

Quantitative Reasoning Quotient (QRQ)

Purpose: The purpose of this survey is to indicate how you use quantitative information in everyday life.

Take your time: The questions require you to read and think carefully about various situations. If you are unsure of what you are being asked to do, please raise your hand for assistance. The following pages consist of multiple-choice questions about quantitative thinking. Read the questions carefully before selecting an answer.

1. Nine students in a science class separately weighed a small object on the same scale. The weights (in grams) recorded by each student are shown below.

6.2 6.0 6.0 15.3 6.1 6.3 6.2 6.329 6.2

The students want to determine as accurately as they can the actual weight of this object. Of the following methods, which would you recommend they use?

- a. Use the most common number, which is 6.2
 - b. Use the 6.329 since it includes more decimal places.
 - c. Add up the 9 numbers and divide by 9.
 - d. Throw out the 15.3, add up the other 8 numbers and divide by 8.
2. The following message is printed on a bottle of prescription medication:

WARNING: For application to skin areas there is a 15% chance of developing a rash. If a rash develops, consult your physician.

Which of the following is the best interpretation of this warning?

- a. Don't use the medication on your skin-- there's a good chance of developing a rash.
- b. For application to the skin, apply only 15% of the recommended dose.
- c. If a rash develops, it will probably involve only 15% of the skin.
- d. About 15 of 100 people who use this medication develop a rash.
- e. There is hardly a chance of getting a rash using this medication.

3. The Springfield Meteorological Center wanted to determine the accuracy of their weather forecasts. They searched their records for those days when forecasts had reported a 70% chance of rain. They compared their forecasts to records of whether or not it actually rained on those particular days.

The forecast of 70% chance of rain can be considered very accurate if it rained on:

- a. 95%-100% of those days.
 - b. 85%-94% of those days.
 - c. 75%-84% of those days.
 - d. 65%-74% of those days.
 - e. 55%-64% of those days.
4. A teacher wants to change the seating arrangement in her class in the hopes that it will increase the number of comments her students make. She first decides to see how many comments students make with the current seating arrangement. A record of the number of comments made by her 8 students during one class period is shown below.

	Student Initials							
	A.A	R.F.	A.G.	J.G.	C.K.	N.K.	J.L.	A.W.
Number of Comments	0	5	2	22	3	2	1	2

She wants to summarize this data by computing the typical number of comments made that day. Of the following methods, which would you recommend she use?

- a. Use the most common number, which is 2.
- b. Add up the 8 numbers and divide by 8.
- c. Throw out the 22, and then add up the other 7 and divide by 7.
- d. Throw out the 0, add up the other 7 numbers and divide by 7.

For items 5-6

A new medication is being tested to determine its effectiveness in the treatment of eczema, an inflammatory condition of the skin. Thirty patients with eczema were selected to participate in the study. The patients were randomly divided into two groups. Twenty patients in an experimental group received the medication, while ten patients in a control group received no medication. The results after two months are shown below.

Experimental group (medication)

Improved	8
No improvement	12

Control group (no medication)

Improved	2
No Improvement	8

5. Based on the data, I think the medication was:

- a. somewhat effective
- b. basically ineffective

6. If you chose option a, select the one explanation below that best describes your reasoning.

- a. 40% of the people (8/20) in the experimental group improved.
- b. 8 people improved in the experimental group while only 2 improved in the control group
- c. In the experimental group, the number of people who improved is only 4 less than the number who didn't improve (12-8), while in the control group the difference is 6 (8-2).
- d. 40% of the patients in the experimental group improved (8/20), while only 20% improved in the control group (2/10).

If you chose option b, select the one explanation below that best describes your reasoning.

- a. In the control group, two people improved even without medication.
- b. In the experimental group, more people didn't get better than did (12 vs. 8).
- c. The difference between the numbers who improved and didn't improve is about the same in each group (4 vs. 6).
- d. Only 40% of the patients in the experimental group improved (8/20), while 20% improved in the control group (2/10).

Items 7-9

Listed below are several possible reasons one might question the results of the experiment described above. Mark A for every reason you agree with.

A = Agree B = Disagree

7. It's not possible to compare the two groups because there are different numbers of patients in each group.
8. With a sample size of 30, it's possible that random assignment of patients may have, just by chance, placed the most severe cases in one of the groups.
9. I'm not given enough information about how doctors decided whether or not patients improved. Doctors may have been biased in their judgment.

10. Two containers, labeled A and B, are filled with red and blue marbles in the following quantities.

<u>Container</u>	<u>Red</u>	<u>Blue</u>
A	6	4
B	60	40

Each container is shaken vigorously. After choosing one of the containers, you will reach in, without looking, draw out a marble. If the marble is blue, you win \$50. Which container gives you the best chance of drawing a blue marble?

- a. Container A (with 6 red and 4 blue)
- b. Container B (with 60 red and 40 Blue)
- c. Equal chances from each container.

11. Which of the following sequences is most likely to result from flipping a fair coin five times? (H=Heads, T=Tails)
- a. H H H T T
 - b. T H H T H
 - c. T H T T T
 - d. H T H T H
 - e. All four are equally likely

Items 12-15

Select one or more explanations for possible coin-flipping outcomes.

A = Agree B = Disagree

- 12. Since coin flipping is random, the coin ought to alternate frequently between landing heads and tails.
 - 13. If you repeatedly flipped a coin five times, each of the sequences would occur about as often as any sequence.
 - 14. If you get a couple of heads in a row, the probability of tails on the next flip increases.
 - 15. Every sequence of five flips has exactly the same probability of occurring.
17. Listed below are the same sequences of H's and T's that were listed in Item 11. Which of the sequences is least likely to result from flipping a coin 5 times?
- a. H H H T T
 - b. T H H T H
 - c. T H T T T
 - d. H T H T H
 - e. All four sequences are equally unlikely

Items 17-22

A marketing research company was asked to determine how much money teenagers (ages 13-19) spend on recorded music (cassette tapes, CD's, and DVD's). The company randomly selected 80 malls located around the country. A field researcher stood in a central location in the mall and passers-by who appeared to be the approximate age were asked to fill out the questionnaire. A total of 2,050 questionnaires were completed by teenagers. On the basis of this survey, the research company reported that the average teenager in this country spends \$155 each year on recorded music.

Listed below are several statements concerning the survey. Mark A for each statement you agree with. Mark B for each statement you disagree with.

A = Agree

B = Disagree

17. The average is based on teenagers' estimates of what they spend and therefore could be quite different from what teenagers actually spend.
18. They should have done the survey at more than 80 malls if they wanted an average based on teenagers throughout the country.
19. The sample of 2,050 teenagers is too small to permit drawing a conclusion about the entire country.
20. They should have asked teenagers coming out of music stores.
21. The average could be a poor estimate of the spending of all teenagers given that teenagers were not randomly chosen to fill out the questionnaire.
22. The average could be a poor estimate of the spending of all teenagers given that only teenagers in malls were sampled.
23. Five faces of a fair die are painted black, and one face is painted white. The die is rolled six times. Which of the following results is more likely?
 - a. Black side up on five of the rolls; white side up on the other roll
 - b. Black side up on all six rolls
 - c. a and b are equally likely

24. Half of all newborn children are girls and half are boys. Hospital A records an average of 50 births a day. Hospital B records an average of 10 births a day. On a particular day, which hospital is more likely to record 80% or more female births.

- a. Hospital A (with 50 births a day)
- b. Hospital B (with 10 births a day)
- c. The two hospitals are equally likely to record such an event.

25. The Caldwelles want to buy a new car, and they have narrowed their choices to a Buick or an Oldsmobile. They first consulted an issue of Consumer Reports, which compared rates of repairs for various cars. Records on repairs done on 400 cars of each type showed somewhat fewer mechanical problems with the Buick than the Oldsmobile.

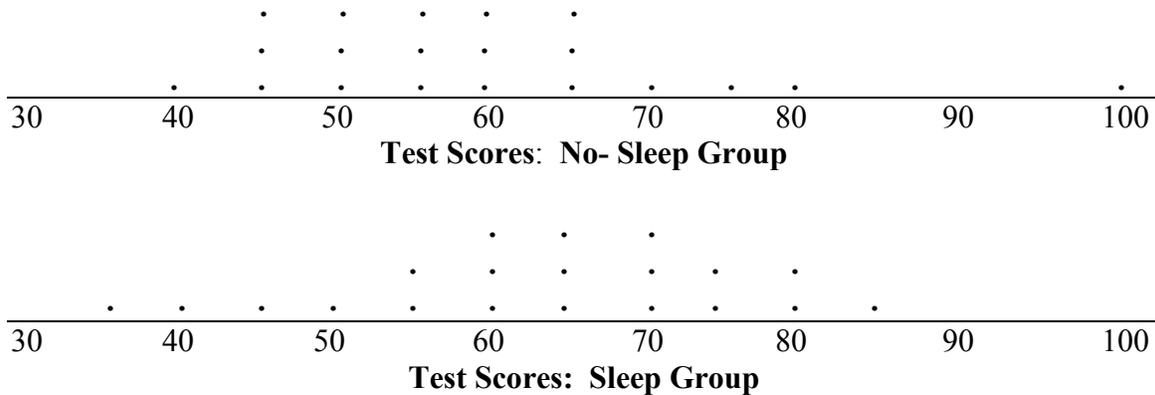
The Caldwelles then talked to three friends, two Oldsmobile owners, and one former Buick Owner. Both Oldsmobile owners reported having a few mechanical problems, but nothing major. The Buick owner, however, exploded when asked how he liked his car:

“First the fuel injection went out-- \$250 bucks. Next I started having trouble with the rear end and had to replace it. I finally decided to sell it after the transmission went. I’d never buy another Buick.”

The Caldwelles want to buy the car that is less likely to require major repair work. Given what they currently know, which car would you recommend that they buy?

- a. I would recommend they buy the Oldsmobile, primarily because of all the trouble their friend had with his Buick. Since they haven’t heard similar horror stories about an Oldsmobile, they should go with it.
- b. I would recommend they buy the Buick in spite of their friend’s bad experience. This is just one case, while the information reported in Consumer Report is based on many cases. And according to the data, the Buick is somewhat less likely to require repairs.
- c. I would tell them that it didn’t matter which car they bought. Even though one of the models might be more likely than the other to require repairs, they could still, just by chance, get stuck with a particular car that would need a lot of repairs. They may as well toss a coin to decide.

26. Forty college students participated in a study of the effect of sleep on test scores. Twenty of the students volunteered to stay up all night studying the night before the test (no sleep group). The other 20 students (the control group) went to bed by 11:00 p.m. on the evening of the test. The test scores for each group are shown in the graphs below. Each dot on the graph represents a particular student's score. For example, the two dots above 80 in the bottom graph indicate that two students in the sleep group scored 80 on the test.



Examine the two graphs carefully. Then choose from the 6 possible conclusions listed below the one you most agree with.

- The no-sleep group did better because none of these students scored below 40 and, a student in this group achieved the highest score.
- The no-sleep group did better because its average appears to be a little higher than the average of the sleep group.
- There is no difference between the two groups because there is considerable overlap in the scores of the two groups.
- There is no difference between the two groups because the difference between their averages is small compared to the amount of variation in the scores.
- The sleep group did better because its average appears to be a little higher than the average of the no sleep group.

Items 27-31

For one month, 500 elementary students kept a daily record of the hours spent watching television. The average number of hours per week spent watching television was 28. The researchers conducting the study also obtained report cards for each of the students. They found that the students who did well in school spent less time watching television than those students who did poorly.

Listed below are several possible statements concerning the results of this research. Mark A for each statement you agree with.

A = Agree B = Disagree

27. The sample of 500 is too small to permit drawing conclusions.
28. If a student decreases the amount of time spent watching television, his or her performance in school would improve.
29. Even though students who did well watched less television, this doesn't necessarily mean that watching television hurts school performance.
30. One month is not a long enough period of time to estimate how many hours the students really spend watching television.
31. The research demonstrates that watching television causes poorer performance in school.

Items 32-37

The school committee of a small town wanted to determine the average number of children per household in their town. They divided the total number of children in the town by 50, the total number of households. Indicate which statements must be true if the average number of children per household is exactly 2.2.

Mark A for the statements you agree with and B for the statements you disagree with.

A = Agree B = Disagree

32. Half of the households in the town have more than 2 children.
33. More households in the town have 3 children than have 2 children.
34. There are 110 children in the town.
35. There are 2.2 children in the town for every adult.
36. The most common number of children in a household is 2.
37. More households in the town have 2 children than have 3 children.

38. When two dice are simultaneously thrown it is possible that one of the following two results occurs:

Result 1: A 5 and a 6 are obtained.

Result 2: A 5 is obtained twice.

Select the response that you agree with most:

- a. The chance of obtaining each of these results is equal.
- b. There is more chance of obtaining *Result 1*.
- c. There is more chance of obtaining *Result 2*.
- d. It is impossible to give an answer.

39. When three dice are simultaneously thrown, which of the following results is MOST LIKELY to be obtained?

- a. *Result 1:* A 5, a 3 and a 6
- b. *Result 2:* A 5 three times
- c. *Result 3:* A 5 twice and a 3
- d. All three results are equally likely

40. When three dice are simultaneously thrown, which of these three results is LEAST LIKELY to be obtained?

- a. *Result 1:* A 5, a 3 and a 6
- b. *Result 2:* A 5 three times
- c. *Result 3:* A 5 twice and a 3
- d. All three results are equally unlikely