

Case Study 1 : to check whether there is significant diff in the no of cases registered in year 2020 and 2021

Characteristic : no of cases registered as per NCRB under study test :

Wilcoxon signed rank test

alpha : 0.05

H0 : there is no significant diff between the median of no of cases registered in year 2020 and year 2021

H1 : there is significant diff between the median of no of cases registered in year 2020 and year 2021

test statistic :

Test Statistic for The Wilcoxon Rank Sum Test

- Given two independent samples, the **test statistic** z for the Wilcoxon rank sum test is

$$z = \frac{R - \mu_R}{\sigma_R}$$

where

R = sum of the ranks for the smaller sample,

$$\mu_R = \frac{n_1(n_1 + n_2 + 1)}{2} \quad \text{and} \quad \sigma_R = \sqrt{\frac{n_1 n_2 (n_1 + n_2 + 1)}{12}}$$

wilcoxon rank sum exact test

data: data20 and data21

w = 495, p-value = 0.8259

alternative hypothesis: true location shift is not equal to 0

Conclusion : as p value (0.8259) > alpha(0.05) we can say that we fail to reject the null hypothesis and it can be statistically said that there is no significant diff between median of no of cases registered in year 2020 and year 2021.

Case study 2 : To check whether crimes like cruelty by husband or his relatives(section 498A IPC), attempt to commit rape(18 years or above)(sec 376/511 IPC),assault on women with an intent to outrage her modesty characteristic under study : to study crimes against women

H0 : There is no significant diff between the crimes like cruelty by husband or his relatives(section 498A IPC), attempt to commit rape(18 years or above)(sec 376/511 IPC),assault on women with an intent to outrage her modesty (no relation)

H1 : There is significant diff between the crimes like cruelty by husband or his relatives(section 498A IPC), attempt to commit rape(18 years or above)(sec 376/511 IPC),assault on women with an intent to outrage her modesty (some relation)

Friedman rank sum test

```
data: data1
Friedman chi-squared = 0.048, df = 2, p-value = 0.9763
```

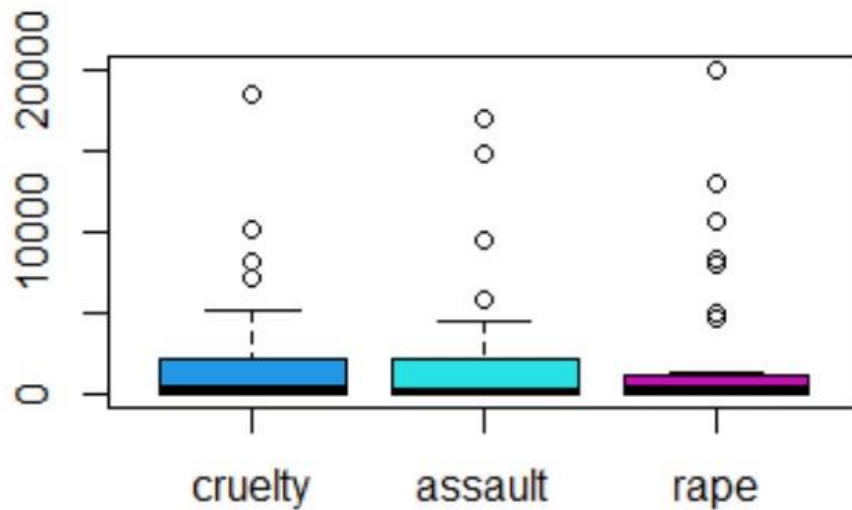
```
data1 = matrix(c(7092,112,12950,2069,963,1,2271,5755,221,931,2336,7929,
10095,18,21,11,2,4889,1714,16949,3,875,9468,355,18375,519,
19952,95,6,501,3,12,4615,66,4494,385,1248,55,621,2882,419,
1289,5103,5760,10568,91,92,31,11,14853,632,8055,17,1077,
4263,94,8334,606,2485,25,7,1851,1,31,127,3,561,57,6,0,1,
235,1,159,3,24,1,0,23,0,0,151,36,938,0,20,31,14,261,28,
875,0,0,14,0,0),nrow = 32,byrow = TRUE,dimnames =
list(1:32,c("cruelty","assault","rape")))
friedman.test(data1)

cruelty = c(7092,112,12950,2069,963,1,2271,5755,221,931,2336,7929,
10095,18,21,11,2,4889,1714,16949,3,875,9468,355,18375,519,
19952,95,6,501,3,12)
length(cruelty)
shapiro.test(cruelty)
assault = c(4615,66,4494,385,1248,55,621,2882,419,1289,5103,5760,
10568,91,92,31,11,14853,632,8055,17,1077,4263,94,8334,606,
2485,25,7,1851,1,31)
length(assault)
rape = c(127,3,561,57,6,0,1,235,1,159,3,24,1,0,23,0,0,151,36,938,0,
20,31,14,261,28,875,0,0,14,0,0)
length(rape)
```

kruskal-wallis rank sum test

data: cruelty and assault

kruskal-wallis chi-squared = 30.994, df = 30, p-value = 0.4157



```
property=c(77,0,105,635,68,0,39,58,8,168,126,169,172,0,1,0,0,111,66,151,0,120,107,6,227,7,16,0,1,15,0,1)
```

```
family=c(182,8,82,265,93,1,93,116,16,103,151,249,328,2,3,0,1,535,92,115,1,388,248,26,257,8,72,3,1,18,0,1)
```

```
money=c(40,0,15,118,15,2,80,33,2,40,36,55,202,0,10,0,0,12,51,43,0,62,51,3,41,6,17,4,1,0,0,0)
```

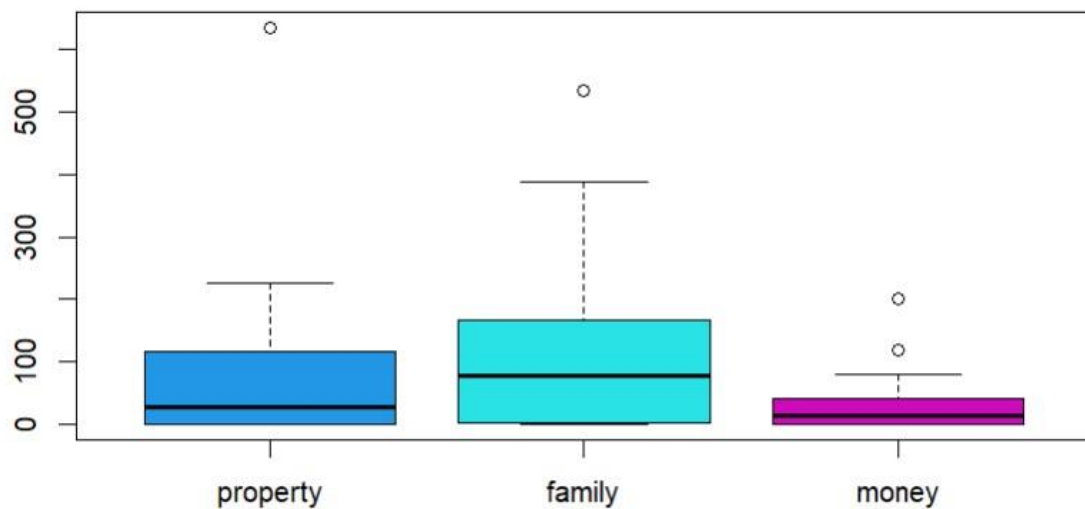
```
data1=data.frame(property,family,money) data1  
friedman.test(as.matrix(data1))  
boxplot(data1,col = c(4,5,6))
```

```
> friedman.test(as.matrix(data1))
```

Friedman rank sum test

data: as.matrix(data1)

Friedman chi-squared = 28.775, df = 2, p-value = 5.645e-07



case study 3 : is there a significant diff between the no of males and females convicted for crime against women

Ho : there is no diff in the proportion of males and females convicted H1 :

there is significance diff in the proportion of males and females convicted

our sample is too extreme to realistically hold on to the hypothesis that there was no diff in the population

```
> data2=prop.test(x=c(31660,1616),n=c(123251,15018),correct = FALSE)
> data2
```

2-sample test for equality of proportions without continuity correction

```
data: c(31660, 1616) out of c(123251, 15018)
X-squared = 1632.2, df = 1, p-value < 2.2e-16
alternative hypothesis: two.sided
95 percent confidence interval:
 0.1437462 0.1547937
sample estimates:
 prop 1      prop 2 
0.2568742 0.1076042
```

	male	female
convicted	31660	1616
aquitted	91591	13402

```
> data1 = matrix(c(7092,112,12950,2069,963,1,2271,5755,221,931,2336,7929,
+                 10095,18,21,11,2,4889,1714,16949,3,875,9468,355,18375,519,
+                 19952,95,6,501,3,12,4615,66,4494,385,1248,55,621,2882,419,
+                 1289,5103,5760,10568,91,92,31,11,14853,632,8055,17,1077,
+                 4263,94,8334,606,2485,25,7,1851,1,31,127,3,561,57,6,0,1,
+                 235,1,159,3,24,1,0,23,0,0,151,36,938,0,20,31,14,261,28,
+                 875,0,0,14,0,0),nrow = 32,byrow = TRUE,dimnames =
+                 list(1:32,c("cruelty by husband or relatives","assault to outrage her modest
y","attempt to rape"))))
> friedman.test(data1)
```

Friedman rank sum test

```
data: data1
Friedman chi-squared = 0.048, df = 2, p-value = 0.9763
```

Friedman rank sum test

```
data: data1
Friedman chi-squared = 0.048, df = 2, p-value = 0.9763
```

```
data1 = matrix(c(7092,112,12950,2069,963,1,2271,5755,221,931,2336,7929,
10095,18,21,11,2,4889,1714,16949,3,875,9468,355,18375,519,
19952,95,6,501,3,12,4615,66,4494,385,1248,55,621,2882,419,
1289,5103,5760,10568,91,92,31,11,14853,632,8055,17,1077,
4263,94,8334,606,2485,25,7,1851,1,31,127,3,561,57,6,0,1,
235,1,159,3,24,1,0,23,0,0,151,36,938,0,20,31,14,261,28,
875,0,0,14,0,0),nrow = 32,byrow = TRUE,dimnames =
list(1:32,c("cruelty by husband or relatives","assault to outrage her modesty",
"attempt to rape"))))
friedman.test(data1)
```

```
> wilcox.test(data20,data21,alternative = "two.sided",conf.level = 0.95,paired = TRUE)
```

Wilcoxon signed rank test with continuity correction

```
data: data20 and data21
V = 211.5, p-value = 0.3309
alternative hypothesis: true location shift is not equal to 0
```

A Wilcoxon signed-rank test is a non parametric hypothesis test used to compare two related samples, matched samples, or repeated measurements on a single sample to estimate whether their population means rank differ.

Z statistic value :

$$Z = \frac{W - \mu_W}{\sigma_W}$$

Where ,

Standard deviation is :

$$\sigma_W = \sqrt{\frac{n(n+1)(2n+1) - \sum \frac{t_i^3 - t_i}{2}}{24}}$$

Expected value of W is :

$$\mu_W = \frac{n(n+1)}{4}$$

The cases registered under offences against human body depict an increase of 5.1% in 2021 over 2020 (10,47,216 cases) and the crime rate has increased from 77.4 in 2020 to 80.5 in 2021

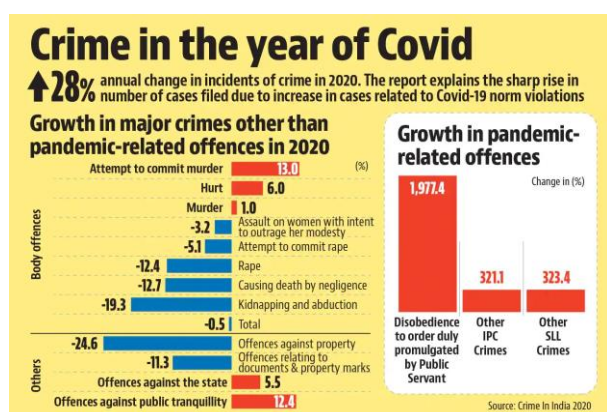
The Crime in India (CII) report has been published since 1954 and provides data & insights into various aspects of crimes, reflecting the overall state of law & order in the country. Data on various IPC Crimes, SLL Crimes, Crimes against women, children, SCs/STs, senior citizens, environmental offences, cyber-crimes, juveniles in conflict with the law, crimes in railways, terrorism, etc. is provided in the report, along with data on the disposal of these crimes by police and courts.

Data is available at the national level, state level, and for metropolitan cities with more than 2 million population.

The data has been compiled by NCRB from States/UTs Police and CAPFs/CPOs for the calendar year 2021. It should be noted that data in the NCRB report is based on the 'Principal Offence Rule', which means among many offences registered in a single FIR case, only the most heinous crime (maximum punishment) will be considered as counting unit for the purpose of data collection. However, for crimes against children, women, SC/ST and a few other similar cases, the rule is not followed.

2020 NCRB report of crimes in India: Year of the 'anti-national'

In the list of crimes in the country in 2020 released by the National Crime Records Bureau, "offences against the state" show a significant spike.



The FBI's [latest data](#), as well as [provisional data from the CDC](#), suggest that murders continued to rise in 2021.

The [most recent version of the FBI study](#) shows no rise in the national violent crime rate between 2020 and 2021.

For each of the four violent crime types tracked in the survey – simple assault, aggravated assault, robbery and rape/sexual assault – there was no statistically significant increase either in 2020 or 2021.

In comparison to 2020, there was a 7.6% overall drop in reported crimes in 2021.

the crime rate (per 100,000 people) has decreased from 487.8 in 2020 to 445.9 in 2021, but significant can be seen in crime rate (385.5) in year 2019 than 2021