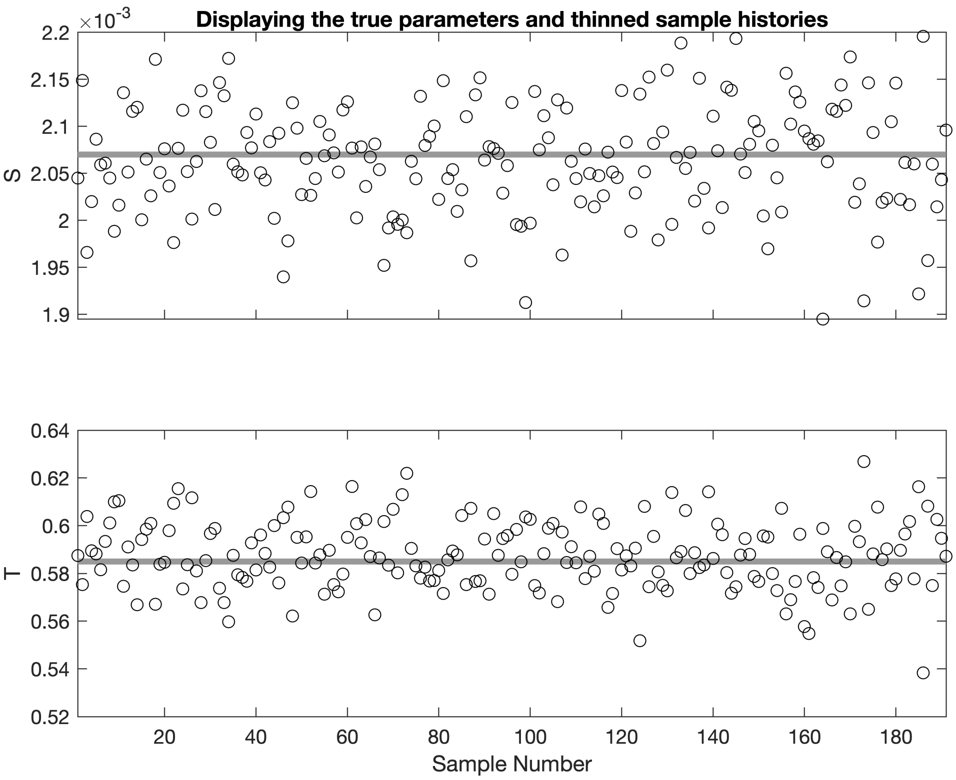
4.(a) Identify the number of samples that remain after the thinning process. Plot the hisstory of the thinned posterior samples, and include the true parameters.

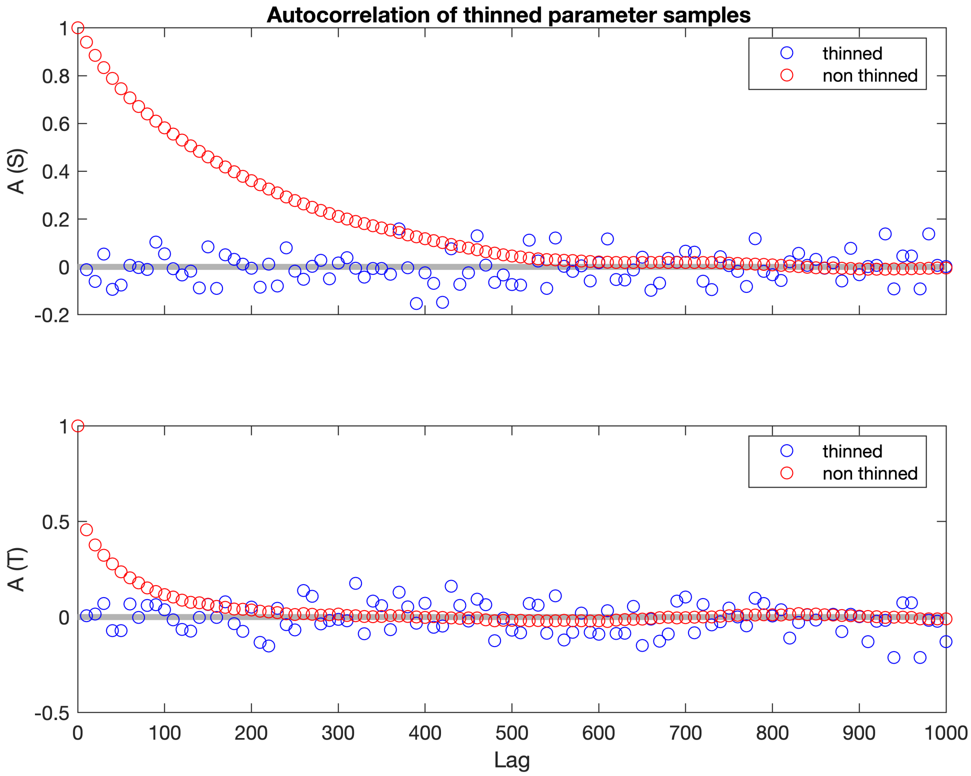
```
mout = 2×200000
    0.0050    0.0050    0.0050    0.0050    0.0050    0.0050    0.0050    0.0050 ···
    1.0000    0.9334    0.9334    0.9334    0.9334    0.9334    0.9334    0.9334
mMAP = 2×1
    0.0021
    0.5854
pacc = 0.2938
```

```
The corresponding number of samples = 191 samples
```



There is anti-correlation in the sequence of parameter samples S and T.

b) Plot autocorrelations of S and T both before and after thinning. Discuss if there was enough thinning with skipping every 1000 samples.



According to the graph above, we observe before thining, the 1000 samples are positively auto correlated, and after thinning with skipping every 1000 steps, the thinned samples (blue) are effectively decorrelated, hence there was no enough thining with skipping every 1000 samples.

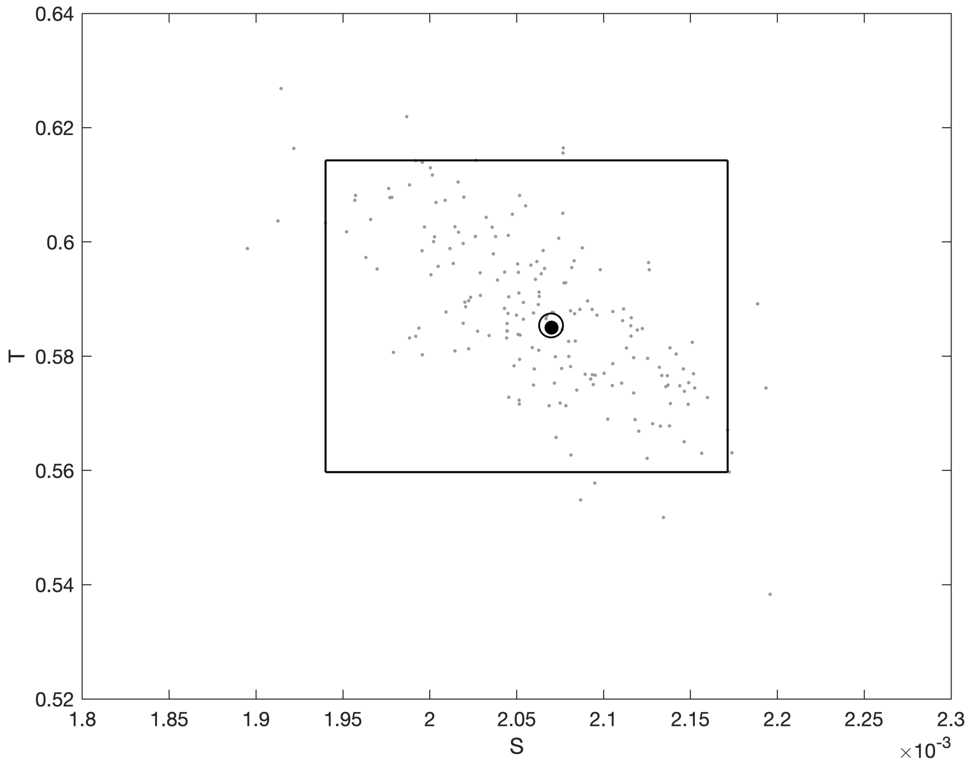
(c) Estimate the 95% credible intervals by sorting the ensemble of parameter estimates, as is done in Exercise 11.4.

```
95% confidence interval for m1 is [0.00194,0.0021714]
95% confidence interval for m2 is [0.55971,0.61428]
```

(d) Estimate the Bayesian confidence intervals as we've done previously, using the standard deviation of the MCMC samples.

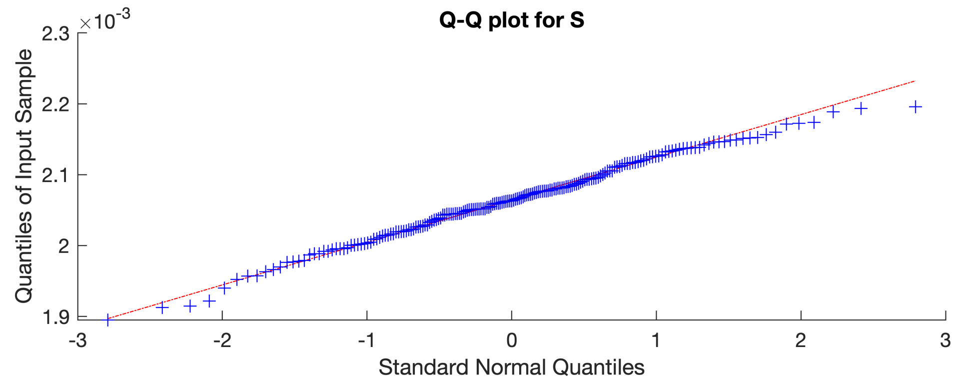
```
95% confidence interval for m1 is [0.0019561,0.0021834]
95% confidence interval for m2 is [0.55712,0.61364]
```

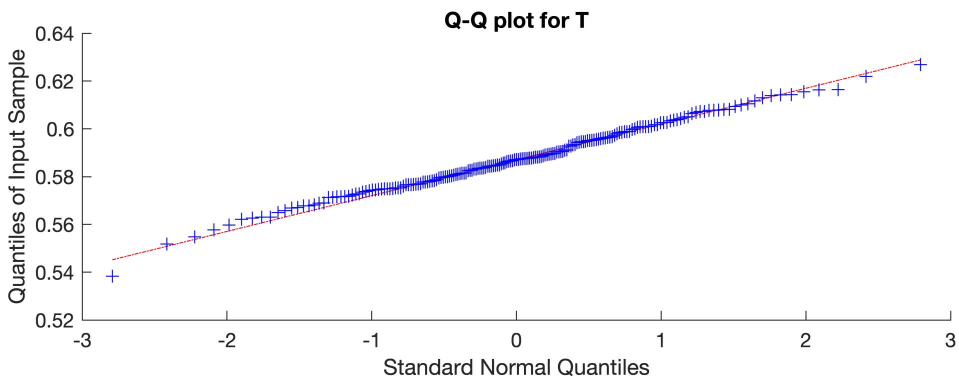
(e) As in Figure 11.16, plot the sampled posterior distribution S vs T with the true model as a large black dot, and the MAP estimate with an open circle. On the same graph plot the thinned samples as gray dots and 95% credible intervals by a box.



From the graph above almost all the thinned samples are captured inside the box, and the MAP estimates and the true model parameters are enclosed, almost to the cennter of the box

(f) Apply a Q-Q plot and discuss the normality of the sampled posterior distribution. In your discussion, address how the 95% credible intervals play a role.





Since the graphical test from the Q-Q plot depicts that the quantile data and standard normal quantiles almost follow a straight line between -1.8 to 1.8 for both parameters then the MCMC data samples with a 95% credible interval exhibit a normal distribution.