

HOMEWORK *t*-test for *r*

In StatTool open: HW_*t-r*.dat

A shop owner recorded the number of times that consumers bought or asked for a given item. She called this amount the "demand." Each month she had 15 of the items to sell. In addition, the owner recorded the price of the item each month.

Month	Demand	Price	Month	Demand	Price
Jan.	25	\$0.50	July	13	\$0.80
Feb.	10	.90	Aug.	19	.70
Mar.	12	.90	Sept.	18	.72
Apr.	18	.75	Oct.	16	.74
May	11	.85	Nov.	15	.75
June	20	.70	Dec.	15	.75

1. Draw a scatterplot and from it describe the relationship between price and demand.
2. The shop owner had learned in school that high demand is associated with high prices. She wants to use this data to check out that hypothesis. Does the data pattern support her school hypothesis? Do you need to check statistical conclusion validity to support your answer? Why or why not?
3. Suppose that someone else hypothesized that high demand should be associated with low prices. (a) state the Scientific Hypothesis and Skeptical-scientific hypothesis. Also state the PCH of chance. (b) Is the sci hyp directional or non-directional? Why? © Translate the sci hyp and the PCH of chance into statistical hypotheses--that is, state H_0 and H_1 . (d) Name the test statistic you will use to decide between the statistical hypotheses. (e) What is the alpha level (level of significance, p -value) that you will use? (f) In your own words what does this p -value mean? (g) Calculate your df. (h) Is H_1 one- or two-tailed? Why? (i) Look up the critical value (or values) in the table in your book. (j) Draw a line representing the range of your test statistic. What is the center value predicted by H_0 ? Draw it on the line. Also draw in the critical value (or values) on the line. Label the "Reject H_0 " region (or regions). Label the "Do not reject H_0 " region. (k) Why does H_0 predict a value of zero for your test statistic?

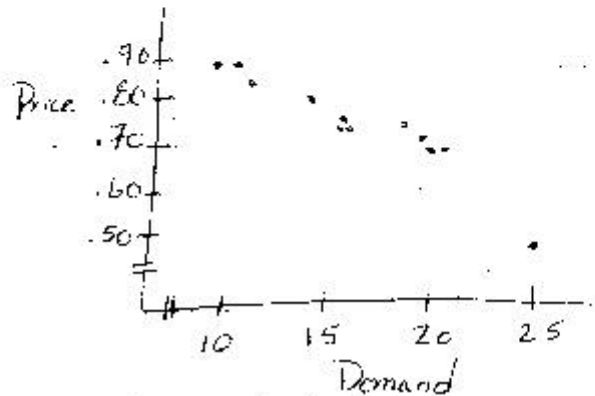
NOW FOR THE DATA:

(L) Does the pattern of data favor the scientific or Skeptical-scientific hypothesis? (m) Now calculate the value of your test statistic from the data. Take this calculated value of your test statistic and put on the number line you made in (j). Does it fall in a rejection region? (n) Do you reject H_0 or not? (o) Verbally summarize the issue of statistical conclusion validity (PCH of chance) in this case. That is, do you think this study has statistical conclusion validity or not?

t for r

(y) (x)

Price	Demand
.50	25
.90	10
.90	12
.75	18
.85	11
.70	20
.80	13
.70	19
.72	18
.74	16
.75	15
.75	15



As price increases, demand decreases or
As demand increases, price decreases

2. No, data pattern does not support school hypothesis.
No because the pattern is not consistent with
the hypothesis.

3a. Sci: There is a negative relationship between price & demand
Skep: There is no relationship between price & demand

PCH of chance. Results that support the scientific
hypothesis were obtained due to chance alone

b. Directional, expect a negative relationship

c. $H_0: E(r) = 0$ $H_1: E(r) < 0$

d. t-test for r

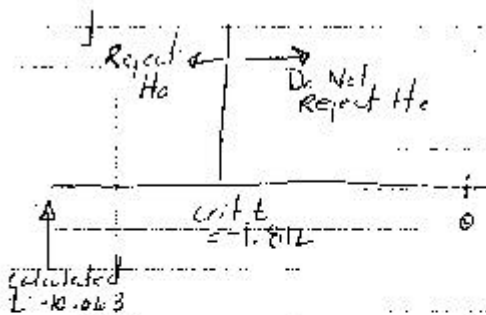
e. $\alpha = .05$

f. Chance of rejecting H_0 when it is true

g. $df = N - 2 = 12 - 2 = 10$

h. One tailed H_1 is directional

i. critical $t(10)_{.05} = -1.812$



k. Not expecting correlation to be significantly different from 0

l. Favors the scientific hypothesis

M

X	X ²	Y	Y ²	XY
25	625	.50	.25	12.50
10	100	.90	.81	9
12	144	.90	.81	10.8
18	324	.75	.5625	13.5
11	121	.85	.7225	9.35
20	400	.70	.49	14
13	169	.80	.64	10.4
19	361	.70	.49	13.3
18	324	.72	.5184	12.96
16	256	.74	.5476	11.84
15	225	.75	.5625	11.25
15	225	.75	.5625	11.25
192	3274	9.06	6.966	140.15

$$r_{xy} = \frac{n \sum X_i Y_i - (\sum X_i)(\sum Y_i)}{\sqrt{(n \sum X^2 - (\sum X)^2)(n \sum Y^2 - (\sum Y)^2)}}$$

$$= \frac{(12)(140.15) - (192)(9.06)}{\sqrt{(12)(3274) - (192)^2} \sqrt{(12)(6.966) - (9.06)^2}}$$

$$= \frac{1681.80 - 1739.52}{\sqrt{(39,288 - 36,864)(83.592 - 82.0836)}}$$

$$= \frac{-57.72}{\sqrt{(2424)(1.5084)}}$$

$$= \frac{-57.72}{60.4679}$$

$$= -.954$$

$$\begin{aligned}t &= \frac{r \sqrt{N-2}}{\sqrt{1-r^2}} \\&= \frac{-0.954 \sqrt{12-2}}{\sqrt{1-(-0.954)^2}} \\&= \frac{-3.017}{\sqrt{0.08988}} \\&= \frac{-3.017}{0.2998} \\&= -10.0634\end{aligned}$$

Reject H_0

0. It is highly unlikely that there is not a negative relationship between price & demand. (calculated t is much more extreme than critical t.)

