

CHAPTER 13: Further Topics in Statistics: Sampling and Time Series Analysis

This Assignment is a Multiple Choice Assignment

Marks: 1 mark per question.

1. Answer: 1

The question states that life expectancy is gradually increasing in developed countries. This would be an example of secular variation or a secular trend. The variance in life expectancy would not have predictable, cyclical ups and downs, so you would not call it cyclical variation. It would also not vary significantly with the seasons, so it would not be considered seasonal variation. Finally, it would not be considered irregular, because life expectancy amongst countries is very predictable when considering other factors such as GDP and quality of life.

2. Answer: 3

(A) is false; $\mu_p = \$330,429$. (B) is false; $\mu_s = \$310,333$. (C) is false; $\sigma_p = \$64,908.41$. (D) is true; $\sigma_s = \$72,920.05$; the standard deviation of the sample uses (n-1) as the denominator.

3. Answer: 4

None of the statements are true. Option (1) is false; the graph shows time series data, not cross-sectional data. Option (2) is false; the graph shows cyclical variation, not seasonal variation, because each cycle is longer than a season or part of a year. Option (3) is also false; the secular trend equation uses the cyclical code values ranging from -2 to 2 as the dependent variable.

4. Answer: 3

The cyclical variation index = actual value \div predicted value \times 100. The actual value in 2012 is 45,000 and using the secular trend equation we find the predicted value of 42,476.5. Therefore, the cyclical variation index for 2012 equals $45,000 \div 42,476.5 \times 100 = 105.9$. All the other options are false. Cyclical variation for 2003 = $43,000 \div 44,273 \times 100 = 97.1$; cyclical variation for 2007 = $36,500 \div 37,087 \times 100 = 98.4$.

5. Answer: 3

This problem requires calculation of a 3-year moving total for Year 3. To obtain the 3-year moving total, sum the values for years 2, 3, and 4. The following table summarizes the results for all years. Based on the table, the 3-year moving total for Year 3 is 119.5.

Year	Value	3-Year Total	3-Year Moving Average
1	50.0		
2	30.0	125.0	41.7
3	45.0	119.5	39.8
4	44.5	128.4	42.8
5	38.9	121.5	40.5
6	38.1	110.3	36.8
7	33.3	110.1	36.7
8	38.7	113.7	37.9
9	41.7	135.9	45.3
10	55.5		

6. Answer: 4

This problem requires calculation of a three-year moving average. To construct a three-year moving average, it is necessary to calculate three-year moving totals which are attributed to the middle year of the three years. Once the three-year moving totals are calculated, each must be divided by three to obtain the three-year moving average which is also attributed to the middle year of the three. The table in the previous question summarizes shows the results for moving totals and moving averages for all years. The three-year moving average value for Year 8 is 37.9.

7. Answer: 3

Statement B is true; a 7-year moving average requires three data points before and after each year the moving average can be computed, therefore given 10 years data, the moving average can only be computed for years 4, 5, 6, and 7. Statement A is false; using fewer periods to calculate the moving average results in MORE variation, but it also increases the visibility of the cyclical or seasonal trends. Statement C is false; when more periods are used to calculate the moving average, it becomes more smoothed out and more similar to the secular trend.

8. Answer: 2

$$\begin{aligned}\sum_{i=1}^4 P_n^i Q_n^i &= (16.7)(95) + (129.00)(38) + (6.00)(88) + (1.75)(32) \\ &= 1,586.5 + 4,902 + 528 + 56 \\ &= 7,072.5\end{aligned}$$

$$\begin{aligned}\sum_{i=1}^4 P_o^i Q_o^i &= (15.00)(55) + (71.50)(36) + (8.00)(48) + (0.55)(40) \\ &= 825 + 2,574 + 384 + 22 \\ &= 3,805\end{aligned}$$

$$\begin{aligned}\sum_{i=1}^4 P_o^i Q_n^i &= (15.0)(95) + (71.5)(38) + (8.0)(88) + (0.55)(32) \\ &= 1,425 + 2,717 + 704 + 17.6 \\ &= 4,863.6\end{aligned}$$

$$\begin{aligned}\sum_{i=1}^4 P_n^i Q_o^i &= (16.7)(55) + (129.0)(36) + (6.0)(48) + (1.75)(40) \\ &= 918.5 + 4,644 + 288 + 70 \\ &= 5,920.5\end{aligned}$$

PI with base period weights:

$$\frac{\sum_{i=1}^4 P_n^i Q_o^i}{\sum_{i=1}^4 P_o^i Q_o^i} \times 100 = \frac{5,920.5}{3,805.0} \times 100 = 1.556 \times 100 = 155.6 \text{ (an increase of 55.60\%)}$$

PI with second period weights:

$$\frac{\sum_{i=1}^4 P_n^i Q_n^i}{\sum_{i=1}^4 P_o^i Q_n^i} \times 100 = \frac{7,072.5}{4,863.6} \times 100 = 1.4542 \times 100 = 145.42 \text{ (an increase of 45.4\%)}$$

9. Answer: 1

QI with base period weights:

$$\frac{\sum_{i=1}^4 P_o^i Q_n^i}{\sum_{i=1}^4 P_o^i Q_o^i} \times 100 = \frac{4,863.6}{3,805.0} \times 100 = 1.2782 \times 100 = 127.82 \text{ (an increase of 27.82\%)}$$

QI with second period weight:

$$\frac{\sum_{i=1}^4 P_n^i Q_n^i}{\sum_{i=1}^4 P_n^i Q_o^i} \times 100 = \frac{7,072.5}{3,805.0} \times 100 = 1.1946 \times 100 = 119.46 \text{ (an increase of 19.46\%)}$$

10. Answer: 4

$$VI = \frac{\sum_{i=1}^4 P_n^i Q_n^i}{\sum_{i=1}^4 P_o^i Q_o^i} \times 100 = \frac{7,072.5}{3,805.0} \times 100 = 1.8587 \times 100 = 185.87$$

11. Answer: 3

Options (1) and (2) are false because lumber prices rose by 80% ($129 \div 71.5$). Option (3) is true. Using base period weights facilitates repeated comparisons to a base year. Option (4) is false. Using current year weights does not allow repeated comparisons and quantity information must be recalculated each year.

12. Answer: 3

The single digits in a random number table are generated in a totally random fashion so that the probability that any single digit will appear in any position is 0.1. The probability that the first digit of the first number in the first row and column is a 9 (or any other digit) is 0.1.

13. Answer: 2

$$\sigma_{\bar{x}} = \bar{X} \times \sqrt{n}$$

$$\sigma_{\bar{x}} = 10 \times \sqrt{225} = 10 \times 15 = 150$$

14. Answer: 3

$$n = \frac{44,787^2}{2,000^2} = 501.47$$

15. Answer: 1

Choosing comparable sales requires the appraiser to determine which properties are the most similar to the subject property; therefore, the appraiser would use a judgment sample.

16. Answer: 3

Statement B is true: if systematic sampling is used on a listing that reflects a regular pattern (such as ascending order), then the sample will have order bias. Statement C is true; separating a population into strata, then selecting a proportional sample from each strata helps to ensure the sample is proportionately representative of the population. Statement A is false; random sampling is generally more costly and inconvenient (but more truly random) than other sampling methods. Statement D is false; stratified sampling occurs when the population is divided into heterogeneous groups then a random sample is taken from each strata. Statement D describes cluster sampling.

17. Answer: 3

If the managers buy stocks when the market is in the downturn, it means that they believe that the market will go up in the next period, or vice versa. Thus, they believe that the market is cyclical.

18. Answer: 2

Managers that hold stocks expect the market to exhibit a long-term positive secular trend since they believe that their holdings will increase in value as the time passes.

19. Answer: 2

Option (1) is false. Statistical reliability is independent of the population size if the sample is drawn from the population and constitutes less than 5% of the population. Option (2) is true. Statistical reliability increases in proportion to the square root of the sample size. To reduce the sampling error by one-half (and thus improve the reliability of the sample by two), it is necessary to increase the sample size by a factor of four. Option (3) is false. A positive correlation coefficient means that the prices of houses and widgets move in unison. Thus, if the price of widgets goes up, the price of houses will also go up. Option (4) is false. Multivariate regression analysis involves determining more than one variable that has an effect on the sale price.

20. Answer: 4

The sample size needed is found using the following equation:

$$\sqrt{n} = \frac{\sigma}{\sigma_{\bar{x}}} = \frac{15,000}{1,875} = 8$$

$$n = 64$$

20 Total Marks