CS_final

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2a

```
## [1] "Test statistics is: 0.72"
```

2b

Part 1 Use Newtown Method to find lambda

```
## [1] "The lambda that minimizes P_bound is:  34.657"
```

Part 2 find p2

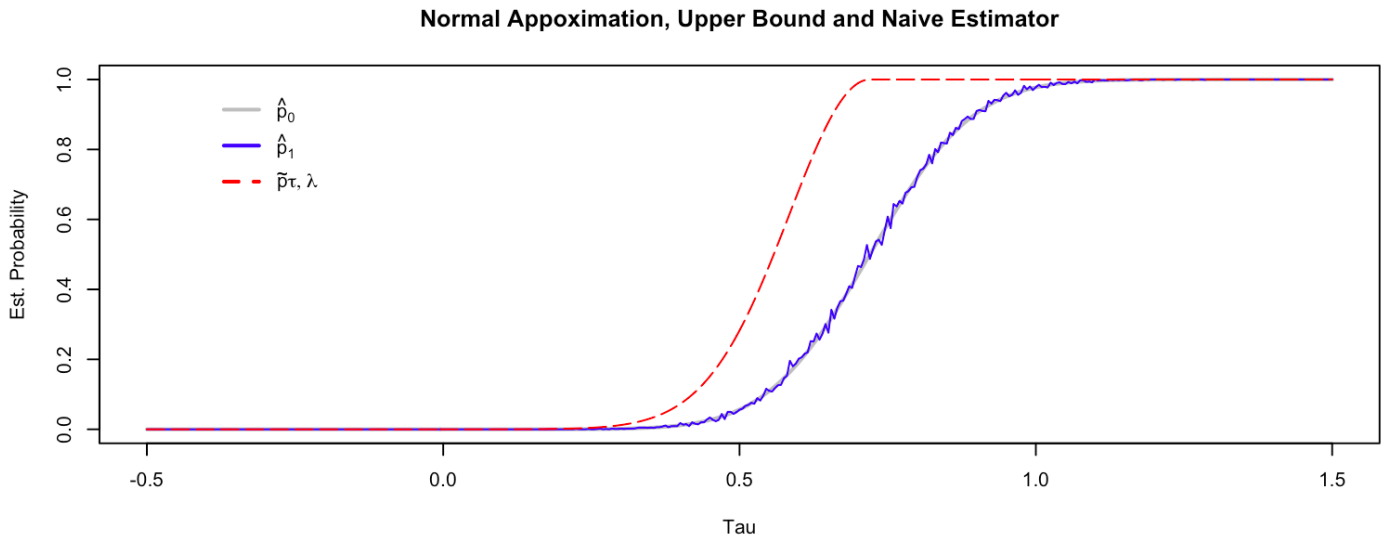
```
## [1] "The computed estimate is:  1.55e-06"
```

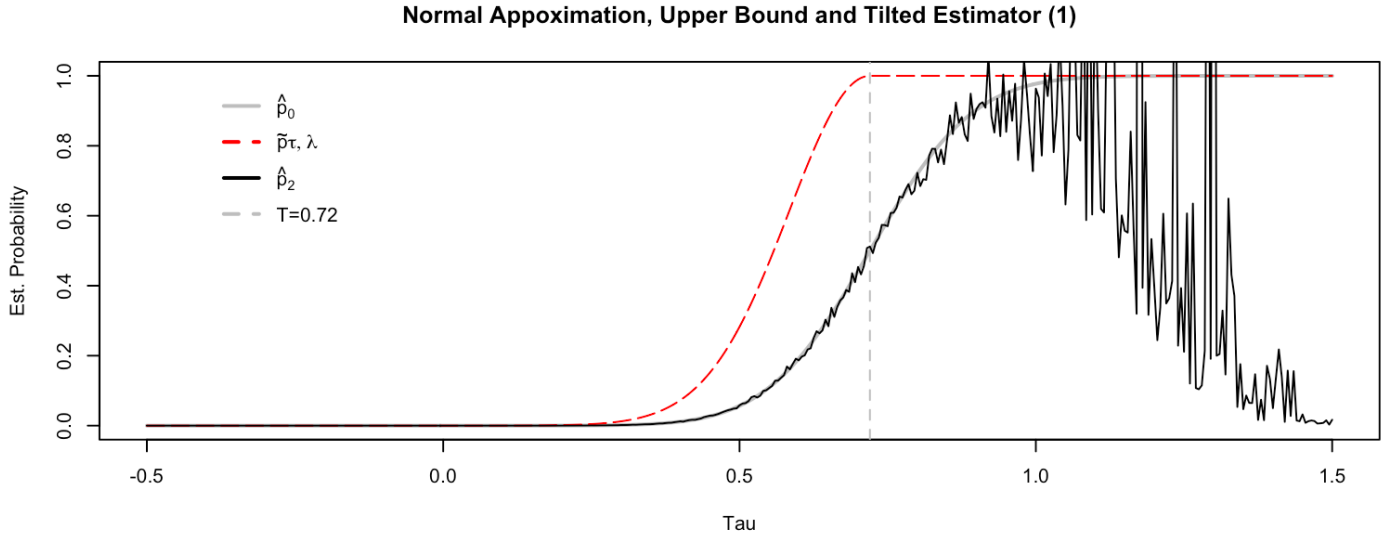
Part 3 explain choice of M

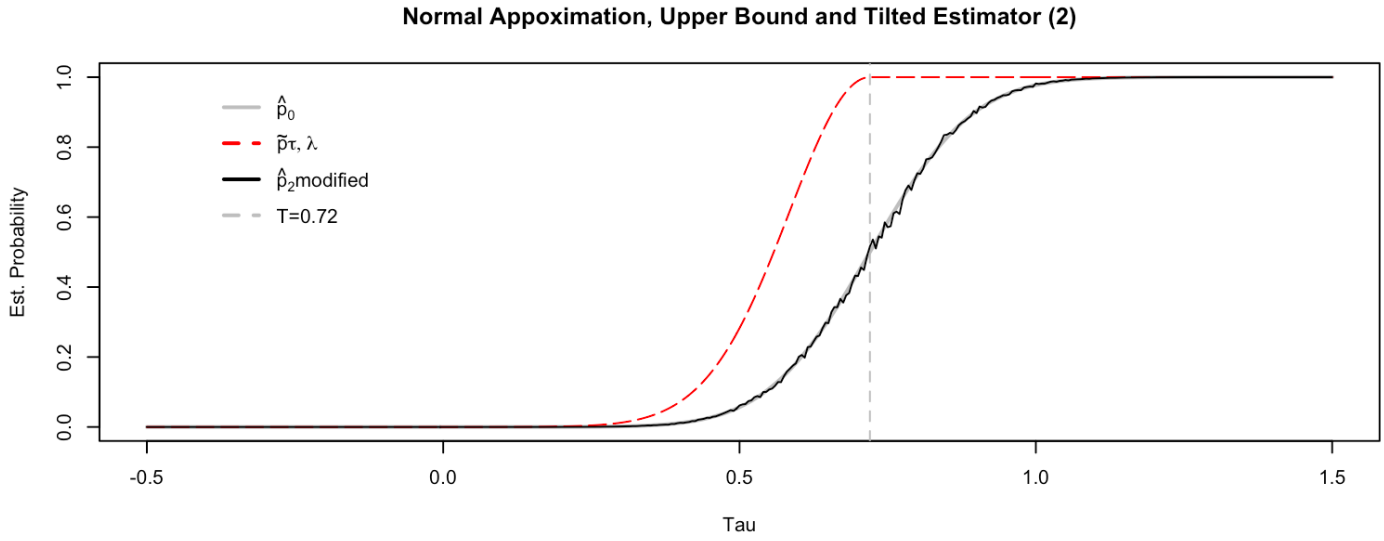
```
##   M    Var/P
## A 10   10 %
## B 100  1 %
## C 1000 0.1 %
```

When M is 1000, the variance is small enough (<0.1% of the estimate).

2c







In the middle panel, as we can see with Tau>t, the orginal tilted estimator breaks apart. This is because the chernoff bound only works with tail probability. So we flipped the distribution for Tau > t in the bottom panel.

2d

```
##          Lower 50% Upper 50% Lower 95% Upper 95%
## P_0          0.630     0.810     0.450     0.990
## P_1          0.620     0.810     0.445     0.995
## P_bound      0.490     0.615     0.340     0.685
## P_2          0.630     0.810     0.445     0.995
```