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Statistics for laboratory scientists

Solutions for the homework problems for lecture 14

1. The pooled estimate of the population SD is $\sqrt{\{ [10.67^2 \times 9 + 9.30^2 \times 4] / 13 \}} = \mathbf{10.27}$.

The estimated SE of the difference between the sample means is $10.27 \times \sqrt{\{ 1/10 + 1/5 \}} = \mathbf{5.62}$

The 97.5 percentile of the t distribution with 13 degrees of freedom is **2.16**. (In R, use `qt(0.975,13)`.)

Thus the 95% confidence interval is $(103-67) \pm 2.16 \times 5.62 = \mathbf{36 \pm 12 = (24, 48)}$.

In R, if `x` is the data for the sample from strain A and `y` is the data for the sample from strain B, type `t.test(x,y,var.equal=TRUE)` to get the above confidence interval.

2.
 - a. The 97.5 percentile of the t distribution with 5 degrees of freedom = `qt(0.975, 5)` = 2.57.

Thus the 95% confidence interval for the population mean is $100.8 \pm 2.57 \times 8.28 / \sqrt{\{6\}} = \mathbf{100.8 \pm 8.7 = (92.1, 109.5)}$.
 - b. The 95% confidence interval for the population SD is $(8.28 \times \sqrt{\{5/12.8\}}, 8.28 \times \sqrt{\{5/0.831\}}) = \mathbf{(5.2, 20.3)}$.
3. The difference between the sample means is $96.58-92.33=4.25$. Our estimate of the standard error of the difference between the sample means is $\sqrt{\{29.09^2/12 + 12.17^2/9\}} = 9.33$.

The "degrees of freedom" parameter we use for the t-distribution is $[29.09^2/12 + 12.17^2/9]^2 / \{ [29.09^2/12]^2/11 + [12.17^2/9]^2/8 \} = 15.56$.

The 97.5 percentile of the t distribution with 15.56 degrees of

freedom = `qt(0.975, 15.56)` = 2.12.

Finally, the 95% confidence interval for the difference between the population means is $4.25 \pm 2.12 \times 9.33 = \mathbf{4.3 \pm 19.8} = \mathbf{(-15.6, 24.1)}$.

[[3rd term syllabus](#) | [4rd term syllabus](#) | [R for Windows](#)]

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