MATH 8452
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HW#5

#4. Customer churn is a major problem and one of the biggest concerns for telecommunication industry. Due to the cost of retaining an existing customer is much lower than acquiring a new one, the company is seeking to develop a churn prediction model to assist telecom operators in predicting which customers are most likely to lose. Therefore, identifying the factors that increase customer churn is important to build this model. The purpose of this project is to explore these data more deeply, utilizing nonparametric statistical methods to do so. Through the course of this analysis, new insights will be offered as to the types of indicators that influence churn and charge, as well as attempting to compare both nonparametric and parametric methods. The raw data for this project contains 7043 observations and 21 features. The method I am planning to use include but not limit to Sign Test, Wilcoxon Rank Sum Test, Permutation Test, Jonckheere Terpstra Test and Hoeffding's Test.

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HW # 5

1)

The # of possibilities is $\frac{4!}{2!} = 12$

$\hat{\rho} = 2(\frac{5}{6}) + 1 = \frac{5}{6}$ $\hat{\rho} = \frac{1}{6}$ $\hat{\rho} = \frac{1}{2}$ $\hat{\rho} = \frac{1}{6}$ $\hat{\rho} = \frac{1}{6}$ $\hat{\rho} = -\frac{1}{6}$

X	Y
0	0
1	2
3	2
5	5

$3+1.5+1 = 5.5$ $r_s = 3/\sqrt{10}$

X	Y
0	0
1	5
3	2
5	2

$3+0.5 = 3.5$ $r_s = 1/\sqrt{10}$

X	Y
0	2
1	0
3	2
5	5

$1.5+2+1 = 4.5$ $r_s = 3/\sqrt{10}$

X	Y
0	2
1	0
3	5
5	2

$1.5+2 = 3.5$ $r_s = 1/\sqrt{10}$

X	Y
0	2
1	2
3	0
5	5

$1.5+1+1 = 3.5$ $r_s = 1/\sqrt{10}$

X	Y
0	2
1	2
3	5
5	0

$1.5+1 = 2.5$ $r_s = -1/\sqrt{10}$

X	Y
0	2
1	5
3	0
5	2

$1.5+1 = 2.5$ $r_s = -3/\sqrt{10}$

X	Y
0	2
1	5
3	2
5	0

1.5 $r_s = -1/\sqrt{10}$

X	Y
0	5
1	0
3	2
5	2

$2+0.5 = 2.5$ $r_s = -1/\sqrt{10}$

X	Y
0	5
1	2
3	0
5	2

$0.5+1 = 1.5$ $r_s = -3/\sqrt{10}$

X	Y
0	5
1	2
3	2
5	0

0.5 $r_s = -3/\sqrt{10}$

X	Y
0	0
1	2
3	5
5	2

$3+1.5 = 4.5$ $r_s = 2/\sqrt{10}$

$\hat{\rho} = -\frac{1}{6}$ $r_s = -1/\sqrt{10}$

$\hat{\rho} = -\frac{1}{2}$ $r_s = -3/\sqrt{10}$

$\hat{\rho} = -\frac{1}{6}$ $r_s = -1/\sqrt{10}$

$\hat{\rho} = -\frac{1}{2}$ $r_s = -3/\sqrt{10}$

$\hat{\rho} = -\frac{5}{6}$ $r_s = -3/\sqrt{10}$

$\hat{\rho} = \frac{1}{2}$ $r_s = 3/\sqrt{10}$

Find null distribution

$\hat{\rho}$	prob
$-\frac{5}{6}$	$\frac{1}{12}$
$-\frac{1}{2}$	$\frac{2}{12}$
$-\frac{1}{6}$	$\frac{3}{12}$
$\frac{1}{6}$	$\frac{3}{12}$
$\frac{1}{2}$	$\frac{2}{12}$
$\frac{5}{6}$	$\frac{1}{12}$

r_s	prob
$-3/\sqrt{10}$	$\frac{1}{12}$
$-2/\sqrt{10}$	$\frac{2}{12}$
$-1/\sqrt{10}$	$\frac{3}{12}$
$1/\sqrt{10}$	$\frac{3}{12}$
$2/\sqrt{10}$	$\frac{2}{12}$
$3/\sqrt{10}$	$\frac{1}{12}$