Example: Assume that weights of luggage for passengers on international flights are normally distributed with $\mu = 25kg$ and $\sigma = 8.5kg$. Calculate the following probabilities:

a) The luggage of a randomly selected passenger exceeds 30kg.

The average luggage weight for 20 randomly selected passengers exceeds 30kg.

Example: A tire manufacturer claims that the tires have a mean life of 60 000 km. A consumer agency randomly selects 100 of those tires and finds a sample mean of 56 000km. Assume $\sigma = 8000km$, should the agency doubt the manufacturer's claim?

Point Estimator of μ (when σ is known)

What if we want to know the population average μ based on a sample average $\overline{x}$. How accurate is such an estimate?

Example: What is the probability that a sample mean $\overline{x}$ of a random sample of 30 tires will be within 3000km of the unknown population mean μ if $\sigma = 7500km$?

This is called a **point estimate**.

Example: Calculate the margin of error in using $\overline{x}$ from a random sample of size n=30 to estimate μ if $\sigma = 7500$ and we want 95% confidence in our estimate.

Summary

(margin of error) $$E = z(\alpha/2) \cdot \frac{\sigma}{\sqrt{n}}$$

where $$\alpha/2 = \frac{1 - \text{confidence}}{2}$$

Example: Construct a 90% confidence interval estimate for the mean repair cost of a DVD player if the average repair cost from a sample of 35 DVD players was $64.50. (Assume $\sigma = 14.40$)

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Note: Here 90% confidence means that if this confidence interval construction was repeated many times 90% of those intervals would contain the actually mean μ.

This last example is a **confidence interval estimate** (rather than the previous point estimates).

Increasing the sample size

Suppose we wanted to specify both the level of confidence and the margin of error. What would the sample size need to be to guarantee this?

Recall $$E = z(\alpha/2) \cdot \frac{\sigma}{\sqrt{n}}$$

Implying

Note: We will always round up to the nearest integer to ensure the level of confidence and the margin of error.

Example: What is the smallest sample size that can estimate the average commuting time for Montrealers within 2 minutes with 98% confidence if $\sigma = 16.4$?