

Name: _____

(From Willerman & Churchill “Intelligence and Birth Weight in Identical Twins,” *Child Dev.* 38 (1967), 623-629, quoted in Nemeny et al., *Statistics from Scratch*, Holden-Day 1977, p. 218.) In a study of the effect of maternal malnutrition on intelligence, the following data were obtained, representing IQ some years after birth.

Pair	IQ of Heavier Twin	IQ of Lighter Twin	Heavy minus Light
1	97	97	0
2	79	70	9
3	100	101	-1
4	100	106	-6
5	100	85	15
6	124	123	1
7	95	84	11
8	80	70	10
9	91	84	7
10	108	106	2
11	91	97	-6
12	90	90	0
13	104	92	12
14	119	104	15

	heavier	lighter	heavy minus light
mean	98.43	93.5	4.93
stdev	12.77	14.53	7.25

Perform the appropriate t-test to determine whether malnutrition is related to IQ.

Solution:

Let μ_d be the true difference in mean IQ (in the population) for heavier minus lighter twin.

$$H_0 : \mu_d \leq 0$$

$$H_1 : \mu_d > 0$$

Our test statistic & p-value are:

$$t = \frac{\bar{X}_d - \mu_{d0}}{s_d/\sqrt{n}} = \frac{4.93 - 0}{7.25/\sqrt{14}} = 2.54$$

$$p - \text{value} = P(t_{13} \geq 2.54) = 1 - pt(2.54, 13) = 0.0123$$

Our p-value is small, so we have enough evidence to reject the null hypothesis. It appears as though prenatal malnutrition has a deleterious association with IQ.