BASICS OF PROBABILITY

MULTIPLE CHOICE QUESTIONS

1. Consider the following data: 1, 7, 3, 3, 6, 4
   a. the mean and median for this data are
   b. 4 and 3
   c. 4.8 and 3
   d. 4.8 and 3 1/2
   e. 4 and 3 1/2
   f. 4 and 3 1/3

2. A distribution of 6 scores has a median of 21. If the highest score
   a. increases 3 points, the median will become __.
   b. 21
   c. 21.5
   d. 24
   e. Cannot be determined without additional information.
   f. none of these

3. If you are told a population has a mean of 25 and a variance of 0, what must you conclude?
   a. Someone has made a mistake.
   b. There is only one element in the population.
   c. There are no elements in the population.
   d. All the elements in the population are 25.
   e. None of the above.

4. Which of the following measures of central tendency tends to
   a. be most influenced by an extreme score?
   b. median
   c. mode
   d. mean

5. The mean is a measure of:
   a. variability.
   b. position.
   c. skewness.

d. central tendency.
e. symmetry.

6. Suppose the manager of a plant is concerned with the total number of man-hours lost due to accidents for the past 12 months. The company statistician has reported the mean number of man-hours lost per month but did not keep a record of the total sum. Should the manager order the study repeated to obtain the desired information? Explain your answer clearly.
Answer:
No--the estimate that he would get using the mean number per month would most likely be accurate enough, without having to go to the extra expense of another study. Presumably the mean number of hours lost per month is equal to the total number of hours lost divided by 12, so it's not difficult to calculate the total.

7. The standard deviation of a group of scores is 10. If 5 were subtracted from each score, the standard deviation of the new scores would be
   a. 2
   b. 10/25
   c. 5
   d. none of these.

8. A frequency distribution provides the following information:
   a. The value of the measurement and the number of individuals with that value.
   b. The value of the measurement and the percent of individuals with that value.
   c. The value of the measurement and the percent of individuals with that value or a smaller one.

9. The average weight of a group of 30 friends increases by 1 kg when the weight of their football coach was added. If average weight of the group after including the weight of the football coach is 31kgs, what is the weight of their football coach in kgs?
   a) 31 kgs
   b) 61 kgs
   c) 60 kgs
   d) 62 kgs
   e) 91 kgs

10. A casino offers a simple card game. There are 52 cards in a deck with 4 cards for each 2, 3, 4, 5, 6, 7, 8, 9,10, , , , *J Q K A*. Each time the cards are thoroughly shuffled (so each card has equal probability of being selected). You pick up a card from the deck and the dealer picks another one without replacement. If you have a larger number, you win; if the numbers are equal or yours is smaller, the house

wins—as in all other casinos, the house always has better odds of winning. What is your probability of winning?

Solution: One answer to this problem is to consider all 13 different outcomes of your card. The card can have a value 2, 3, , *A* and each has 1/13 of probability. With a value of 2, the probability of winning is 0/51; with a value of 3, the probability of winning is 4/51 (when the dealer picks a 2); …; with a value of *A*, the probability of winning is 48/51 (when the dealer picks a 2, 3, , or *K*). So your probability of winning is

$$\frac{1}{13}\times\left(\frac{0}{51}+\frac{4}{51}+\cdots+\frac{48}{51}\right)=\frac{4}{13\times 51}\times(0+1+\cdots+12)=\frac{4}{13\times 51}\times\frac{12\times 13}{2}=\frac{8}{17}.$$

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11. A line of 100 airline passengers are waiting to board a plane. They each hold a ticket to one of the 100 seats on that flight. For convenience, let's say that the *n*-th passenger in line has a ticket for the seat number *n*. Being drunk, the first person in line picks a random seat (equally likely for each seat). All of the other passengers are sober, and will go to their proper seats unless it is already occupied; In that case, they will randomly choose a free seat. You're person number 100. What is the probability that you end up in your seat (i.e., seat #100)?.

Solution: Let's consider seats #1 and #100. There are two possible outcomes:

E_1: Seat #1 is taken before #100;

E_2: Seat #100 is taken before #1.

If any passenger takes seat #100 before #1 is taken, surely you will not end up in you own seat.

But if any passenger takes #1 before #100 is taken, you will definitely end up in you own seat. By symmetry, either outcome has a probability of 0.5.

So the probability that you end up in your seat is 50%.

Explanation:

If the drunk passenger takes #1 by chance, then it's clear all the rest of the passengers will have the correct seats. If he takes #100, then you will not get your seat.

The probabilities that he takes #1 or #100 are equal. Otherwise assume that he takes the *n-th* seat, where *n* is a number between 2 and 99.

Everyone between 2 and (n-1) will get his own seat. That means the *n-th* passenger essentially becomes the new "drunk" guy with designated seat #1. If he chooses #1, all the rest of the passengers will have the correct seats. If he takes #100, then you will not get your seat. (The probabilities that he takes #1 or #100 are again equal.) Otherwise he will just make another passenger down the line the new "drunk" guy with designated seat #1 and each new "drunk" guy has equal probability of taking #1 or #100. Since at all jump points there's an equal probability for the "drunk" guy to choose seat #1 or 100, by symmetry, the probability that you, as the 100*th* passenger, will seat in #100 is 0.5.