Lecture 13

22.08.2011

Example 2 (*Rice, p. 467*)**:** An experiment was done to test for reducing faults on telephone lines. Fourteen matched pairs of areas were used. The data represents the fault rates for the control areas and for the test areas.

```
> d <- read.table(
file=url("http://www.maths.usyd.edu.au/stat2912/r/phonelines.txt"),
header = T)
> d
   test control
1   676      88
2   206     570
3   230     605
4   256     617
5   280     653
6   433    2913
7   337     924
8   466     286
9   497    1098
10  512     982
11  794    2346
12  428     321
13  452     615
14  512     519
> diff <- d$test-d$control
> median(diff)
[1] -368.5
>
> # Manual calculation of Hodges-Lehmann estimator
> k <- 1
> p <- 1:length(diff)*length(diff)/2
> for (i in 1:length(diff)) for (j in 1:i) {p[k] <-
(diff[i]+diff[j])/2; k <- k+1}
> median(p)
[1] -368
>
> # Built-in function to calculate Hodges-Lehmann estimator
> library(ICSNP)
> hl.loc(diff)
[1] -368
>
```

The median is estimated to be **-368** by the Hodges-Lehmann estimator.

```
> # CI
> M <- length(diff)*(length(diff)+1)/2
> for(k in 1:25) print(c(k, psignrank(M-k, length(diff))-
psignrank(k-1, length(diff))))
[1] 1.000000 0.999878
[1] 2.0000000 0.9997559
[1] 3.0000000 0.9996338
[1] 4.0000000 0.9993896
[1] 5.0000000 0.9991455
[1] 6.0000000 0.9987793
[1] 7.000000 0.998291
[1] 8.0000000 0.9976807
[1] 9.0000000 0.9969482
[1] 10.0000000  0.9959717
[1] 11.000000  0.994751
[1] 12.0000000  0.9932861
[1] 13.000000  0.991455
[1] 14.0000000  0.9892578
[1] 15.0000000  0.9865723
[1] 16.0000000  0.9833984
[1] 17.0000000  0.9797363
[1] 18.0000000  0.9754639
[1] 19.000000  0.970459
[1] 20.0000000  0.9647217
[1] 21.0000000  0.9581299
[1] 22.0000000  0.9505615
[1] 23.0000000  0.9420166
[1] 24.000000  0.932373
```

All of the above can be replaced with:

```
> k = qsignrank(0.025, length(diff))
> sort(p)[k]
sort(p)[M-k+1]
 [1] -946
> sort(p)[M-k+1]

[1] -90.5
```

A 95.06% CI for the median is **[-946, -90.5]**.