LO.a: Distinguish between descriptive statistics and inferential statistics, between a population and a sample, and among the types of measurement scales.

1. An analyst gathers the market capitalization figures of firms comprising the S&P 500 and then ranks them from highest to lowest market capitalization. She then assigns the number 1 to the group with the lowest market capitalization value, number 2 to the group with the second lowest market capitalization, and so on. The measurement scale used by the analyst is *best* described as:
   A. interval.
   B. nominal.
   C. ordinal.

2. Statistical inference *least likely* involves which of the following steps?
   A. Forecasting.
   B. Estimation and judgment.
   C. Description of a data set.

3. Which type of measurement scale will *most likely* be used to measure the height of the players in a basketball team?
   A. Nominal scale.
   B. Ordinal scale.
   C. Ratio scale.

LO.b: Define a parameter, a sample statistic, and a frequency distribution.

4. A parameter describes the characteristic of a:
   A. population.
   B. sample.
   C. population and a sample.

5. A subset of a population is *best* known as:
   A. parameter.
   B. sample.
   C. sample statistic.

LO.c: Calculate and interpret relative frequencies and cumulative relative frequencies, given a frequency distribution.

6. The actual number of observations in a given interval is known as the:
   A. absolute frequency.
   B. relative frequency.
   C. cumulative absolute frequency.

7. Which of the following statements about frequency distribution is *most* accurate?

A. An observation can fall in more than one interval.
B. The data is sorted in a descending order for the construction of a frequency distribution.
C. The cumulative relative frequency tells the observer the fraction of the observations that are less than the upper limit of each interval.

LO.d: Describe the properties of a data set presented as a histogram or a frequency polygon.

8. Which of the following statements about histograms is *least likely* accurate?
   A. A histogram is the graphical equivalent of a frequency distribution.
   B. A histogram is a form of a bar chart.
   C. In the histogram, the height represents the relative frequency for each interval.

9. Which of the following graphical tools for displaying data require the mid points to be plotted for each interval?
   A. Frequency polygon.
   B. Histogram.
   C. Cumulative frequency curve.

10. The following table shows the average monthly returns of a portfolio over the past one year:

Month	**Return (%)**	**Month**	**Return (%)**
January	10%	July	5%
February	15%	August	6%
March	14%	September	7.5%
April	11%	October	9%
May	8%	November	12%
June	3%	December	11%

The following intervals are used for the construction of the frequency polygon:

Interval
$1 \leq r \leq 3$
$4 \leq r \leq 6$
$7 \leq r \leq 9$
$10 \leq r \leq 12$
$13 \leq r \leq 15$

The cumulative relative frequency for the interval '$10 \leq r \leq 12$' is *equal to*:
A. 16.67%.
B. 33.33%.
C. 83.33%.

LO.e: Calculate and interpret measures of central tendency, including the population mean, sample mean, arithmetic mean, weighted average or mean, geometric mean, harmonic mean, median, and mode.

11. An analyst computes the geometric mean of a portfolio that has yearly returns of: -8%, 2%, -4%, 7%, and 12%. The geometric mean computed by the analyst is *closest* to:
    A. 1.50%.
    B. 1.80%.
    C. 2.10%.

12. Considering the following set of numbers.

40	47	51	69	39	47
48	44	41	53	55	45
37	41	40	42	41	57

    Which of the following statements is *least likely* accurate?
    A. The mode is larger than the mean.
    B. The median is smaller than the mean but larger than the mode.
    C. The mean is larger than both the mode and the median.

13. The following ten observations are a sample drawn from a normal population: 24, 5, 12, 6, -3, 11, 18, 15, -4, and 29. The mean of the sample is *closest* to:
    A. 11.30.
    B. 12.90.
    C. 14.00.

14. Over the past five years, a portfolio gave returns of 18%, 12% -5%, -10% and 7%. The geometric mean return of the portfolio over the five year period is *closest* to:
    A. 3.87%.
    B. 4.40%.
    C. 10.31%.

15. A portfolio has the following annual returns: 5%, 11%, -6%, 0%. The geometric mean across the four-year period is *closest* to:
    A. 2.3%.
    B. 2.5%.
    C. 2.6%.

16. The table below shows some sample figures:

-25	-12	-2	0	1
2	6	7	9	11
13	19	20	21	25

29	39	41	55	65

The median value of the above items is *closest* to:
A. 11.
B. 12.
C. 13.

17. The discount rate set by the central bank of country XYZ for the past 6 quarters is shown below:

Quarter	Discount Rate	Quarter	Discount Rate
1	10.0%	4	8.5%
2	10.5%	5	9.6%
3	11.4%	6	11.5%

The sample mean rate for the 6 quarters is *closest to*:
A. 10.25%.
B. 11.24%.
C. 12.3%.

18. Which of the following statements about arithmetic mean is *most* accurate?
A. Deviations from the arithmetic mean indicate risk.
B. The product of the deviations around the mean is equal to 0.
C. The disadvantage of an arithmetic mean is it fails to make use of all data.

19. The discount rate set by the central bank of Romulus for the past 6 quarters is shown below:

Quarter	Discount Rate	Quarter	Discount Rate
1	10.0%	4	8.5%
2	10.5%	5	9.6%
3	11.4%	6	11.5%

The median is *closest* to:
A. 10.25%.
B. 10.50%.
C. 11.25%.

20. The following table shows the intervals for temperatures recorded at different places all over the country. The respective frequency for each interval represents the number of towns and cities.

Interval	Frequency
$0 \leq r \leq 10$	29
$10 < r \leq 20$	37

$20 < r \leq 30$	31
$30 < r \leq 40$	35
$40 < r \leq 50$	33

The modal interval of this distribution is *most likely*:
A. $0 \leq r \leq 10$.
B. $10 < r \leq 20$.
C. $30 < r \leq 40$.

21. A portfolio manager is computing the weighted mean of a portfolio, whose asset allocation as of 31 December, 2012, is given below:

Local Equities:	25%
International Equities:	13%
Bonds:	27%
Mortgage:	18%
Gold:	17%

The returns on the above assets on 31 December, 2012, were 5.4%, 8.9%, -2.5%, -7%, and 11% respectively. The mean return earned by the portfolio is *closest* to:
A. 2.44%.
B. 3.16%.
C. 4.88%.

22. Judith Owen buys a share for $45 on January 1, 2011. The price of the share is $54 on January 1, 2012 and $63 on January 1, 2013. Assuming no dividends were paid, which of the following *best* represent the geometric mean annual return earned by Owen over the two year period?
A. 18.32%.
B. 18.34%.
C. 30.21%.

23. Sam Pepper is an investor, who buys $2,000 of a stock every quarter. The price of the stock over the last three quarters was $20, $22, and $25 per share. The harmonic mean of the stock's price is *closest* to:
A. $22.33.
B. $22.15.
C. $22.06.

24. If all the observations in a data set have different values, then which of the following relationships is most accurate?
A. Arithmetic Mean < Geometric Mean < Harmonic Mean.
B. Geometric Mean < Harmonic Mean < Arithmetic Mean.
C. Harmonic Mean < Geometric Mean < Arithmetic Mean.

LO.f: Calculate and interpret quartiles, quintiles, deciles, and percentiles.

25. The following table shows the returns of various stocks of a portfolio, ranked in ascending order:

Stock	Return (%)	Stock	Return (%)
Stock 1	10.50	Stock 6	14.24
Stock 2	11.25	Stock 7	14.75
Stock 3	12.05	Stock 8	15.30
Stock 4	12.65	Stock 9	16.00
Stock 5	13.55	Stock 10	17.45

The value of the third quintile is *closest* to:
A. 15.475%.
B. 14.55%.
C. 15.30%.

26. The table below shows data on volatility of a series of funds:

	Volatility (%)
Fund 1	5.05%
Fund 2	6.20%
Fund 3	6.93%
Fund 4	7.56%
Fund 5	8.25%
Fund 6	10.11%
Fund 7	11.36%
Fund 8	14.52%
Fund 9	15.02%
Fund 10	15.66%
Fund 11	15.98%
Fund 12	16.01%
Fund 13	19.25%

The value of the second quintile is *closest* to:
A. 7.56%.
B. 9.37%.
C. 10.11%.

27. Which of the following statements is *least accurate*?
A. The first quintile generally exceeds the first decile.
B. The first quintile generally exceeds the first quartile.
C. The third quintile generally exceeds the median.

28. The following ten observations are a sample drawn from a normal population: 6, 12, 32, -12, 10, 3, -21, 15, 8, and 11. The third quintile (60th percentile) of the sample is *closest* to:
A. 3.0.
B. 10.6.
C. 11.0.

29. Which of the following statements is *least likely* accurate?
A. The median is the 50th percentile.
B. Quintiles divide the distribution into fifths.
C. Linear interpolation is used when the location, L, is a whole number.

30. The following table shows the earnings per share (EPS) of 20 hypothetical companies.

Company	**EPS**	**Company**	**EPS**
AB	$4.50	AAA	$13.22
CDE	$14.50	BBB	$13.25
FG	$9.33	CCC	$12.98
HIJ	$7.21	DDD	$11.54
KLM	$6.44	EEE	$11.73
NO	$6.99	FFF	$15.00
PQR	$6.27	GGG	$10.49
STU	$8.11	HHH	$5.78
VWX	$5.25	III	$6.50
YZ	$12.15	JJJ	$4.75

The 30th percentile is *closest* to:
A. 6.44.
B. 6.29.
C. 6.99.

31. For a data set of 100 observations, which of the following *best* represents a quintile?
A. P_{25}.
B. P_{40}.
C. P_{50}.

32. The second quartile represents which of the following?
I. Median
II. 50th percentile
III. 2nd quintile
IV. 5th decile
A. I and II only.
B. I, II, and IV only.
C. II, III, and IV only.

LO.g: Calculate and interpret 1) a range and a mean absolute deviation and 2) the variance and standard deviation of a population and of a sample.

33. Which of the following is *closest* to the sample variance of the observations given below?

-5	**4**	**7**	**11**	**4**	**-8**	**-1**	**3**	**5**

A. 31.3.
B. 33.7.
C. 35.2.

34. The following observations are drawn from an approximately normal population:

Observation	1	2	3	4	5
Value	13	-5	1	3	-8

The sample standard deviation is *closest* to:
A. 7.22.
B. 7.86.
C. 8.13.

35. UBL Fund's return for the last five years are as follow:

Year	Return (%)
2009	-12
2010	10
2011	15
2012	17
2013	19

The mean absolute deviation of returns for this fund is *closest* to:
A. 8.72%.
B. 9.00%.
C. 9.50%.

36. The annual returns of a stock portfolio since its inception on 1 January 2008 is given below:

Year	**Portfolio return**
2008	7.5%
2009	9.0%

2010	11.5%
2011	-5.3%
2012	9.7%

The portfolio's mean absolute deviation for the five-year period is *closest* to:

A. 3.42%.
B. 4.71%.
C. 6.50%.

37. The returns of a fund are given below:

Year	Return %
2009	5.0
2010	-3.2
2011	6.1
2012	4.5
2013	1.3

The mean absolute deviation of returns for this fund is *closest* to:

A. 3.55.
B. 2.95.
C. 3.95.

38. The table below shows the temperatures recorded at different places:

Place	**Temperature (degree Celsius)**	**Place**	**Temperature (degree Celsius)**
A	48	E	51
B	21	F	35
C	10	G	16
D	-8	H	-15

The range for this data is *closest* to:

A. 26.
B. 36.
C. 66.

39. The weekly rainfall received by some areas in Australia during June 2013 is tabulated below:

Port Hedland	100 mm	Falls Creek	176 mm
Gove	15 mm	Esperance	66 mm
Millbrook	107 mm	Mt Read	74 mm
Tree House Creek	120 mm	Samuel Hill	113 mm
Thredbo	178 mm	Hunters Hill	132 mm

The range for this data set is *closest* to:

A. 108 mm.
B. 163 mm.

C. 178 mm.

40. The number of pages read by a group of students per day is given below:

Patrick	100	Fiona	175
Salis	65	James	50
Melisa	27	Nelson	20
Tina	120	Samuel	75
Thomas	34	Gordon	90

The mean absolute deviation (MAD) is *closest* to:
A. 36.5.
B. 55.6.
C. 75.6.

41. The dividend yield for five hypothetical companies is given below:

Paknama	10.5%
Genie Ltd.	16.25%
Mirinda Corp.	27.0%
Tina Travels Ltd.	12.0%
Thomas Press Ltd.	7.8%

The population variance is *closest* to:
A. 36.89.
B. 45.20.
C. 56.49.

42. The return on equity for four hypothetical companies is given below:

Little Wonder	10.5%
Genesis Ltd.	16.25%
Moral Corp.	9.81%
Travis Ltd.	12.0%

The population standard deviation is *closest* to:
A. 2.50.
B. 2.88.
C. 6.25.

43. The dividend yield for five hypothetical companies from a list of 100 companies is given below:

Paknama	10.5%
Genie Ltd.	16.25%
Mirinda Corp.	27.0%

Tina Travels Ltd.	12.0%
Thomas Press Ltd.	7.8%

The sample variance is *closest* to:
A. 36.89.
B. 45.20.
C. 56.49.

44. The return on equity for four hypothetical companies from a list of 100 companies is given below:

Little Wonder	10.5%
Genesis Ltd.	16.25%
Moral Corp.	9.81%
Travis Ltd.	12.0%

The sample standard deviation is *closest* to:
A. 2.50.
B. 2.88.
C. 6.25.

45. Semivariance is defined as the average squared deviation:
A. below the mean.
B. equivalent to the mean.
C. above the mean.

LO.h: Calculate and interpret the proportion of observations falling within a specified number of standard deviations of the mean using Chebyshev's inequality.

46. According to Chebyshev's inequality, in a population of 1000 what is the *minimum* proportion of observation that must lie within three standard deviations of the mean, regardless of the shape of the distribution?
A. 75%.
B. 89%.
C. 99%.

47. A sample of 320 observations is randomly selected from a population. The mean of the sample is 144 and the standard deviation is 12. Based on Chebyshev's inequality, the endpoints of the interval that must contain at least 75% of the observations are *closest* to:
A. 108 and 180.
B. 120 and 168.
C. 135 and 153.

48. According to Chebyshev's inequality, at least 88.89 percent of the observations for any distribution must lie within:
A. 1 standard deviation of the mean.

B. 2 standard deviations of the mean.
C. 3 standard deviations of the mean.

LO.i: Calculate and interpret the coefficient of variation and the Sharpe ratio.

49. A portfolio of large-cap companies' stocks generated a mean portfolio return of 20% when the risk free rate was 6% in the economy. The variance of portfolio returns was found to be 0.025. The Sharpe ratio of the portfolio is *closest* to:
A. 0.26.
B. 0.89.
C. 0.92.

50. Diana Sorenson, an equity fund manager has the following information about a common stock portfolio:

Arithmetic mean return	12.9%
Geometric mean return	10.3%
Portfolio beta	1.6
Risk-free rate of return	3.50%
Variance of returns	212

From the given information, the coefficient of variation is *closest to*:
A. 1.13.
B. 1.41.
C. 1.55.

51. An analyst gathered following information on a common stock portfolio:

Arithmetic mean return	15.0%
Geometric mean return	13.2%
Portfolio beta	1.22
Risk-free rate of return	5.0%
Variance of returns	520

From the given information, the Sharpe Ratio is *closest to*:
A. 0.36.
B. 0.44.
C. 0.66.

52. The table below shows information about three portfolios:

Portfolio	**Mean return on portfolio (%)**	**Standard deviation of the return on the portfolio (%)**

A	16	32
B	11	15
C	9	8

If the risk-free rate is 3%, which portfolio has the *highest* Sharpe ratio?

A. A.
B. B.
C. C.

53. The table below provides data on annual mean returns and standard deviations for three bonds:

Asset Class	**Arithmetic mean return (%)**	**Standard deviation of return (%)**
Bond A	16.4%	4.9%
Bond B	12.6%	3.5%
Bond C	14.8%	4.2%

Which of the above bonds is *least* risky using a relative measure?

A. Commercial Bond A.
B. Corporate Bond B.
C. Government Bond C.

54. The table below summarizes the performance data for three portfolios:

Portfolio	**Arithmetic mean return (%)**	**Variance of (%)**
Portfolio A	16.4%	4.9%
Portfolio B	12.6%	3.5%
Portfolio C	14.8%	4.2%

Given that the mean return on the risk-free asset is 10.5 percent, which portfolio is *most likely* to have the highest Sharpe ratio?

A. Portfolio A.
B. Portfolio B.
C. Portfolio C.

LO.j: Explain skewness and the meaning of a positively or negatively skewed return distribution.

55. A distribution more peaked than the normal distribution is *best* described as being:

A. platykurtic.
B. mesokurtic.
C. leptokurtic.

56. In a continuous distribution where the graph shows the right tail of the curve to be longer than the left tail is *best* described as having:

A. lepto-kurtosis.
B. negative skewness.
C. positive skewness.

57. Which of the following return distribution is *most likely* characterized by frequent small losses and a few large gains?
A. Normal distribution.
B. Negatively skewed.
C. Positively skewed.

58. Which of the following relationships *best* characterize a negatively skewed distribution?
A. Mean < median < mode.
B. Mode < median < mean.
C. Median < mean < mode.

59. Which of the following statements *best* describe a positively skewed distribution?
A. A distribution skewed to the right.
B. A distribution skewed to the left.
C. A distribution skewed upward.

LO.k: Describe the relative locations of the mean, median, and mode for a unimodal, nonsymmetrical distribution.

60. If a distribution exhibits negative skewness, then the mean *most likely* is located to the:
A. left of both the median and mode.
B. right of both the median and mode.
C. left of the mode and right of the median.

61. Which of the following is *most likely* to be the largest in a positively skewed unimodal distribution?
A. Mean.
B. Median.
C. Mode.

LO.l: Explain measures of sample skewness and kurtosis.

62. Equity return series are *best* described as:
A. mesokurtotic.
B. platykurtotic.
C. leptokurtotic.

63. A distribution that is less peaked than normal is *most* accurately described as:
A. leptokurtotic.

B. mesokurtotic.
C. platykurtotic.

64. Which of the following statistical measures *most likely* measure the peakedness of a distribution such as more or less peaked than a normal distribution?
A. Skewness.
B. Chebyshev's inequality.
C. Kurtosis.

65. A distribution identical to a normal distribution is:
A. Leptokurtic.
B. Mesokurtic.
C. Platykurtic.

LO.m: Compare the use of arithmetic and geometric means when analyzing investment returns.

66. An analyst calculates the geometric and arithmetic means for the same set of data which has variability in the observations. In this case, the geometric mean will *most likely* be:
A. equal to the arithmetic mean.
B. greater than the arithmetic mean.
C. less than the arithmetic mean.

Solutions

1. C is correct. The analyst is using an ordinal scale which involves sorting data into categories based on some characteristic, such as the firms' market capitalization value.

2. C is correct. The steps involved in statistical inference include forecasting, making estimates, or using a smaller group to make judgments about a larger group. Description of important aspects comes under descriptive statistics.

3. C is correct. The height of basketball players in a team is measured on a ratio scale as it is possible to express in terms of a ratio. For example, the height of player A is 1.2 times the height of player B, etc.

4. A is correct. A parameter describes the characteristic of a population while a sample statistic describes the characteristic of a sample.

5. B is correct. A subset of a population is known as a sample.

6. A is correct. The actual number of observations in a given interval is known as the absolute frequency. Relative frequency is the absolute frequency of each interval divided by the total number of observations. Cumulative absolute frequency is the sum of all absolute frequencies.

7. C is correct. The cumulative relative frequency is the fraction of the observations that are less than the upper limit of each interval. A is incorrect as an observation *cannot* fall in more than one interval. B is incorrect as the data is sorted in *ascending* order for the construction of a frequency distribution.

8. C is correct. In the histogram, the height represents the *absolute* frequency for each interval.

9. A is correct. For a frequency polygon, the mid points for each interval are plotted on the x-axis and the absolute frequency for that interval on the y-axis.

10. C is correct.

Interval	Frequency	Relative Frequency	Cumulative Relative Frequency
$1 \leq r \leq 3$	1	8.33%	8.33%
$4 \leq r \leq 6$	2	16.67%	25%
$7 \leq r \leq 9$	3	25%	50%
$10 \leq r \leq 12$	4	33.33%	83.33%
$13 \leq r \leq 15$	2	16.67%	100%

$$\text{Relative Frequency} = \frac{\text{Frequency}}{\text{Total Observations}}.$$

Cumulative relative frequency is the sum of subsequent relative frequencies. Thus the cumulative relative frequency is 83.33% for the interval $10 \leq r \leq 12$.

11. A is correct.

$$Geometric\ Mean = [(1 - 0.08) \times (1 + 0.02) \times (1 - 0.04) \times (1 + 0.07) \times (1 + .12)]^{\frac{1}{5}} - 1$$
$$= 1.5\%$$

12. B is correct. The mode is the most frequent value in the set of items and thus is equal to 41. The mean is the average value from the set of items and is computed as follows:

$$Mean = \frac{Sum\ of\ observations}{Number\ of\ observations} = \frac{837}{18} = 46.5$$

The median is the value of the middle item of a set of items and is computed as the average of the n/2th item and the (n+2)/2th item which is the 9th and 10th item. The median is thus 44.5.
Therefore the median is smaller than the mean but larger than the mode.

13. A is correct. The sum of the ten numbers is 113. Dividing by 10 gives the mean of 11.30.

14. A is correct. Add one to each of the given returns, then multiply them together, then take the fifth root of the resulting product. 1.18 × 1.12 × 0.95 × 0.90 × 1.07 = 1.209066. 1.209066 raised to the 0.20 power is 1.0387. Subtracting one and multiplying by 100 gives the correct geometric mean return of 3.87%.

15. A is correct. The geometric mean return is calculated as $[(1 + 0.05) \times (1 + 0.11) \times (1 - 0.06) \times (1 + 0.00)]^{0.25} - 1 = 0.0231 \sim 2.3\%$.

16. B is correct. Median is the value of the middle item of a set of items. The value of the 10th item is 11; the value of the 11th item is 13. The mean of 11 and 13 is 12.

17. A is correct.

$$\text{Sample Mean} = \frac{\sum_{t=1}^{n} X_i}{N}$$

$$\text{Sample Mean} = \frac{10.0 + 10.5 + 11.4 + 8.5 + 9.6 + 11.5}{6} = 10.25 \text{ percent}$$

18. A is correct. B is incorrect because the sum of the deviations around the mean is equal to 0. C is incorrect because the advantage of an arithmetic mean is that it makes use of all data.

19. A is correct. Arrange the data in ascending order as: 8.5, 9.6, 10.0, 10.5, 11.4, 11.5
Since there are an even number of observations, take the average of the two middle values to calculate median: $\frac{10.0+10.5}{2} = 10.25$
Median = 10.25 percent

20. B is correct. The modal interval is the interval with the highest frequency, which in this case, is $10 < r \leq 20$.

21. A is correct. Mean portfolio return is the weighted average of each asset class' returns.
$\overline{X_w} = (0.25 * 5.4) + (0.13 * 8.9) + (0.27 * -2.5) + (0.18 * -7) + (0.17 * 11) = 2.44$ percent

22. A is correct. First, calculate the holding period returns at the end of year 1 and year 2.
$HPY_1 = \frac{54}{45} - 1 = 20\%$
$HPY_2 = \frac{63}{54} - 1 = 16.67\%$
$\text{Geometric Mean} = [(1 + 0.2)(1 + 0.1667)]^{0.5} - 1 = 18.32$ percent

23. B is correct.
$$\text{Harmonic Mean} = \frac{3}{\left[\left(\frac{1}{20}\right) + \left(\frac{1}{22}\right) + \left(\frac{1}{25}\right)\right]} = \$22.15$$

24. C is correct. Unless all observations in a data set are equal, the harmonic mean is less than the geometric mean which is less than the arithmetic mean.

25. B is correct. The position of the third quintile can be found through the following formula:
$L_y = (n + 1) * \left(\frac{y}{100}\right)$; Where, y is the percentage point at which we are dividing the distribution. Here, y = 60, the 60th percentile (third quintile);
n = 10
$L_{60} = (10 + 1) * \left(\frac{60}{100}\right) = 6.6$
Therefore, the location of the third quintile is between the return of Stock 6 and Stock 7.
Linear interpolation is used for finding the approximate value of the third quintile.
In the above case, return on the 6th stock is 14.24% and on the 7th stock is 14.75%. L60 = 14.55% which is 14.24% (6th value) plus 0.6 times the linear distance between 14.24% and 14.75%.

26. B is correct. Quintiles divide data into five parts. Hence the first quintile corresponds to the 20th percentile and the second quintile corresponds to the 40th percentile. The location can be determined using: $L_y = (n + 1) * \left(\frac{y}{100}\right) \rightarrow L_{40} = (13 + 1) * \left(\frac{40}{100}\right) = 5.6$. The value corresponding to location 5 (Fund 5) is 8.25%. The value corresponding to location 6 (Fund 6) is 10.11%. The approximate value corresponding to location 5.6 can be estimated using linear interpolation: $8.25\% + \left(0.6 * (10.11\% - 8.25\%)\right) = 9.37\%$.

27. B is correct. The first quintile is the 20th percentile and the third quintile is the 60th percentile. The first decile is the 10th percentile, the first quartile is the 25th percentile, and the median is the 50th percentile. While it is possible that these various percentiles or some

subsets of them might be equal (for example the10th percentile possibly could be equal to the 20th percentile), in general the order from smallest to largest would be: first decile, first quintile, first quartile, median.

28. B is correct. First we need to sort the data in ascending order: -21, -12, 3, 6, 8, 10, 11, 12, 15, 32. The third quintile corresponds to the 60th percentile. The location of the 60th percentile is given by: L_{60} = (10 + 1) 60 / 100 = 6.6. The value is estimated using linear interpolation: P_{60} = 10 + 0.6(11 – 10) = 10.6.

29. C is correct. Linear interpolation is used when the location, L, is not a whole number and lies between two closest integers.

30. A is correct.
    The 30th percentile is the value at or below which 30 percent of observations lie.
    To solve this problem, we first arrange the 20 data points in ascending order: 4.50, 4.75, 5.25, 5.78, 6.29, 6.44, 6.50, 6.99, 7.21, 8.11, 9.33, 10.49, 11.54, 11.73, 12.15, 12.98, 13.22, 13.25, 14.50, and 15.00.
    The location of the 30th percentile is 30% of 20 = 6. The 6th data point is 6.44.
    We can also use the location formula: $L_y = (n + 1)\left(\frac{y}{100}\right) = (20 + 1)\left(\frac{30}{100}\right) = 6.30$
    $P_{30} \approx X_6 + (6.3 - 6.0)(X_7 - X_6) = 6.44 + (0.3)(6.50 - 6.44) = 6.46$
    The two numbers (6.44 and 6.46) are different because the percentile calculations using the location formula gives an approximate answer when n is small.

31. B is correct. Since quintiles divide the distribution into fifths, they are represented as $P_{20,}P_{40}, P_{60},$ and P_{80}.

32. B is correct. The second quartile is equivalent to the median, the 50th percentile, and the 5th decile.

33. C is correct.
    Using your calculator:
    - [2ND][DATA]
    - [2ND][CLR WORK]
    - 5[+/-] [ENTER]
    - [↓][↓]4 [ENTER]
    - [↓][↓]7[ENTER]
    - [↓][↓]11[ENTER]
    - <and so on for the rest of the data>
    - [2ND][STAT]
    - Press [2ND][SET] repeatedly until you get **I-V**
    - Press[↓] to begin computing results.
    - You'll Sx (sample standard deviation) = 5.93; simply square this to get the variance = 35.19

34. C is correct.

	Observation	Value	Difference from Mean	Difference^2
	1	13	12.2	148.84
	2	-5	-5.8	33.64
	3	1	0.2	0.04
	4	3	2.2	4.84
	5	-8	-8.8	77.44
Sum		4		264.8
Mean		0.8		

The sample variance is given by

$$s^2 = \sum_i^n (X_i - \bar{X})^2 / n - 1$$

s^2 = 264.8/5-1 = 66.2

The sample standard deviation is simple the square root of the sample variance. The sample standard deviation is 8.13.

OR

Keystrokes	Explanation	Display
[2nd] [DATA]	Enter data entry mode	
[2nd] [CLR WRK]	Clear data registers	X01
13 [ENTER]		X01 = 13
[↓] [↓] 5 +/- [ENTER]		X02 = -5
[↓] [↓] 1 [ENTER]		X03 = 1
[↓] [↓] 3 [ENTER]		X04 = 3
[↓] [↓] 8 +/- [ENTER]		X05 = -8
[2nd] [STAT] [ENTER]	Puts calculator into stats mode.	
[2nd] [SET]	Press repeatedly till you see →	1-V
[↓]	Number of data points	N = 5
[↓]	Mean	X = 0.8

Keystrokes	Explanation	Display
[↓]	Sample standard deviation	Sx = 8.136
[↓]	Population standard deviation	σx = 7.277

35. A is correct. The Mean Absolute Deviation (MAD) is calculated through the following formula:
Mean = (-12+10+15+17+19)/5 = 9.8%
MAD = (|-12 - 9.8| + |10 - 9.8| + |15 – 9.8| + |17 – 9.8| + |19 – 9.8|)/5 = 8.72%.

36. B is correct. Compute the mean: (7.5 + 9.0 + 11.5 – 5.3 + 9.7) / 5 = 6.48% and compute MAD, (|7.5 – 6.48| + |9.0 – 6.48| + |11.5 – 6.48| + | –5.3 – 6.48| + |9.7 – 6.48|) / 5 = 4.71%.

37. B is correct. Mean is 2.74. MAD is the mean of the absolute deviations from 2.74:
(2.26 + 5.94 + 3.36 + 1.76 + 1.44) / 5 = 2.95.

38. C is correct. Range = Maximum value − Minimum value
Range = 51 − (−15) = 66.

39. B is correct. Range = Maximum value − Minimum value
Range = 178 − 15 = 163.

40. A is correct. First, calculate the arithmetic mean return.

$$\text{Mean Absolute Deviation} = [\sum_{i=1}^{n} |X_i - \bar{X}|]/n$$

$$\text{Mean}, \bar{X} = \frac{\text{Sum of observations}}{\text{Number of observations}}$$

$$\text{Mean}, \bar{X} = \frac{100 + 65 + 27 + 120 + 34 + 175 + 50 + 20 + 75 + 90}{10} = 75.6$$

$$\text{Mean Absolute Deviation} = \frac{[|100 - 75.6| + |65 - 75.6| + \cdots + |90 - 75.6|]}{10} = 36.5$$

41. B is correct. Use the following keystrokes to calculate the population variance:
[2nd] [DATA]
[2nd] [CLR WRK]
X01 = 10.5
X02 = 16.25
X03 = 27
X04 = 12
X05 = 7.8
Choose the population standard deviation: σ = 6.723.

Then square it, to get population variance as 45.2.

42. A is correct. Use the following keystrokes to calculate the population standard deviation:
[2nd] [DATA]
[2nd] [CLR WRK]
X01 = 10.5
X02 = 16.25
X03 = 9.81
X04 = 12
Population standard deviation: σ =2.5.

43. C is correct. Use the following keystrokes to calculate the sample variance:
[2nd] [DATA]
[2nd] [CLR WRK]
X01 = 10.5
X02 = 16.25
X03 = 27
X04 = 12
X05 = 7.8
Choose the sample standard deviation: s = 7.515. Square this value to get sample variance as 56.49.

44. B is correct. Use the following keystrokes to calculate the sample standard deviation:
[2nd] [DATA]
[2nd] [CLR WRK]
X01 = 10.5
X02 = 16.25
X03 = 9.81
X04 = 12
s represents the value of sample standard deviation = 2.88.

45. A is correct. Semivariance can be defined as the average squared deviations below the mean.

46. B is correct. Chebyshev's inequality holds for any distribution, regardless of shape, and states that the minimum proportion of observations located within k standard deviations of the mean is equal to $1 - 1/k^2$. In this case, k = 3 and 1 – 1/9 = 0.89 or 89%.

47. B is correct. According to Chebyshev's inequality, the proportion of the observations within k standard deviations of the arithmetic mean is at least $1 - 1/k^2$ for all k>1. For k =2, that proportion is $1 - 1/2^2$, which is 75%. The lower endpoint is, therefore the mean (144) minus 2 times 12 (the standard deviation) and the upper endpoint is 144 plus 2 times 12.
144 – (2 x 12) = 120; 144 + 2(12) = 168.

48. C is correct. The formula for Chebyshev's inequality is:

$1 - \left(\frac{1}{k^2}\right) = \%$ of distribution

$1 - \left(\frac{1}{k^2}\right) = 0.8889$; solving for k, we get $k = 3$

88.89% of any distribution lies within 3 standard deviations.

49. B is correct. Sharpe Ratio = (Portfolio return−Risk free rate) ÷ standard deviation of returns
= (0.2 - 0.06) ÷ sqrt(0.025)
= 0.89

50. A is correct. The coefficient of variation is: (Standard deviation of return) / (Mean return) = $\sqrt{212}$ / 12.9 = 1.13

51. B is correct. The Sharpe Ratio is: (Return on portfolio – Risk free return)/ (Standard deviation of portfolio) = (15.0 – 5.0) / sqrt (520) = 0.44.

52. C is correct. The Sharpe ratio is defined as $S_p = (R_p - R_F)/s_p$
$S_A = (16 – 3)/32 = 0.40625$
$S_B = (11 – 3)/15 = 0.6$
$S_C = (9 – 3)/8 = 0.75$

53. B is correct. In order to find the bond with the lowest risk per unit of return, we need to determine the bond with the lowest coefficient of variation.
$CV = s/\bar{X}$ where s is the sample standard deviation and $\bar{X}$ is the sample mean.
Bond A: $CV = \frac{4.9}{16.4} = 0.299$
Bond B: $CV = \frac{3.5}{12.6} = 0.277$
Bond C: $CV = \frac{4.2}{14.8} = 0.284$
Bond B, whose standard deviation and CV are the lowest, is least risky.

54. A is correct.
$\text{Sharpe ratio} = \frac{R_p - R_f}{s_p}$
Portfolio A: $\frac{16.4 - 10.5}{\sqrt{4.9}} = 2.665$
Portfolio B: $\frac{12.6 - 10.5}{\sqrt{3.5}} = 1.122$
Portfolio C: $\frac{14.8 - 10.5}{\sqrt{4.2}} = 2.098$

Portfolio A has the highest Sharpe ratio.

55. C is correct. Leptokurtic describes a distribution that is more peaked than the normal distribution.

Platykurtic is a distribution less peaked than a normal distribution.
Mesokurtic is a distribution as peaked as the normal distribution.

56. C is correct. A positively skewed distribution appears as if the right tail has been pulled away from the mean.

57. C is correct. A positively skewed distribution has frequent small losses and a few large gains. A negatively skewed distribution has frequent small gains and a few large losses. A normal distribution is symmetrical.

58. A is correct. For a negatively skewed distribution, the mean is less than the median, which is less than the mode.

59. A is correct. A positively skewed distribution is skewed to the right whereas a negatively skewed distribution is skewed to the left.

60. A is correct. A negatively skewed distribution has a long tail to the left with a large frequency of observations occurring in the right part of the distribution. For a distribution of returns, this means frequent small gains and a few extreme losses. The result is that the extreme losses pull the mean to the left while the mode resides on the right with the bulk of the observations. The median falls between the mean and the mode.

61. A is correct. For the positively skewed unimodal distribution, the mode is less than the median, which is less than the mean.

62. C is correct. Equity return series have been found to be leptokurtotic.

63. C is correct. A distribution that is less peaked than normal is called platykurtotic.

64. C is correct. Kurtosis is the statistical measure that tells us about the peakedness of a distribution.

65. B is correct. A distribution identical to a normal distribution is mesokurtic.

66. C is correct. As stated in the reading, "In fact, the geometric mean is always less than or equal to the arithmetic mean. The only time the two means will be equal is when there no variability in the observations."