
C.   I, II and IV
D.   I, II, III and IV

50. A study on social anxiety included a post-study questionaire in which participants indicated the extent to which they believe that they were aware of the researchers' hypotheses during the research. Significant correlations between the questionaire results and study data indicate that

A.   experimenter expectancy may have impacted internal validity
B.   an experimental observer shared knowledge with participants about the research hypotheses
C.   demand characteristics may be related to research results
D.   some participants tried to 'beat' the experiment to attain evaluation scores they view as socially desireable

Answer Key
Research Methods

1. **A**—fMRI, EEG and PET allow for visualization of neural changes that correspond to neural processes. CT provides detailed structural information.

2. **B**—The criterion validity is the extent to which a measure is related to an outcome. The other forms of validity reflected in the answer choices are related but not as directly given the phrasing of the question. The face validity is the extent to which a test is subjectively viewed as coverin the concept it purports to measure. Content validity refers to the extent to which a measure respresents all facets of a construct. Construct validity is the degree to which a test measures what it claims, or purports, to be measuring.

3. **B**—Random selection is a process of gathering a representative sample for a particular study. Random sampling is important for external validity, enabling generalization of findings to the whole population without actually testing the whole population.

4. **D**—Random assignment in combination with double blind experimental procedure is designed to improve the internal validity of an experiment, minimizing systematic error (or 'bias'). Reactivity is a phenomenon that occurs when individuals alter their performance or behavior due to the awareness that they are being observed. An experimenter effect can occur, for example, when the experimenters subtly communicate their expectations to the participants, who alter their behavior to conform to these expectations. Internal validity contrasts with external validity, the degree results may be generalized to other contexts. Sampling error, in which the experimental subjects chosen are not representative of the target population, presents problems for an experiment's external validity. Sampling error may result from selection bias.

5. **C**—Reactivity is a phenomenon that occurs when individuals alter their performance or behavior due to the awareness that they are being observed. The Pygmalion effect (or Rosenthal effect) is the phenomenon whereby higher expectations lead to an increase in performance. An experimenter effect occurs when the experimenters subtly communicate their expectations to the participants, who alter their behavior to conform to these expectations. Both experimenter effects and Pygmalion effects can be caused by bias and stereotyping. The Hawthorne effect is a type of reactivity in which individuals modify an aspect of their behavior in response to their awareness of being observed.

6. **B**—The effect of childhood trauma on frontal lobe activity is impossible to test experimentally because it is essentially impossible to create an experimental procedure involving manipulation of the independent variable, childhood trauma.

7. **C**—The standard deviation is the square root of the variance. The variance is found by taking the average of the squared differences between each value and the mean, ie. (49 + 1 + 1 + 49) divided by 4. In other words, the variance is 25. Taking the square root of the variance, the standard deviation is 5. A large standard deviation indicates that the data points can spread far from the mean and a small standard deviation indicates that they are clustered closely around the mean.

8. **C**—The median is the value separating the higher half of a data sample, a population, or a probability distribution, from the lower half. In simple terms, it may be thought of as the "middle" value of a data set. Putting our numbers in order: 2,5,6,7,8,8 we see there is no middle value. In such cases, take the average of the two middle values.

9. **C**—With outliers on the negative end of the distribution, the skew will be negative. Negative skew indicates that the tail on the left side of the

probability density function is longer or fatter than the right side.

10. **C**—A confounding variable is a variable in a statistical model that correlates with both the dependent variable and an independent variable, in a way that "explains away" some or all of the correlation between these two variables.

11. **B**—Naturalistic observation involves two main differences that set it apart from other forms of data gathering. In the context of a naturalistic observation the environment is in no way being manipulated by the observer nor was it created by the observer.

12. **B**—Arranging a list of volunteers in alphabetical order and selecting every 3rd volunteer is NOT random sampling. In random sampling you would get a different result each sampling trial but in this case each trial would produce the same result. Using a computer to randomly assign 1/3 of a group of volunteers each to a separate experimental condition is NOT random sampling. This is random assignment. Sampling is a method to assign experimental subjects from a population. Assignment arranges experimental subjects into groups to receive different experimental conditions. Pulling the names of twenty volunteers out of a hat to serve as experimental subjects IS random sampling. Dividing a population into smaller groups based on shared characteristics and choosing a sample from each group using a random number generator IS a type of random sampling. This type of sampling is known as stratified random sampling.

13. **A**—Sampling bias is a bias in which a sample is collected in such a way that some members of the intended population are less likely to be included than others. It results in a biased sample, a non-random sample of a population. This would not be considered to introduce a confounding variable. In the context of an experimental procedure, a confounding variable is anything that differs between the control and experimental group besides the independent variable.

14. **C**—Positive correlation means an increase in one variable is associated with an increase in another. However, correlation does not suggest causation. In this case, both increases are the result of an exceptionally warm summer.

15. **C**—Research studies may involve deception. Social psychology research often does. However, after research is completed, participants must be debriefed and any deceptions used should be revealed.

16. **D**—A confounding variable is a variable in a statistical model that correlates with both the dependent variable and an independent variable. The handedness of the subject is not a confounding variable. Although it correlates with the dependent variable it does not correlate with the independent variable. Such a variable which may effect results but which is not a confounding variable is termed an extraneous variable. An extraneous variable becomes a confounding variable when the extraneous variable changes systematically along with the independent variable that you are studying.

17. **C**—An extraneous variable becomes a confounding variable when the extraneous variable changes systematically along with the independent variable that you are studying. In this case the confounding variable (day of the week) changes systematically with the independent variable (whether or not music is played). This is a threat to the internal validity of the study, making it difficult to determine whether the dependent variable (in-class productivity) changes in response to the independent variable or the confound.

18. **A**—*P*-values are the probability of obtaining an effect at least as extreme as the one in your sample data, assuming the truth of the null hypothesis. The significance level, is the probability of rejecting the null hypothesis when it is

true. This distinction is hard to understand. The significance level is something you assign at the beginning of the study. Picture the graph of a distribution around the null hypothesis value. On the right and left are the tails of the graph, shade 2.5% on each end, together 5%. If you assign a significance level of 5%, then you are accepting the 5% chance that your data may land in either of those tails and you wind up in the position of publishing evidence that the null hypothesis is not true when it actually is. Bad luck! In any experiment based on statistical sampling you have to decide on some percentage chance that your data could rule out the null hypothesis just by the accident of producing a sample in one of those tails. The p-value is assigned after data collection and analysis. This is how you judge your data versus the significance level. The p-value is the chance that a trial will produce data at least as extreme as the experimental value assuming the null hypothesis to be true. You compare the p-value of your data to the significance level you assigned earlier to judge whether your experimental results are statistically significant. If the p-value is less than the significance level, the results are statistically significant.

19. **C**—The 68–95–99.7 rule is a shorthand used to remember the percentage of values that lie within a band around the mean in a normal distribution. 68.27%, 95.45% and 99.73% of the values lie within one, two and three standard deviations of the mean. In other words, approximately 70% of values like within one standard deviation of the mean. Therefore, 15% of values are above the first standard deviation.

20. **A**—Face validity refers to the transparency or relevance of a test as it appears to test participants.

21 **A**—A projective test is a personality test designed to let a person respond to ambiguous stimuli, presumably revealing hidden emotions and internal conflicts projected by the person into the test. This is sometimes contrasted with a so-called "objective test" or "self-report test" in which responses are analyzed according to a presumed universal standard (for example, a multiple choice exam), and are limited to the content of the test.

22. **D**—Operationalization is a key concept in psychology research, referring to a process of defining the measurement of a phenomenon that is not directly measurable, though its existence is indicated by other phenomena. Operationalization is thus the process of defining a fuzzy concept so as to make it clearly distinguishable, measurable, and understandable in terms of empirical observations.

23. **C**—A correlationship coefficient of –0.35 shows a weak inverse association between viewing hours and SAT scores. Regarding choice 'A', correlation does not imply causation. Regarding choice 'B', the variables relayed in the question-stem did not include mention of parental policies. Regarding choice 'D', an observational study based on inferential statistics couldn't be used to make a prescriptive claim regarding an individual case.

24. **A**—In a true experiment, subjects are randomly assigned to the treatment conditions (levels of the independent variable). The only differences in the groups would be due to chance. Quasi-experiments are sometimes called natural experiments because membership in the treatment level is determined by conditions beyond the control of the experimenter (subjects are already in the box). An experiment may seem to be a true experiment, but if the subjects have NOT been randomly assigned to the treatment condition, the experiment is a quasi-experiment. A common type of quasi-experiment, as seen in this question, is to compare pre- versus post- events or behavior.

25. **A**—A longitudinal study is a quasi-experimental research design that involves repeated observations of the same variables over long periods of time, often many decades. This study is de-

signed to investigate the relationship between aging and attitudes towards the criminal justice. However, changes in such attitudes over time could have something to do with these people getting older, but it could instead be that the social and political climate changed over time. In other words, age is confounded with time-of-testing. While it would be possible to control for the other possible confounds in the study time-of-testing is an inevitable confound of longitudinal studies.

26. **A**—To understand the meaning of p-level, imagine the situation where the null hypothesis is correct. The null hypothesis proposes that there may be no correlation between the dependent and independent variable. Assuming the null hypothesis to be correct, what is the percent probability for the correlation observed in the experiment to have occured simply by random chance? That's the p-level. The significance level is different. It's a standard to judge p-level and judge significance ot the findings. The significance level is assigned by the researchers, typically by custom, either 5% or 1%, before the experiment. If the p-level comes in lower than the significance level, the results are significant.

27. **B**—In a balanced placebo design, half of the participants are told they are receiving the active drug and half are told they are receiving the placebo - but only half of the participants in each group actually receive the drug or placebo as told, permitting independent and combined assessment of drug and placebo effects.

28. **B**—Demand characteristics refers to an experimental artifact where participants form an interpretation of the experiment's purpose and subconsciously change their behavior to fit that interpretation. The observer-expectancy effect (also called the experimenter-expectancy effect, expectancy bias, observer effect, or experimenter effect) is a form of reactivity in which a researcher's cognitive bias causes them to subconsciously influence the participants of an experiment. Confirmation bias can lead to the experimenter interpreting results incorrectly because of the tendency to look for information that conforms to their hypothesis, and overlook information that argues against it. The Pygmalion effect, or Rosenthal effect, is the phenomenon whereby higher expectations lead to an increase in performance.

29. **C**—Positron emission tomography (PET) is used to observe metabolic processes in the body. The system detects pairs of gamma rays emitted indirectly by a positron-emitting radionuclide (tracer), which is introduced into the body on a biologically active molecule. Most often, the biologically active molecule chosen for PET is fludeoxyglucose (FDG), an analogue of glucose. The concentrations of tracer imaged will indicate tissue metabolic activity as it corresponds to the regional glucose uptake. Use of this tracer to explore the possibility of cancer metastasis (i.e., spreading to other sites) is the most common type of PET scan in standard medical care (90% of current scans).

30. **C**—MRI is more suited for soft tissue investigation and it does not emit ionizing radiation. CT is higher resolution. especially in imaging bone structures. Contrast agents may be employed in both MRI and CT.

31. **A**—The data is right skewed (positively skewed). Positive skew indicates that the tail on the right side is longer or fatter than the left side. Compared to a normal distribution, which is symmetric, a greater number of outliers are on the right side of the graph.
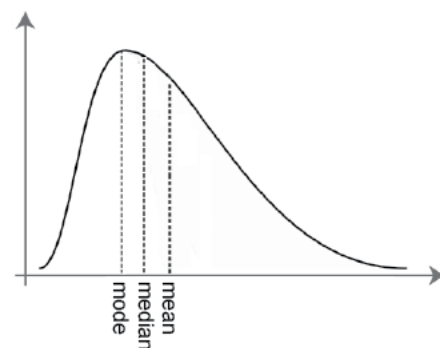
32. **D**—Given that the sample will be derived from the portion of the normal distributtion of IQ scores for the general student population. There will be many more students in the 120 to 130 range than in the 140 to 150 range. In this case, the mean of the distribution will be to the right of the peak of the graph (the mode). The graph will be positively skewed.

33. **D**—Hemoglobin has different magnetic properties in its oxygenated and deoxygenated forms. This leads to magnetic signal variation which can be detected using an MRI scanner and is the basis for fMRI (functional magnetic resonance imaging).

34. **A**—Electroencephalography (EEG) is an electrophysiological monitoring method to record electrical activity of the brain. It is typically noninvasive, with the electrodes placed along the scalp, although invasive electrodes are sometimes used in specific applications. EEG measures voltage fluctuations resulting from ionic current within the neurons of the brain. EEG is most often used to diagnose epilepsy, which causes abnormalities in EEG readings. It is also used to diagnose sleep disorders, coma, encephalopathies, and brain death. The use of EEG for diagnosis of tumors, stroke and other focal brain disorders has been superseded by high-resolution anatomical imaging techniques such as magnetic resonance imaging (MRI) and computed tomography (CT).

35. **B**—A heuristic is a mental shortcut that helps us to streamline our thinking. Using the availability heuristic, we estimate the likelihood of an occurence based on the ease with which it comes to mind. People tend to heavily weigh their judgments toward more recent information, making new opinions biased toward that latest news. Additionally, the availability of consequences associated with an action is positively related to perceptions of the magnitude of the consequences of that action. In other words, the easier it is to recall the consequences of something the greater those consequences are often perceived to be.

36. **B**—The major advantage of naturalistic observation is high external validity: the extent to which findings can be generalized to real-world settings. The disadvantage is low internal validity. In naturalistic designs there is no control over manipulation of key variables so it is difficult to draw cause-and-effect inferences.

37. **D**—To determine what percentage of the variance of one variable is accounted for by variance in another variable, you square the value of the correlation. In this case, we are working backwards. We are given the percentage of how much the variance in Step 1 scores is accounted for by variance in MCAT scores. We need to take the square root of that value to find the value of the correlation.

38. **B**—The Hawthorne effect occurs when participants' knowledge that they're being studied affects their behavior.

39. **A**—The mean is the arithmetic average of all scores. The median is the middle score. The mode is the most frequent score. Of these three measures of central tendency, the mean is the most sensitive to extreme outliers. A truncated mean involves the calculation of the mean after discarding given parts of a probability distribution or sample at the high and low end.

40. **C**—There is a risk of experimenter-expectancy and Rosenthal effect. There are also no controls for the placebo effect. The experimenter-expectancy effect is a form of reactivity in which a researcher's cognitive bias causes them to subconsciously influence the participants of an experiment. The Rosenthal effect is the phenomenon whereby higher expectations lead to an increase in performance. Lastly, she hasn't controlled for the placebo effect. The people

receiving meditation training know they're receiving treatment, and the people in the control group know they're not. In psychological research of this type, a counselor can apply an attention placebo control condition in which the counselor provides attention but no formal therapy to subjects.

41. **D**—EEG has excellent temporal resolution but poor spatial resolution. PET and fMRI can only measure activity changes second by second. MEG, which detects electrical activity in the brain through measurement of tiny magnetic fields, combines good spatial resolution with excellent temporal resolution, measuring activity changes millisecond by millisecond.

42. **D**—Content validity reflects how much a measure represents every single element of a construct. An educational test with strong content validity will represent the subjects actually taught to students.

43. **D**—The scale provides consistent results. It is reliable. Validity refers to how well a test measures what it is supposed to measure. The scale gives consistently incorrect measurements. It does not provide valid measurements.

44. **A**—In lowering the significance level you are giving yourself a higher standard for the p-value of results to be considered significant. This decreases the chance of making a type I error, which would involve claiming a significant correlation when in fact the null hypothesis is true and the data is just an outlier distribution. However, lowering the significance level would increase the chance of making a type II error, in which the null hypothesis is affirmed when in fact the true situation is that there is a reproducible difference between control and experimental groups.

45. **A**—The bias against publishing studies in which the null hypothesis was confirmed is more of a danger with small studies than large studies. Larger studies have smaller p-value

and a greater chance of publication even when confirming the null hypothesis. With smaller studies the chance of type I error is greater and publication is favored for those studies making the error versus other small studies confirming the null hypothesis.

46. **C**— The halo effect is a cognitive bias in which an observer's overall impression of a person, company, brand, or product influences the observer's feelings and thoughts about that entity's character or properties.

47. **A**— The defining feature of a quasi-experiment is the lack of random assignment. This quasi-experiment not only lacks random assignment but also a control group.

48. **B**—In statistics, the 68–95–99.7 rule is a shorthand used to remember the percentage of values that lie within a band around the mean in a normal distribution with a width of two, four and six standard deviations, respectively. In other words, the width of four standard deviations (two above and two below the mean), will include 95% of the values, with 2.5% of values remaining above and 2.5% remaining below. In other words, a score of 97% is right on the border between the second and third standard deviations above the mean. Z scores measure the distance of a score from the mean in units of standard deviations.

49. **D**—In double-blind experiments, neither the participants nor the researchers know which participants belong to the control group, nor the test group. Performing an experiment in double-blind fashion can greatly lessen the power of preconceived notions or physical cues to distort the results. Double-blind procedures reduce the impact of demand characteristics, experimenter expectancy, placebo effect, and Hawthorne effect.

50. **C**—Demand characteristics refers to an experimental artifact where participants form an interpretation of the experiment's purpose and

subconsciously change their behavior to fit that interpretation. If the post-study questionaire correlates with study data, it points to a potential problem with demand characteristics as a source of bias.