



AP[®] Statistics 2001 Sample Student Responses

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5. A growing number of employers are trying to hold down the costs that they pay for medical insurance for their employees. As part of this effort, many medical insurance companies are now requiring clients to use generic brand medicines when filling prescriptions. An independent consumer advocacy group wanted to determine if there was a difference, in milligrams, in the amount of active ingredient between a certain "name" brand drug and its generic counterpart. Pharmacies may store drugs under different conditions. Therefore, the consumer group randomly selected ten different pharmacies in a large city and filled two prescriptions at each of these pharmacies, one for the "name" brand and the other for the generic brand of the drug. The consumer group's laboratory then tested a randomly selected pill from each prescription to determine the amount of active ingredient in the pill. The results are given in the following table.

ACTIVE INGREDIENT
(in milligrams)

Pharmacy	1	2	3	4	5	6	7	8	9	10
Name brand	245	244	240	250	243	246	246	246	247	250
Generic brand	246	240	235	237	243	239	241	238	238	234

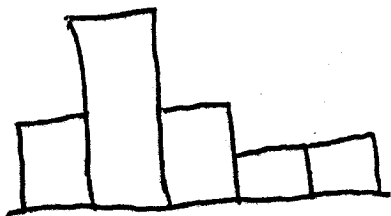
Name brand - Generic Brand
-1 4 5 13 0 7 5 8 9 16

Based on these results, what should the consumer group's laboratory report about the difference in the active ingredient in the two brands of pills? Give appropriate statistical evidence to support your response.

Matched Pair T-test

Assumptions

- ✓ This was a SRS.
- ✓ I don't know if the population is normal, but since n is medium (10) and I don't see any outliers and the data is relatively normal, I will continue with the test.



$$H_0: \mu_{\text{Name-Generic}} = 0$$

$$H_a: \mu_{\text{Name-Generic}} \neq 0$$

$$\bar{x} = 6.6$$

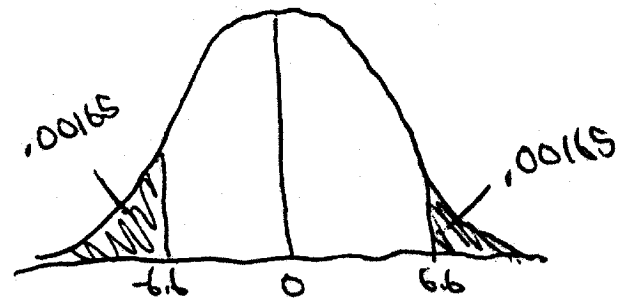
$$s_x = 5.275$$

$$n = 10$$

$$\sigma = 1.668$$

$$SE = \frac{5.275}{\sqrt{10}} =$$

$$SE = 1.668$$



$$\frac{6.6}{1.668} = 3.957 = T\text{-score}$$

$$p\text{-value} = .0033$$

$$\alpha = .05$$

If I assume that the mean of differences between the Name brand and generic drug is 0, there is a .33% chance of seeing my results. This is low, so I have reason to doubt that the mean of differences between the Name Brand and generic drugs is 0. This means that it does not appear that the two types of drugs contain the same amount of active ingredient. I would suggest the consumer group's laboratory to report that there is in fact a difference in the active ingredient amounts.

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Based on these results, what should the consumer group's laboratory report about the difference in the active ingredient in the two brands of pills? Give appropriate statistical evidence to support your response.

Assumptions: Sample size is small but - Simple Random Sample
graph of differences shows no major skewness nor outliers



$$H_0: \mu_d = 0 \quad \mu_d = \mu_{\text{name brand}} - \mu_{\text{generic brand}}$$

$$H_a: \mu_d > 0$$

matched - Pairs t test

$$t = 3.956$$

$$p\text{-value} = .0017$$

Since the p -value is less than .01, there is significant evidence to say there is a difference in the active ingredient in the two brands of pills.

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Name brand	245	244	240	250	243	246	246	246	247	250
Generic brand	246	240	235	237	243	239	241	238	238	234
difference	-1	4	5	13	0	7	5	8	9	16

Based on these results, what should the consumer group's laboratory report about the difference in the active ingredient in the two brands of pills? Give appropriate statistical evidence to support your response.

matched pairs t-test (because its the name brand drug and its counterpart - generic brand, therefore, is not independent of name brand)

conditions

SRS ✓

both data sets show no skewness or outliers

σ is not known

8	8	9	7	5	4	23	
						23	
						24	403
						24	56667
						25	00

$$24|4 = 244 \text{ milligrams}$$

H_0 : there is no difference between the amount of active ingredient in name brand pills and generic pills

$$\mu_{\text{differences}} = 0$$

H_a : $\mu_{\text{differences}} \neq 0$

If you need more room for your response to question 5, use the space below.

$$\bar{x} \text{ of differences} = 6.6$$

$$n = 10$$

$$s = 5.275$$

$$\frac{6.6 - 0}{\frac{5.275}{\sqrt{10}}} = 3.956$$

$$2p(\bar{x} > 0) = 2p(z > 3.956) = .0033$$

$$p\text{-value} = .0033$$

$$.0033 < .01$$

Because the p-value of .0033 is much smaller than .01, the consumer group's laboratory report should reject the null that says there is no difference between the amount of active ingredient in name brand pills and generic pills.

The report should consider that there is a difference between the two types of pills.