Practice Set 21   Nonparametric Hypothesis Testing of Ordinal Data Part I

I.   Darin wants to determine whether the page 68 computer components were drawn at random.
The median of 30.045 mg is the standard for this test. Determine at the .05 level of significance
whether this data was randomly collected. Data was recorded one column at a time starting at
the top of each column. Columns were recorded from left to right.

29.89	30.05	29.98	30.07	29.97	30.05	29.95	30.06	29.99	30.02	30.09	30.12
29.96	29.97	30.06	30.05	29.95	29.95	29.99	29.89	29.99	30.08	30.06	30.16
29.97	29.98	30.04	30.06	30.05	30.09	30.06	30.09	29.98	30.01	30.08	30.15

$n_1 = 18$ below

$n_2 = 18$ above

$r = 18$ runs

-	+	-	+	-	+	-	+	-	-	+	+
-	-	+	+	-	-	-	-	-	+	+	+
-	-	-	+	+	+	+	+	-	-	+	+

$$\sigma_r = \sqrt{\frac{2n_1 n_2(2n_1 n_2 - n_1 - n_2)}{(n_1+n_2)^2(n_1+n_2-1)}}$$

$$= \sqrt{\frac{2(18)(18)[(2(18)(18)-18-18)]}{(18+18)^2(18+18-1)}}$$

$$= \sqrt{\frac{648[648-36]}{(36)^2(35)}}$$

$$= \sqrt{\frac{396,576}{45,360}} = \sqrt{8.743} = 2.957$$

$$\mu_r = \frac{2n_1 n_2}{n_1+n_2} + 1$$

$$= \frac{2(18)(18)}{18+18} + 1$$

$$= \frac{648}{36} + 1$$

$$= 19$$

$$Z = \frac{r-\mu_r}{\sigma_r}$$

$$= \frac{18-19}{2.957}$$

$$= -.34$$

At .05 level of significance, z is ± 1.96.

Accept H_0 because -.34 is not beyond - 1.96.

Parts were drawn at random.

II.   Darin first studied the number of defective 30-milligram parts
on page 96. At that time he did a parametric study because
he felt the data was normally distributed. The consistency
of raw material inputs has changed and Darin isn't sure the
distribution is still normal. Do a .05 level of significance sign
test to determine whether defects have increased from last
year's median of 5.

Sample	Median	Sign
1	6	+
2	7	+
3	5	0
4	4	-
5	8	+
6	6	+
7	7	+

A.   Five of the median defects were above 5. Let n equal 6 because of a tie.

B. $\mu = .50$

C.   The Binomial table (ST 1) yields the following: $P(n \geq 5) = .094 + .016 = .11$

D.   Accepted H_0 because .11 is greater than .05.
Median defects have not increased.

Note: Our small sample size continues to cause problems. All six samples
must be above the median for the null hypothesis to be rejected at the .05
level of significance. A larger sample may be needed.