

- III. ABC Company is questioning whether the quality of material coming from the company's three suppliers has something to do with the number of defective products. The number of defects from 20 production runs for each supplier were counted. Using a .05 level of significance, determine whether the number of defects and the company supplying materials are related (dependent).

Analysis of Material Suppliers and Defects								
	Company #1		Company #2		Company #3		Totals	
	f_o	f_e	f_o	f_e	f_o	f_e	f_o	f_e
High defects	6	10	9	10	15	10	30	30
Low defects	14	10	11	10	5	10	30	30
Totals	20	20	20	20	20	20	60	60

H_0 : defects and supplier are independent
 H_1 : defects and supplier are dependent

$$f_e = \frac{f_r \times f_c}{n}$$

$$f_e = \frac{30 \times 20}{60}$$

$$f_e = \frac{1}{2}(20) = 10$$

$$df = (r - 1)(c - 1) = (2 - 1)(3 - 1) = 2 \rightarrow \chi^2 = 5.99$$

$$\chi^2 = \sum \left[\frac{(f_o - f_e)^2}{f_e} \right]$$

$$= \sum \left[\frac{(14 - 10)^2}{10} + \frac{(6 - 10)^2}{10} + \frac{(11 - 10)^2}{10} + \frac{(9 - 10)^2}{10} + \frac{(5 - 10)^2}{10} + \frac{(15 - 10)^2}{10} \right]$$

$$= \sum (1.6 + 1.6 + .1 + .1 + 2.5 + 2.5) = 8.4$$

Reject H_0 because $8.4 > 5.99$.

Material supplier and defects are dependent.

- IV. Four people were given extensive sales training. Test whether their sales performance improved using a .05 level of significance. Assume normally distributed populations with known standard deviations.

Analysis of Sales Training Effectiveness				
Salesperson	Sales Performance		d	d^2
	Before	After		
A	12	15	-3	9
B	13	17	-4	16
C	10	14	-4	16
D	11	12	-1	1
Total			-12	42

These are the null hypothesis and research hypothesis.

$$H_0: \mu_d \geq 0 \text{ and } H_1: \mu_d < 0$$

Note: An increase in performance results in a negative difference.

$$df = n - 1 = 4 - 1 = 3 \rightarrow t = -2.353$$

$$\bar{d} = \frac{\sum d}{n}$$

$$= \frac{-12}{4}$$

$$= -3$$

$$s_d = \sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{n}}{n-1}}$$

$$= \sqrt{\frac{\sum 42 - \frac{(-12)^2}{4}}{4-1}}$$

$$= \sqrt{\frac{42 - 36}{3}}$$

$$= 1.414$$

$$t = \frac{\bar{d}}{\frac{s_d}{\sqrt{n}}}$$

$$= \frac{-3}{\frac{1.414}{\sqrt{4}}}$$

$$= -4.24$$

Reject H_0 because -4.24 is beyond -2.353 .

Training improved performance.