Practice Set 22 Nonparametric Hypothesis Testing of Ordinal Data Part II

I. Darin conducted a training program for 5 recently-hired employees. This problem first appeared on page 100. At that time it was assumed that the population was approximately normal. If this assumption is not correct or unknown, a .01 level of significance paired difference sign test may be conducted to determine whether training increased worker efficiency.

Employee	Efficiency Rating		Sign
	Before	After	
1	8	9	+
2	6	8	+
3	7	8	+
4	7	9	+
5	8	10	+

A. All 5 employee ratings increased. n is 5.

B. The Binomial table (ST 1) yields the following: $p(x \geq 5) = .031$

C. Accept H_0 because .031 > .01. Efficiency did not increase.

D. **Note:** With a sample of only five and alpha of .01, the null hypothesis will not be rejected when $\mu = .50$.

II. Darin wants to reexamine the ANOVA study conducted on page 110. That study assumed populations were normally distributed with equal variances. Those assumptions are not appropriate. Conduct a .01 level of significance Kruskal-Wallis test to determine whether the median weight of parts produced by these 3 departments are equal. Page 110 data has been increased to conform with the $n \geq 5$ test requirement.

Weight Analysis of 9-mg Parts Produced by 3 Departments					
Department 1		Department 2		Department 3	
Weight	Rank (R_1)	Weight	Rank (R_2)	Weight	Rank (R_3)
8.95	5	9.05	7	9.05	7
8.90	2.5	9.05	7	9.15	15
8.90	2.5	9.10	10.5	9.10	10.5
8.92	4	9.07	9	9.13	13
8.88	1	9.11	12	9.14	14
	R_1= 15.0		R_2= 45.5		R_3= 59.5

H is the designated statistic.
N, the number of observations, is 15.
k, the number of samples, is 3.
n_k, a sample size, is 5.
R_k is a sample rank total.
df = k - 1 = 3 - 1 = 2 → $\chi^2 = 9.21$

$$H = \frac{12}{N(N+1)}\left[\frac{(\sum R_1)^2}{n_1} + \frac{(\sum R_2)^2}{n_2} + \ldots + \frac{(\sum R_k)^2}{n_k}\right] - 3(N+1)$$

$$= \frac{12}{15(15+1)}\left[\frac{(15)^2}{5} + \frac{(45.5)^2}{5} + \frac{(59.5)^2}{5}\right] - 3(15+1)$$

$$= .05[45.00 + 414.05 + 708.05] - 48.00 = 10.355$$

Reject H_0 because H of 10.355 is greater than 9.21. Medians are not equal.