**Problem 1**

Which of the following statements are true?

I. All variables can be classified as quantitative or categorical variables.  
II. Categorical variables can be continuous variables.  
III. Quantitative variables can be discrete variables.

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

**Solution**

The correct answer is (E). All variables can be classified as quantitative or categorical variables. Discrete variables are indeed a category of quantitative variables. Categorical variables, however, are not numeric. Therefore, they cannot be classified as continuous variables.

**Problem 1**

Which of the following statements are true?

I. The mean of a population is denoted by x.  
II. Sample size is never bigger than population size.  
III. The population mean is a statistic.

(A) I only.  
(B) II only.  
(C) III only.  
(D) All of the above.  
(E) None of the above.

**Solution**

The correct answer is (E), none of the above.

The mean of a population is denoted by μ; not x. When sampling with replacement, sample size can be greater than population size. And the population mean is a *parameter*; the sample mean is a statistic.

**Problem 1**

Four friends take an IQ test. Their scores are 96, 100, 106, 114. Which of the following statements is true?

I. The mean is 103.  
II. The mean is 104.  
III. The median is 100.  
IV. The median is 106.

(A) I only  
(B) II only  
(C) III only  
(D) IV only  
(E) None is true

**Solution**

The correct answer is (B). The mean score is computed from the equation:

Mean score = Σx / n = (96 + 100 + 106 + 114) / 4 = 104

Since there are an even number of scores (4 scores), the median is the average of the two middle scores. Thus, the median is (100 + 106) / 2 = 103.

**Problem 1:**

A population consists of four observations: {1, 3, 5, 7}. What is the variance?

(A) 2  
(B) 4  
(C) 5  
(D) 6  
(E) None of the above

**Solution**

The correct answer is (C). First, we need to compute the population mean.

μ = ΣX / N = ( 1 + 3 + 5 + 7 ) / 4 = 4

Then we plug all of the known values into formula for the variance of a population, as shown below:

* σ2 = Σ ( Xi - μ )2 / N  
  σ2 = [ ( 1 - 4 )2 + ( 3 - 4 )2 + ( 5 - 4 )2 + ( 7 - 4 )2 ] / 4  
  σ2 = [ ( -3 )2 + ( -1 )2 + ( 1 )2 + ( 3 )2 ] / 4  
  σ2 = [ 9 + 1 + 1 + 9 ] / 4 = 20 / 4 = 5

**Problem 2**

A simple random sample consists of four observations: {1, 3, 5, 7}. Based on these sample observations, what is the best estimate of the standard deviation of the population?

(A) 2  
(B) 2.58  
(C) 6  
(D) 6.67  
(E) None of the above

**Solution**

The correct answer is (B). First, we need to compute the sample mean.

x = Σx / n = ( 1 + 3 + 5 + 7 ) / 4 = 4

Then we plug all of the known values into formula for the standard deviation of a sample, as shown below:

* *s* = sqrt [ Σ ( xi - x )2 / ( n - 1 ) ]  
  *s* = sqrt { [ ( 1 - 4 )2 + ( 3 - 4 )2 + ( 5 - 4 )2 + ( 7 - 4 )2 ] / ( 4 - 1 ) }  
  *s* = sqrt { [ ( -3 )2 + ( -1 )2 + ( 1 )2 + ( 3 )2 ] / 3 }  
  *s* = sqrt { [ 9 + 1 + 1 + 9 ] / 3 } = sqrt (20 / 3) = sqrt ( 6.67 ) = 2.58

**Problem 1**

A national achievement test is administered annually to 3rd graders. The test has a mean score of 100 and a standard deviation of 15. If Jane's z-score is 1.20, what was her score on the test?

(A) 82  
(B) 88  
(C) 100  
(D) 112  
(E) 118

**Solution**

The correct answer is (E). From the z-score equation, we know

z = (X - μ) / σ

where z is the z-score, X is the value of the element, μ is the mean of the population, and σ is the standard deviation.

Solving for Jane's test score (X), we get

X = ( z \* σ) + 100 = ( 1.20 \* 15) + 100 = 18 + 100 = 118