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 × 9 + 9.30^2 × 4] / 13 } = **10.27**.

   The estimated SE of the difference between the sample means is 10.27 × sqrt{ 1/10 + 1/5 } = **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) ± 2.16 × 5.62 = **36 ± 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 ± 2.57 × 8.28 / sqrt{6} = **100.8 ± 8.7** = **(92.1, 109.5)**.

   b. The 95% confidence interval for the population SD is (8.28 × sqrt{5/12.8}, 8.28 × sqrt{5/0.831}) = **(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 ± 2.12 × 9.33 = **4.3 ± 19.8** = **(-15.6, 24.1)**.

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Last modified: Wed Feb 22 09:43:23 EST 2006