Heimadæmi 10. T-302-TOLF, Vladimir Omelianov. H1

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Dæmi 3:

a) Dæmi 6 í Exercises for Section 5.1 í bókinni.

b) Dæmi 13 í Exercises for Section 5.1 í bókinni.

6. The article "Application of Surgical Navigation to Total Hip Arthroplasty" (T. Ecker and S. Murphy, *Journal of Engineering in Medicine*, 2007:699±712) reports that in a sample of 123 hip surgeries of a certain type, the average surgery time was 136.9 minutes with a standard deviation of 22.6 minutes.

a. Find a 95% confidence interval for the mean surgery time for this procedure.

b. Find a 99.5% confidence interval for the mean surgery time for this procedure.

c. A surgeon claims that the mean surgery time is between 133.9 and 139.9 minutes. With what level of confidence can this statement be made?

d. Approximately how many surgeries must be sampled so that a 95% confidence interval will specify the mean to within ±3 minutes?

e. Approximately how many surgeries must be sampled so that a 99% confidence interval will specify the mean to within ±3 minutes?

$\overline{x} = 136,9 \quad S = 22,6$

a) $1 - \alpha = 0,95 \Rightarrow \alpha = 0,05$

$Z_{\alpha/2} = Z_{0,025} = 1,96$

$\sigma_x = \frac{\sigma}{\sqrt{n}} \approx \frac{22,6}{\sqrt{123}} = 2,04$

confidence interval @ 95% : $136,9 \pm \underbrace{1,96 \cdot 2,04}_{4.0}$

b) $1 - \alpha = 0,995 \Rightarrow \alpha = 0,005$

$Z_{\alpha/2} = Z_{0,0025} = -\text{invNorm}(0.0025, 0,1) = 2,81$

$\sigma_x = \frac{\sigma}{\sqrt{n}} \approx \frac{22,6}{\sqrt{123}} = 2,04$

confidence interval @ 99,5 : $136,9 \pm \underbrace{2,81 \cdot 2,04}_{5,7}$

c) Efri mörkin:

$$139,9 = 136,9 + Z_{\alpha/2}\left(\frac{22,6}{\sqrt{123}}\right) \rightarrow Z_{\alpha/2} = 1,47$$

$$\text{normCdf}\,(1,47,\ 1,47,\ 0,1) = 0,86$$

d) $1 - \alpha = 0,95 \Rightarrow \alpha = 0,05$

$$Z_{\alpha/2} = Z_{0,025} = -\text{invNorm}\,(0.025,\ 0,1) = 1,96$$

$$22,6 \cdot 1,96/\sqrt{n} = 3 \Rightarrow n = 219$$

e) $1 - \alpha = 0,99 \Rightarrow \alpha = 0,01$

$$Z_{\alpha/2} = Z_{0,005} = -\text{invNorm}\,(0.005,\ 0,1) = 2,58$$

$$22,6 \cdot 2,58/\sqrt{n} = 3 \Rightarrow n = 378$$

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13. Refer to Exercise 6.

   a. Find a 98% lower con@dence bound for the mean time.

   b. Someone says that the mean time is greater than 134.3 minutes. With what level of con@dence can this statement be made?

a) $\bar{X} - Z_{\alpha}\,\sigma_{\bar{x}}$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = 2,04 \ ; \quad 1 - \alpha = 0,98 \Rightarrow \alpha = 0,02$$

$$Z_{\alpha} = -\text{invNorm}\,(0.02,\ 0,1) = 2,05$$

98% lower confidence band for the mean time

er $136,9 - 2,05 \cdot 2,04 = 132,7$

b) $134,3 \leftarrow$ lower confidence band for the mean time

$$\Rightarrow 134,3 = 136,9 - Z_{\alpha} \cdot 2,04$$

$$Z_{\alpha} = 1,27 \Rightarrow$$

$$\text{normCdf}\,(-1,27,\ \infty,\ 0,1) = 0,898$$