NANYANG POLYTECHNIC

School of Information Technology

Module	:	Business Statistics
Topic	:	Estimation & Confidence Interval

Learning Outcomes:

By the end of this lesson, you should be able to

1. Compute and interpret a point estimate of population mean by using the sample mean.
2. Calculate the confidence interval for a population mean using the normal distribution and the t-distribution.
3. State the criteria for the t-distribution to be applied in statistical estimation.
4. Solve real-life business problems by applying statistical estimation and confidence interval.

Topic: Estimation & Confidence Interval

QUESTION 1

1.1 Determine the z_c value for the following:

a) 90 % confidence interval for μ.

b) 95 % confidence interval for μ.

1.2 Determine the t_c value for the following:

a) n=10, 90 % confidence interval for μ.

b) n=22, 95 % confidence interval for μ.

1.3 Given that $\bar{x}$ = 10, calculate the 98 % confidence interval for μ when

a) X is a normal random variable, n=20, σ=3.

b) X is a not normal random variable, n=50, σ=3.

QUESTION 2

A factory manufactures can drinks which is approximately normally distributed with standard deviation of 26 millilitres. A random sample of 25 can drinks was found to have a mean volume of 500 millilitres.

a) Find the standard error of the sample mean.

b) Find a 90% confidence interval for the mean volume of can drink.

QUESTION 3

The management of a hospital wants to know the average number of days required for in-patient treatment of teenage patients. A random sample of 500 teenage patients produced a mean and standard deviation of 5.4 and 3.1 days respectively. Determine a 95% confidence interval for the mean length of stay for the teenage patient population. Assume population is normally distributed.

QUESTION 4

A factory manufactures high-end carbon fibre frames for bicycle. The weight of a frame is approximately normally distributed with standard deviation of 24g. A random sample of 144 frame was selected and was found to have a mean weight of 7000g.
(a) What is the point estimate of the population mean?
(b) What is the standard error of the mean?
(c) What is the margin of error of the mean with 95% level of confidence?
(d) What is the upper limit of 95% confidence interval for the mean weight of the frame?

QUESTION 5

An investment advisor believes that the return on stocks is approximately normally distributed. A sample of 24 interest-sensitive stocks were selected. It was found that their mean yearly return and standard deviation is 10.946% and 3.313%. Find a 90% confidence interval for the mean yearly return on stocks.

QUESTION 6

One of the objectives of a large medical study was to estimate the mean physician fee for cataract removal. For 25 randomly selected cases the mean fee was found to be $1550 with a standard deviation of $125.

a) What assumption do you have to make in order to construct a confidence interval on μ, the mean fee for all physicians?

b) Construct a 99% confidence interval on μ.

QUESTION 7

A cheese processing company wants to estimate the mean cholesterol content of all one-ounce servings of cheese. The estimate must be within 0.5 milligram of the population mean. Assume the population is normally distributed with a standard deviation is 2.8 milligrams, determine the minimum required sample size to construct a 99% confidence interval for the population mean.

SUPPLEMENTARY QUESTIONS

QUESTION 8

An apartment-finder service would like to estimate the average cost of a one-bedroom apartment. A random sample of 41 apartment complexes yielded a mean of $310 with a standard deviation of $29. Construct a 90% confidence interval for the mean cost of one-bedroom apartments.

QUESTION 9

A soccer ball manufacturer wants to estimate the mean circumference of soccer balls within 0.1 inch. Assume the population standard deviation is 0.25 inch.

a) Determine the minimum sample size required to construct a 99% confidence interval for the population mean.

b) If the standard deviation is increased, would you require a larger sample size? Explain.

QUESTION 10

A random sample of 15 mobile plan subscribers are selected. The mean monthly price and standard deviation of the sample are $19.73 and $5.13 respectively. Find the 90% confidence interval for the population mean.

Answers:

Q1.1 (a) 1.645 (b) 1.96

Q1.2 (a) 1.833 (b) 2.080

Q1.3 (a) (8.44, 11.56) (b) (9.01, 10.99)

Q2 (a) 5.2 (b) (491.45, 508.55)

Q3 (5.128, 5.672)

Q4 (a) 7000 (b) 2 (c) 3.92 (d) 7003.92)

Q5 (9.787, 12.105)

Q6 (b) (1,480.08, 1,619.93) 208

Q7 (302.550, 317.450)

Q8

Q9. (a) 42

Q10. (17.397, 22.063)