Casual Inference Report Week 5

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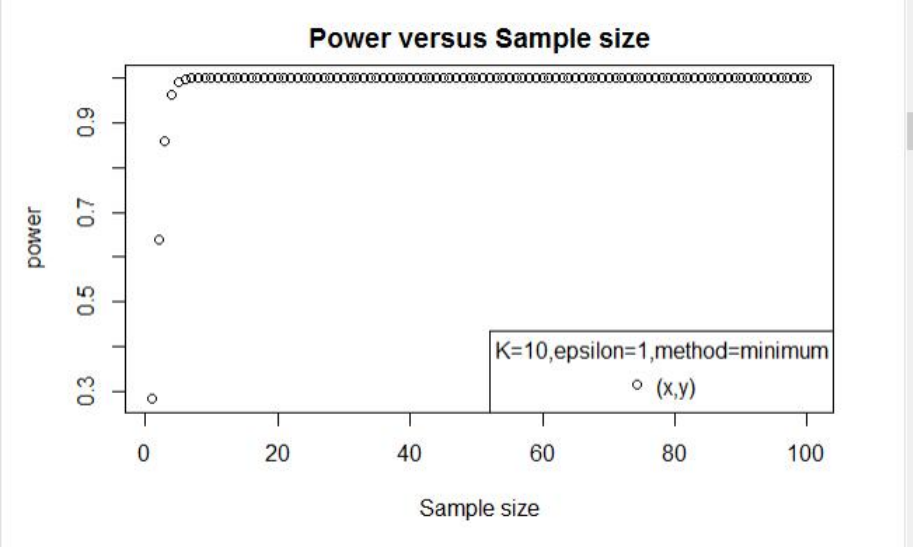
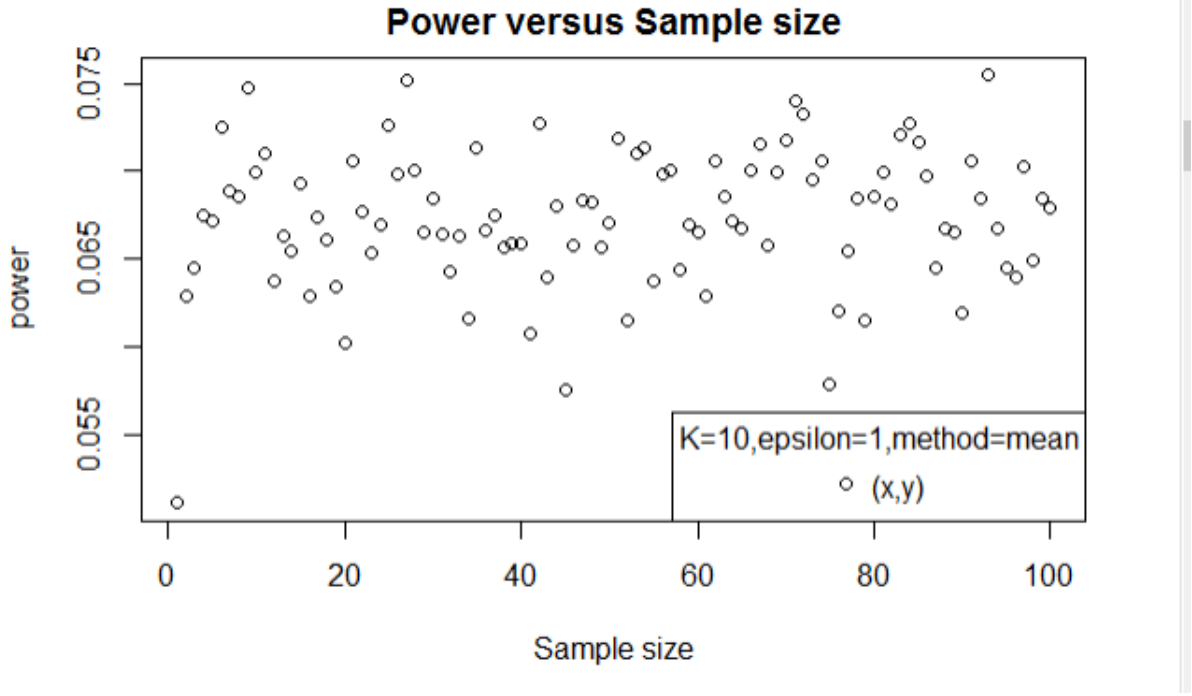
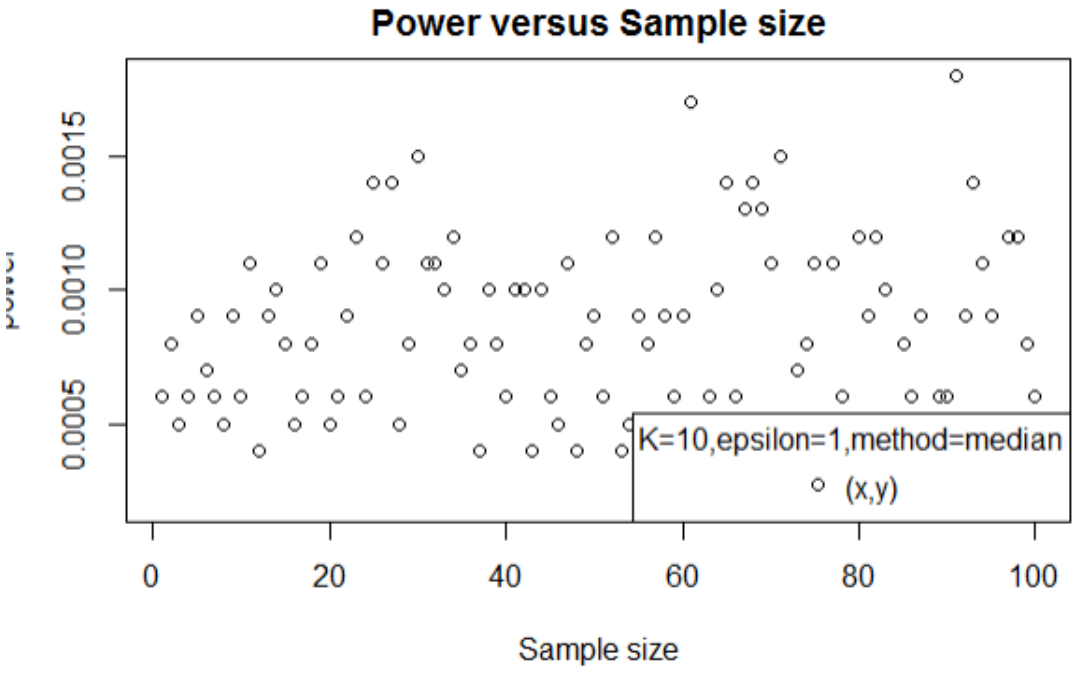
1 For K fixed,plot the statistics power versus the sample size N.

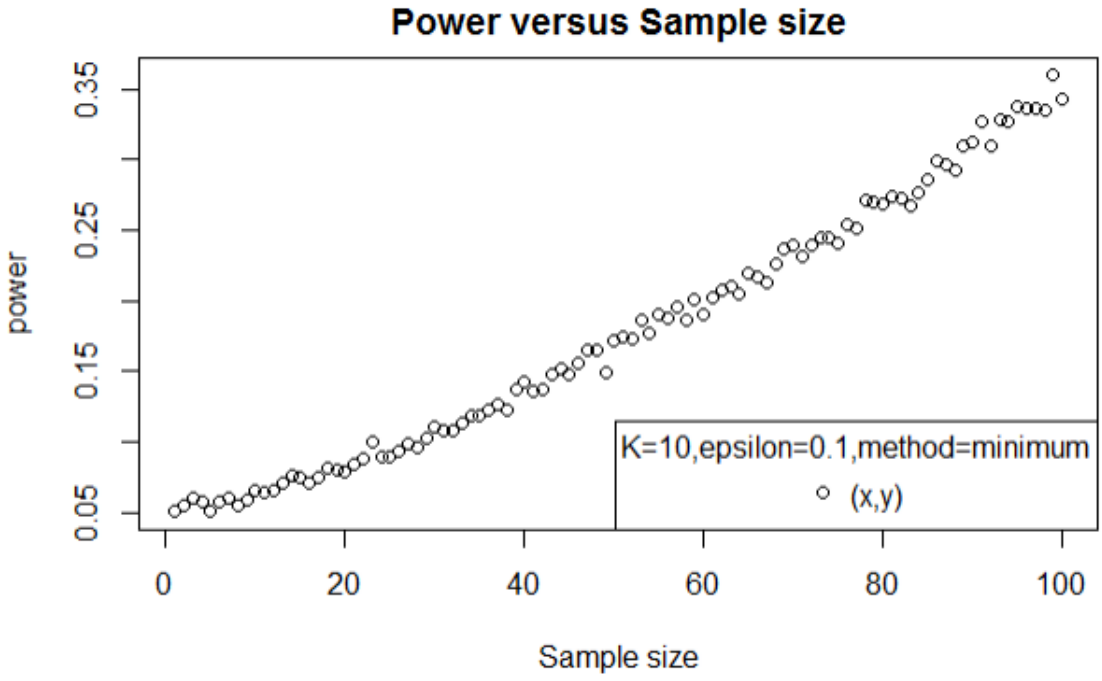
1.1 K=10

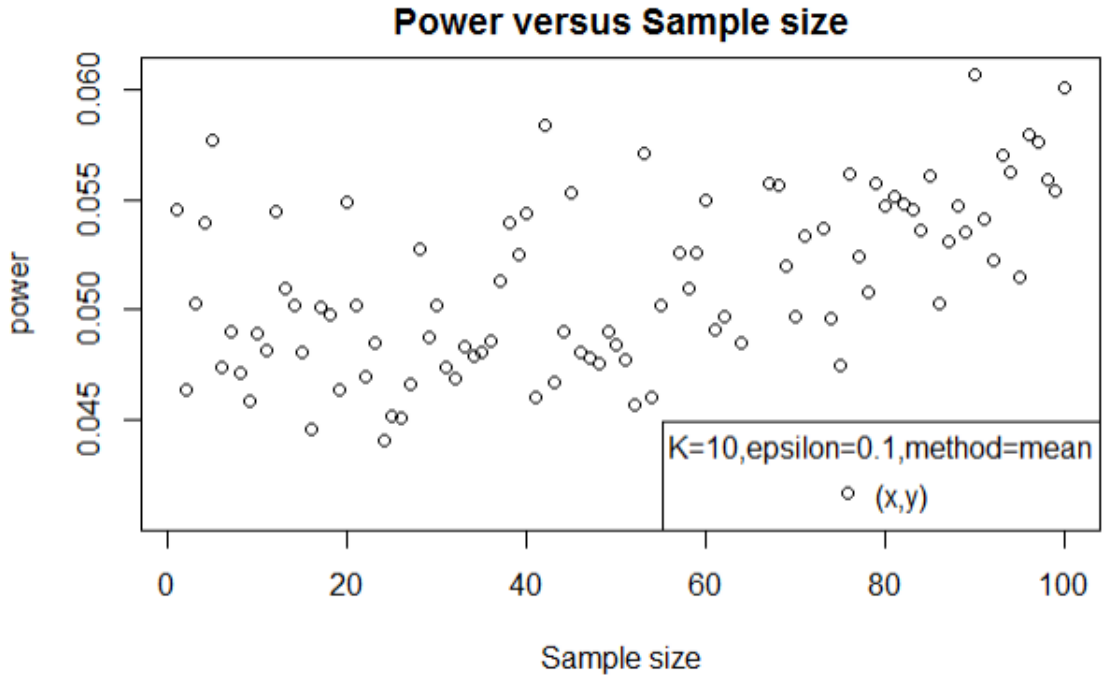
Firstly, I choose the number of the arms, K, equals to 10, setting the last $\bar{Y}$ equals to 1 and 0.1 and computing the combined-pvalue with minimum,mean and median.

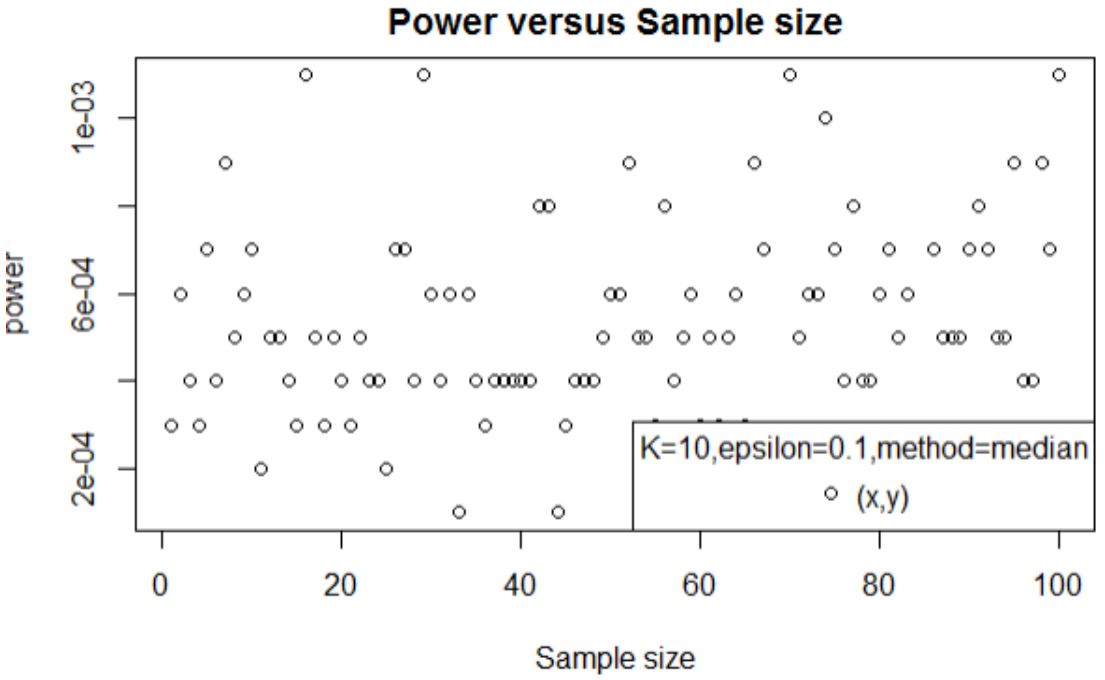





Power versus Sample size
0.0005
0.0010
0.0015
K=10,epsilon=1,method=median
(x,y)
0
20
40
60
80
100
Sample size


Power versus Sample size
power
0.05
0.15
0.25
0.35
K=10,epsilon=0.1,method=minimum
(x,y)
0
20
40
60
80
100
Sample size

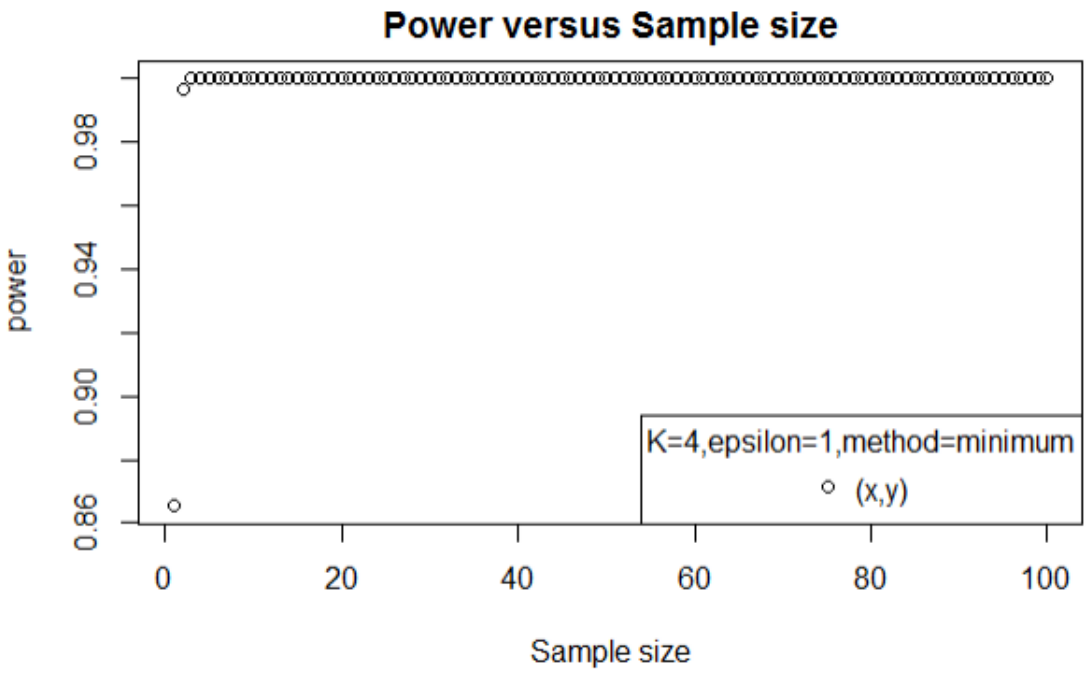


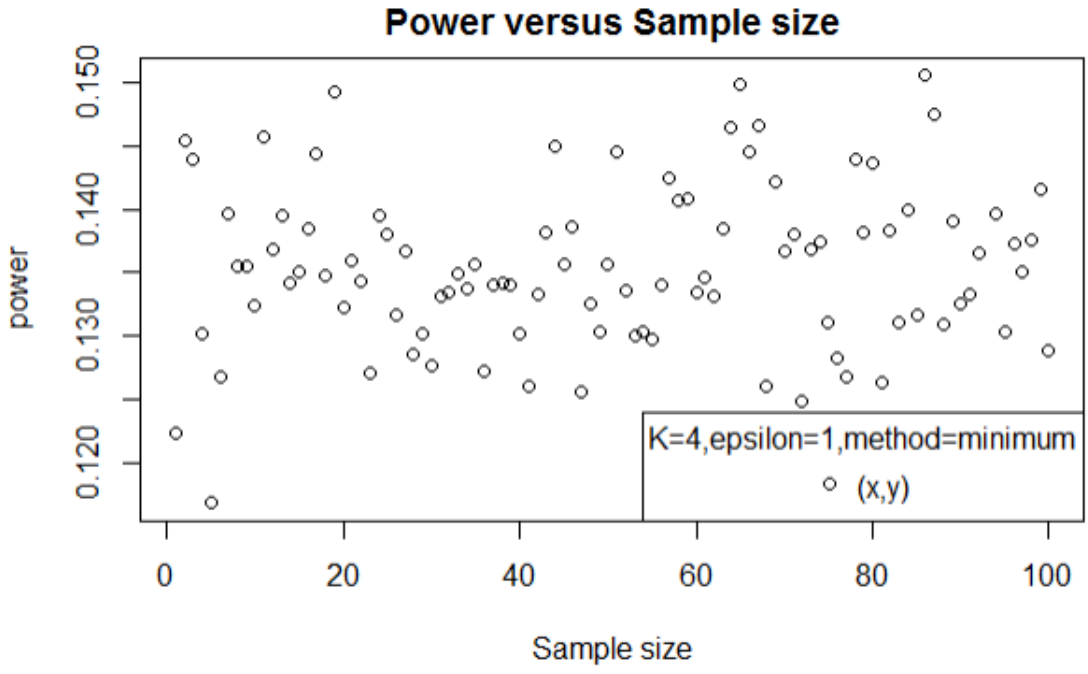


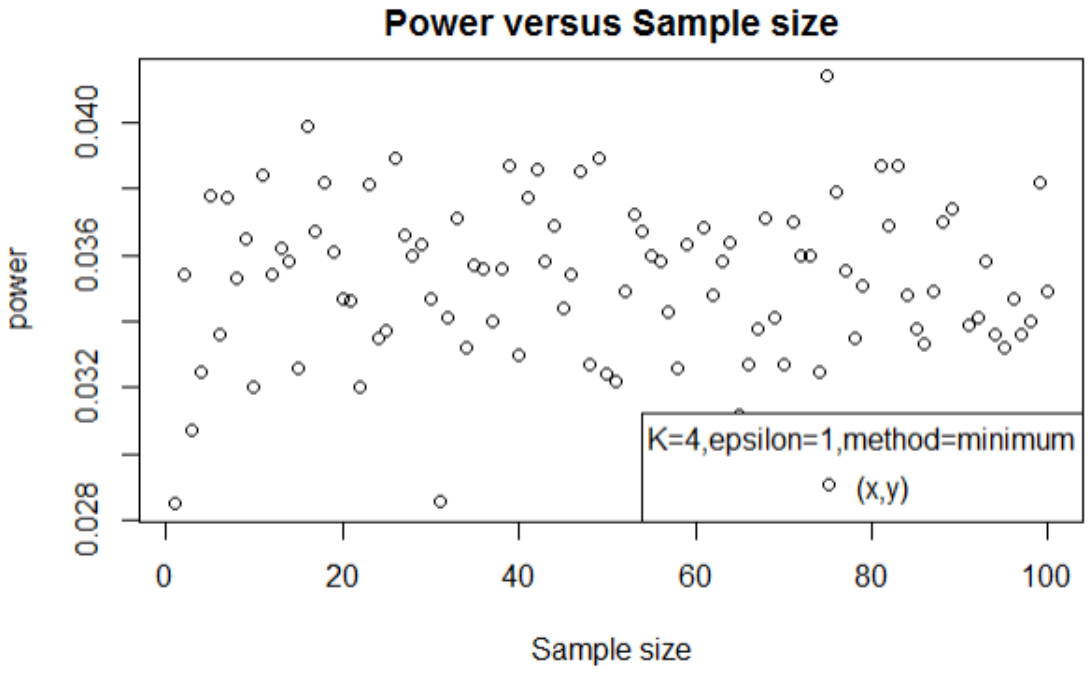
From the figure above,I find that if I choose K=10, the plot between the probability and the K has an increasing trend when using minimum to calculate pcombine. However, for mean and median ,the plot displays a random fluctuation. Transcendentally, we expect an increasing trend for this plot,which means minimum behaves better than median and mean.

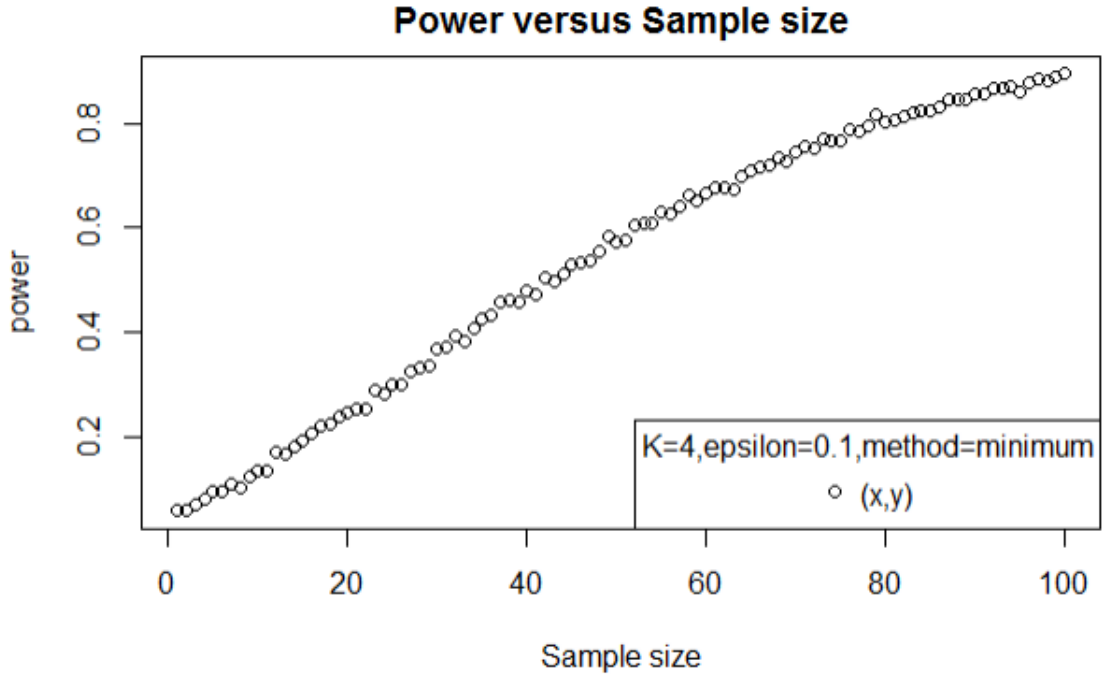
1.2 K=4

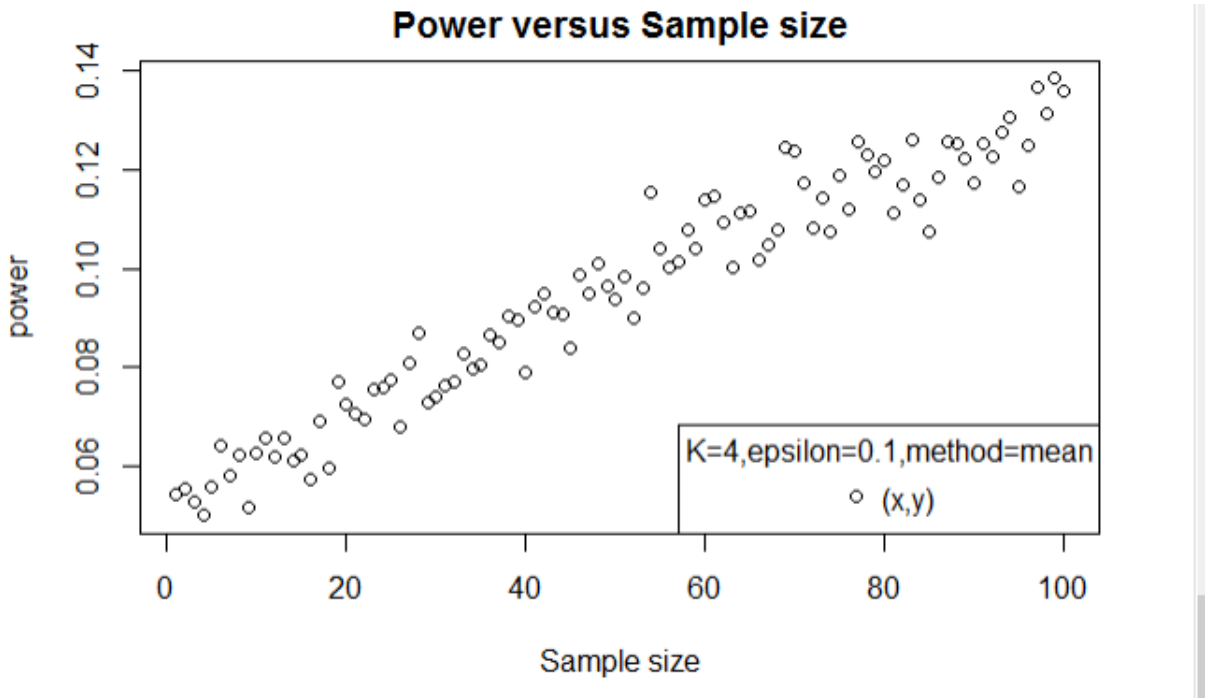
I choose the number of the arms,K,equals to 4,setting the last $\bar{Y}$ equals to 1 and 0.1 and and computing the combined-pvalue with minimum,mean and median.

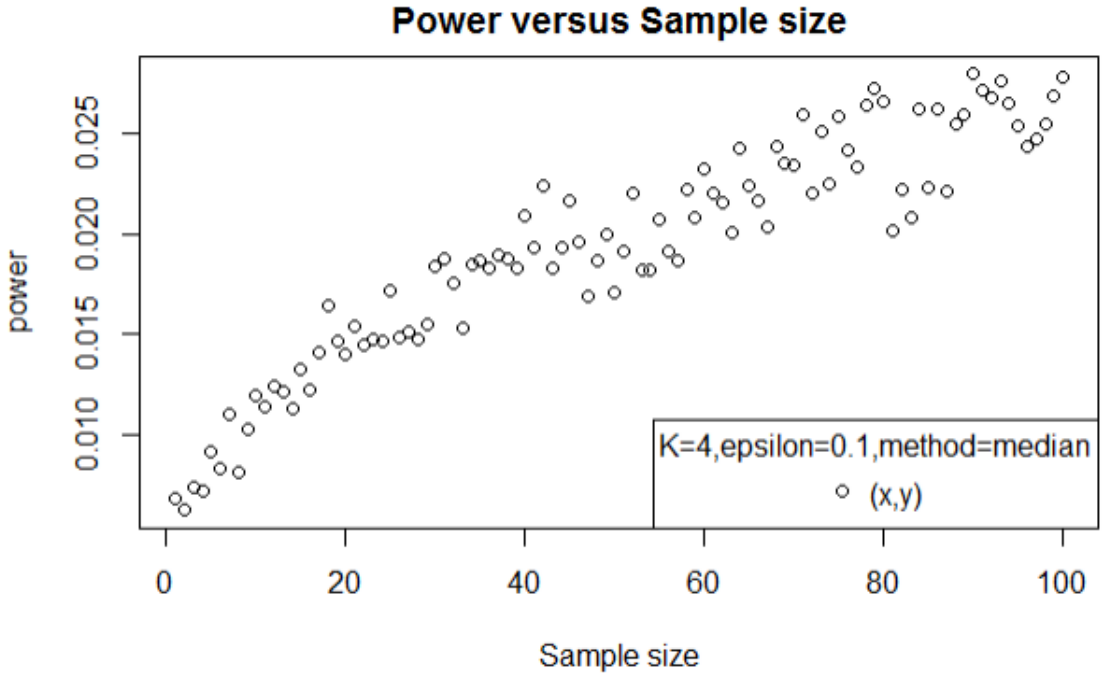

Power versus Sample size
power
0.86
0.90
0.94
0.98
0
20
40
60
80
100
Sample size
K=4,epsilon=1,method=minimum
(x,y)


Power versus Sample size
power
0.120
0.130
0.140
0.150
0
20
40
60
80
100
Sample size
K=4,epsilon=1,method=minimum
(x,y)


Power versus Sample size
power
0.028
0.032
0.036
0.040
0
20
40
60
80
100
Sample size
K=4,epsilon=1,method=minimum
(x,y)


Power versus Sample size
power
0.2
0.4
0.6
0.8
0
20
40
60
80
100
Sample size
K=4,epsilon=0.1,method=minimum
(x,y)



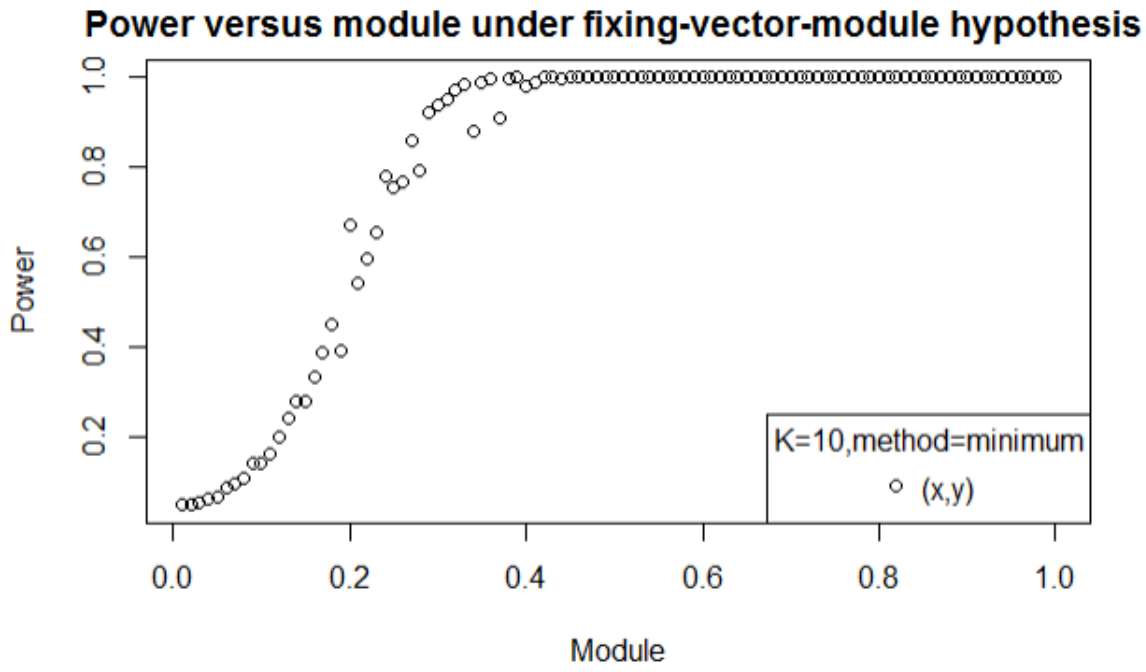


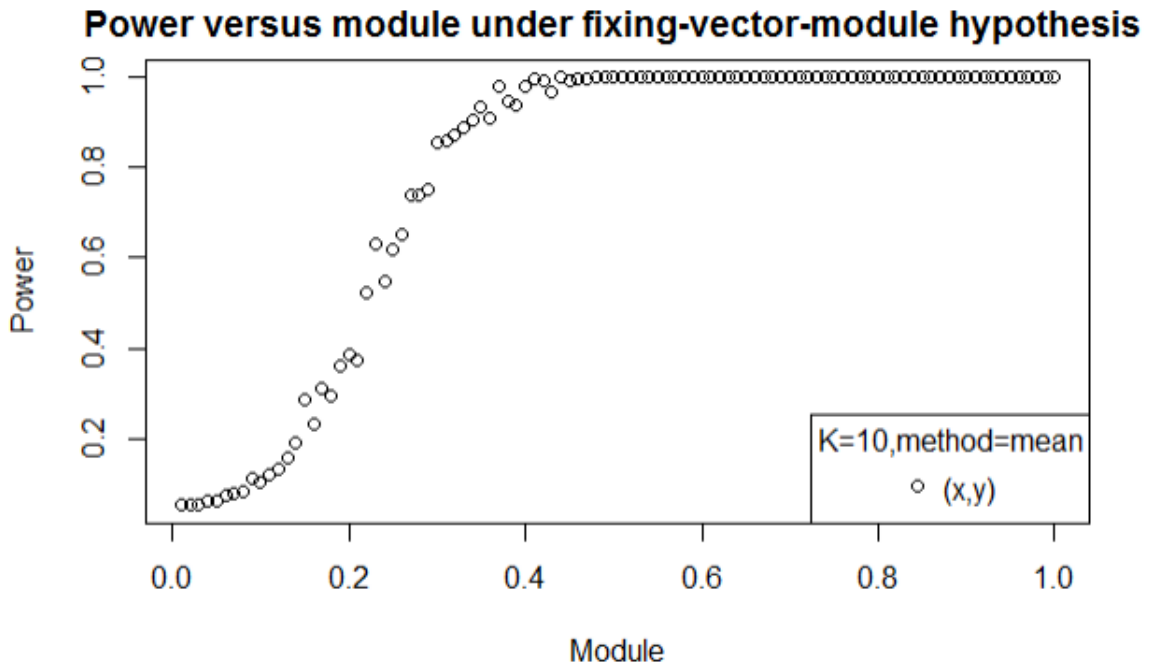
For ϵ=1, I get the similar result that plot under minimum pcombine increases well and there exists random fluctuation in the plot under mean and median pcombine. However, there is an interesting phenomenon when ϵ =0.1. In this case, the plot under minimum pcombine increases well as usual. Despite of some fluctuation occurring in the plot under mean and median pcombine, they both display a general increasing trend which have not be shown before.

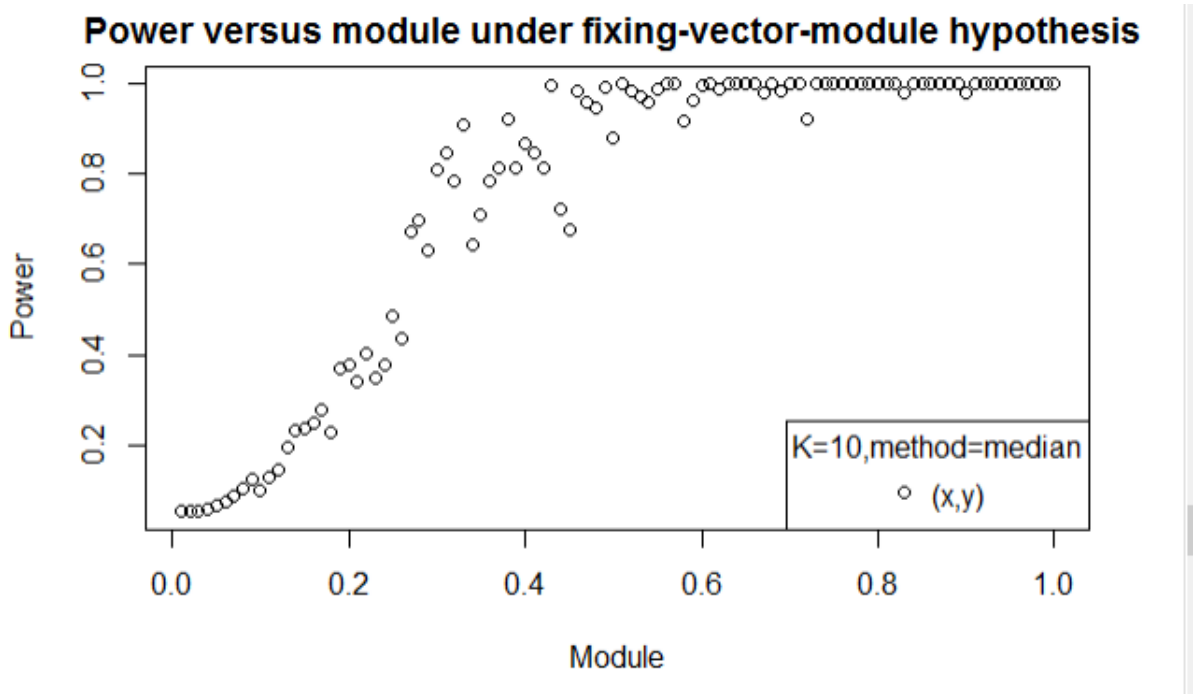
2 Under a constant-vector-module hypothesis,plot the statistics power plot

2.1 Ploy the statistics power versus $\bar{Y}$

In this case, I fix the number of the arms equals to 10, and the module of the $\bar{Y}$ vector ranges from 0.01 to 1 with step length of 0.01.

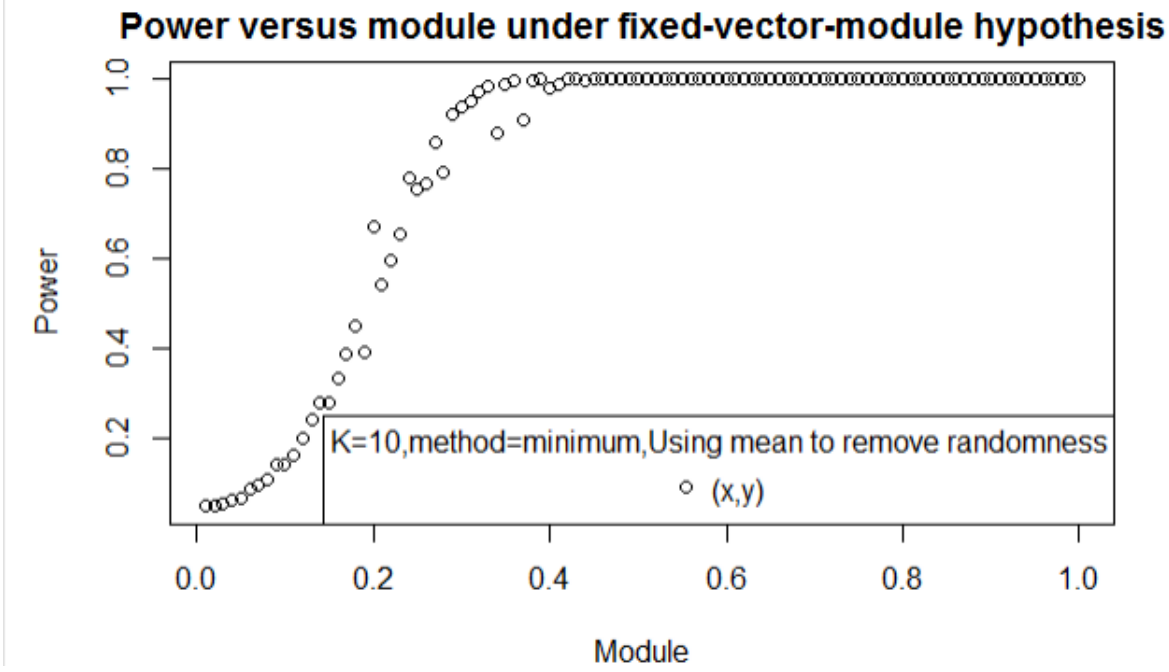


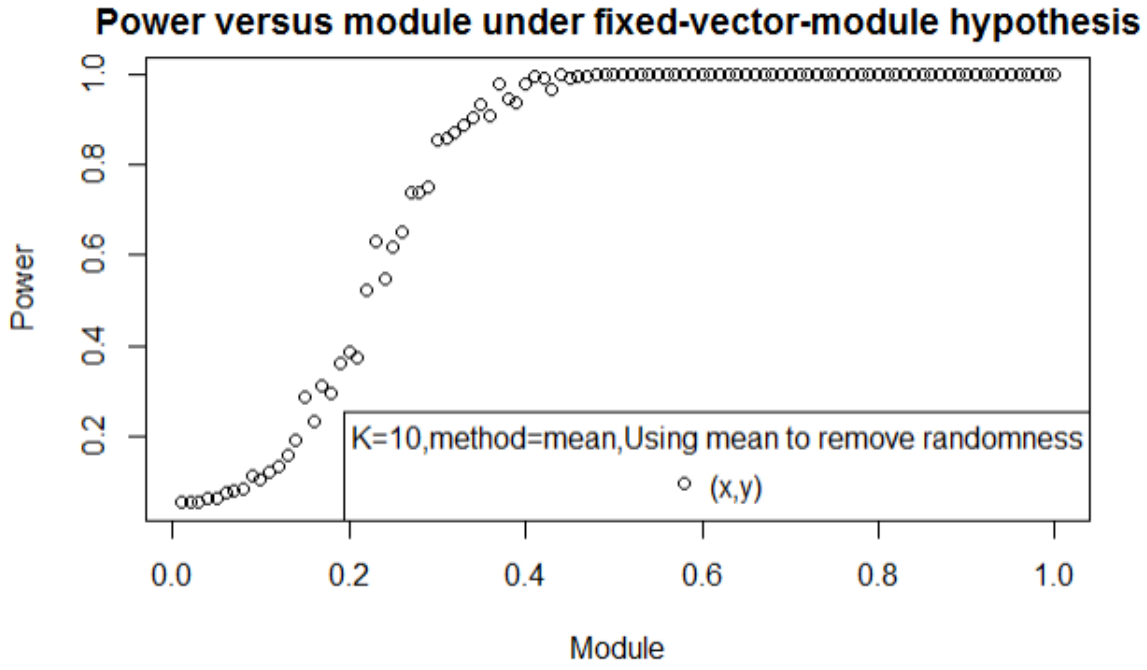


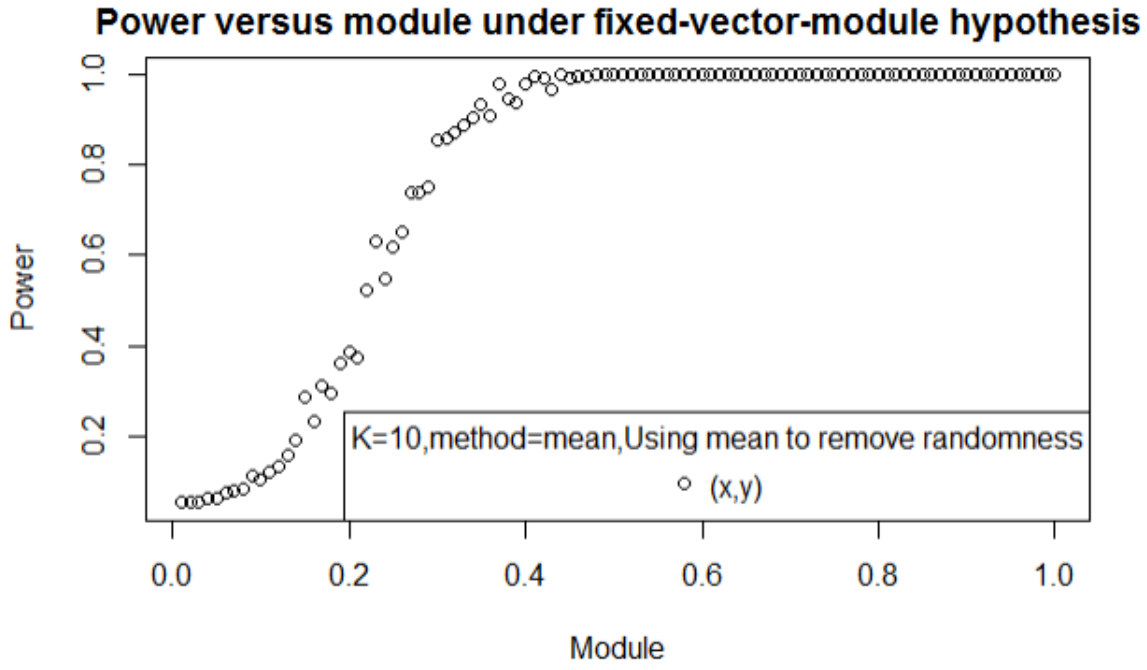


Utilizing a different alternative hypothesis(the module of the vector $\bar{Y}$ equals to ϵ), I get similar "S" curves under three different ways to construct pcombine. However, all of these displays slightly fluctuation in the figures, which, I assume, comes from the randomness of generating Ybar vector.

Therefore, instead of plot probability directly versus ϵ, I use the mean of the probability coming from calculating the corresponding probability 10 times.

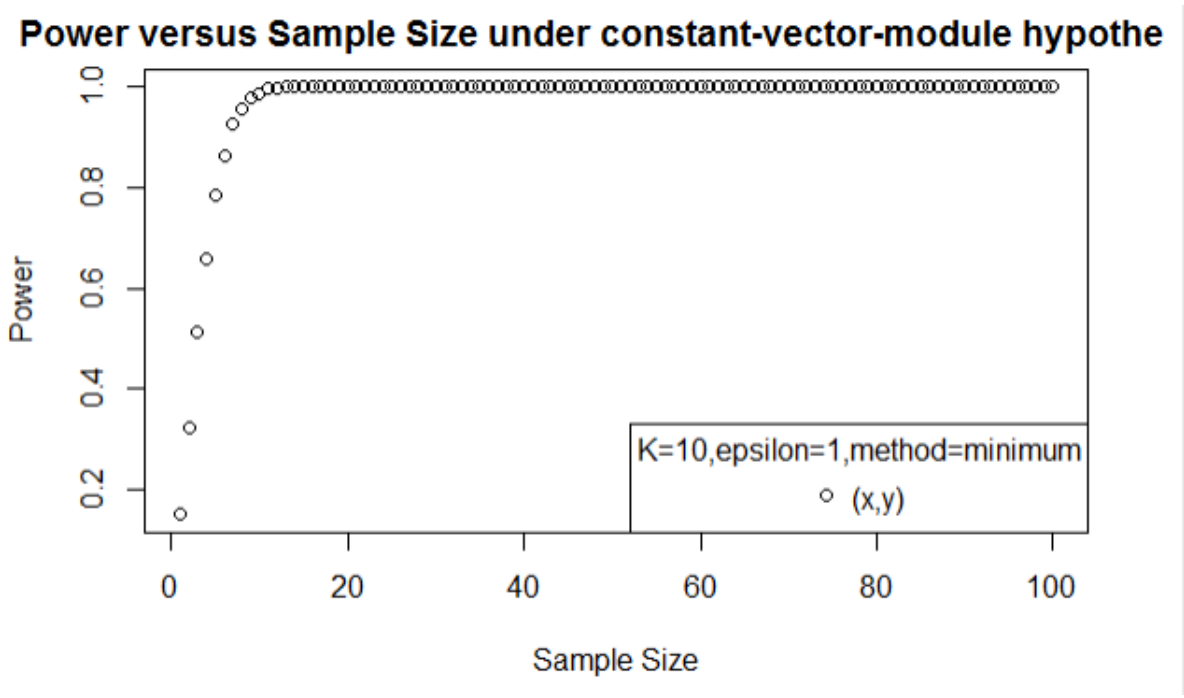


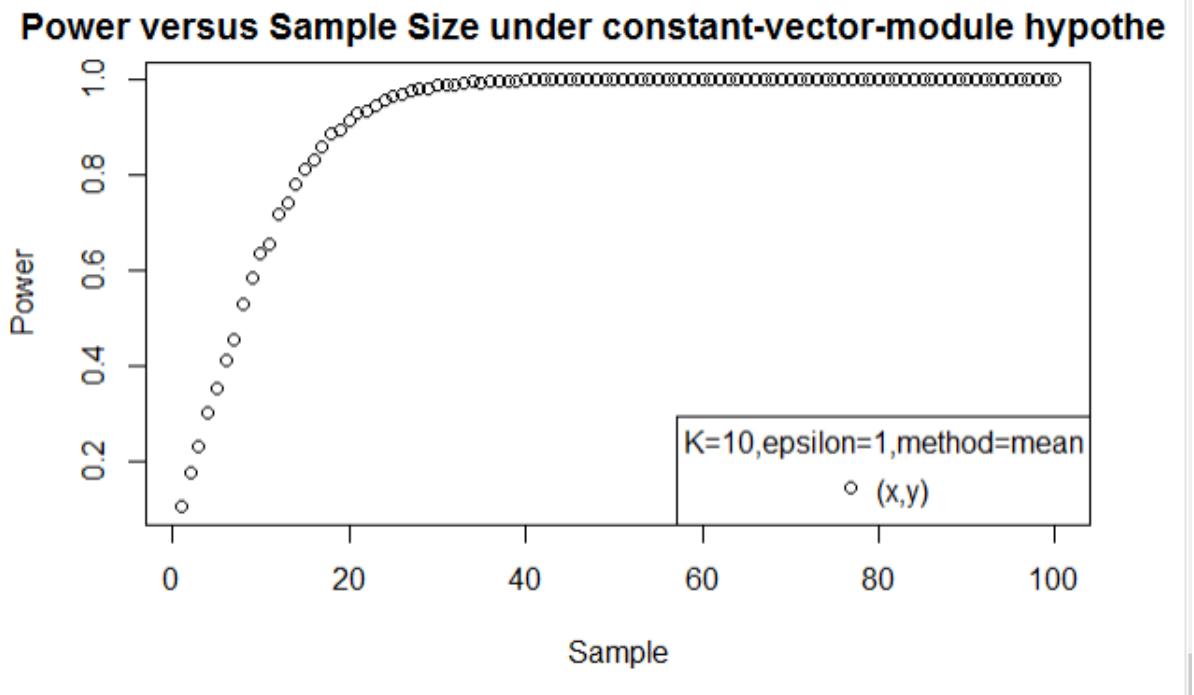


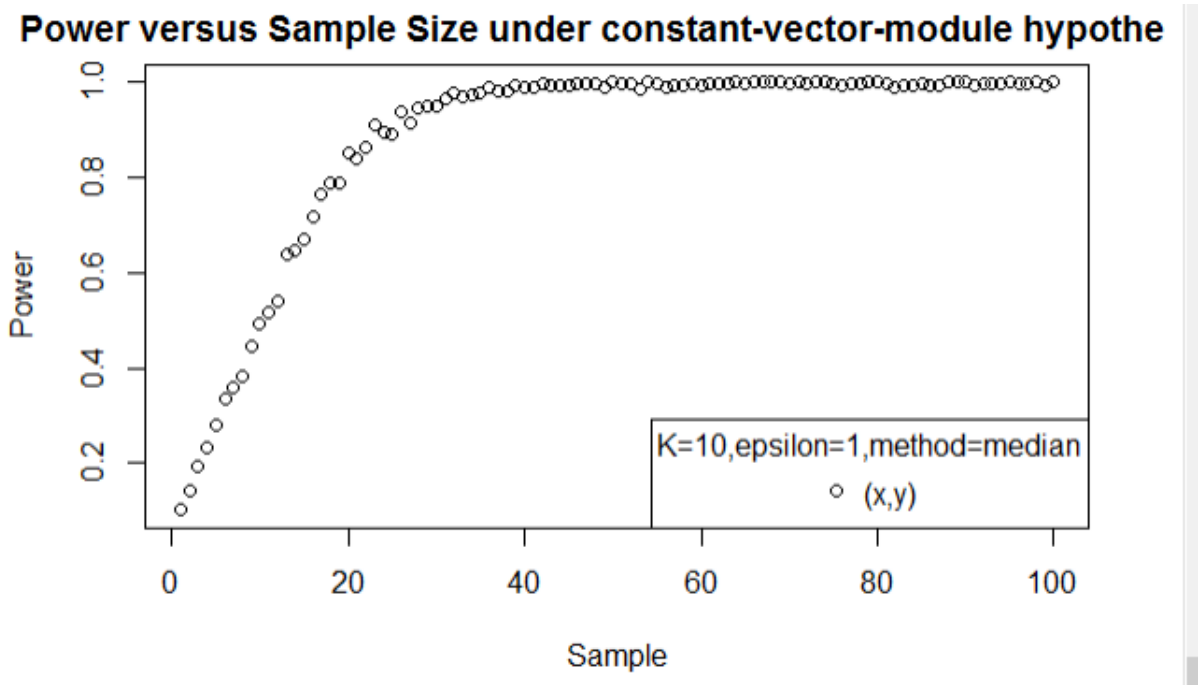


Now I get the plot with slight fluctuation. After observing the plots, I find that for a fixed value on X-axis, the statistics power coming from min-pcombine is the largest, followed by mean-pcombine and median-pcombine subsequently, which indicates that under the fixed-vector-module hypothesis minimum behaves the best in constructing the combined pvalue for the reason that it allows us to reject a wrong hypothesis easiest.

2.2 Plot the statistics power versus the sample size N under new alternative hypothesis







According to the figures above, for a fixed sample size, the statistics power from minimum-combined-pvalue is largest, then the mean and median subsequently. Thus, under this fixed-vector-module hypothesis, minimum is the best constructing pcombine way for us to reject another hypothesis with a "null" hypothesis in hand.

3 Conclusion

Under the brand new hypothesis of fixing-vector-module, minimum is the best way to construct combined p-value considering the plot where statistics power versus sample size and the plot where the statistics power versus the ϵ.