

### Question 8

Here we are interested in testing the following hypotheses

$$H_0: \sigma_{\text{prior}} = \sigma_{\text{new}}$$

$$H_A: \sigma_{\text{prior}} > \sigma_{\text{new}}$$

To test this, we can use the F distribution. The equivalent process here is to look for

$$H_0: S_1^2/S_2^2 = 1$$

$$H_A: S_1^2/S_2^2 > 1$$

This is distributed as an F distribution with  $F_{n_1-1, n_2-1}$

So we can then look for the probability that the  $F_{n_1-1, n_2-1}$  takes on a value of  $S_1^2/S_2^2$

Let  $S_1$  be the prior standard deviation and  $S_2$  be the new standard deviation

$$n_1 = 8, n_2 = 6$$

$$S_1 = 2.459, S_2 = 0.717$$

The value of  $S_1^2/S_2^2$  from the data is 11.785

The probability that the  $F_{7,5}$  takes on the value of 11.785 is then calculated as 0.992  
. (f cdf (11.785,7,5))

Thus, the probability that the variance of the new algorithm is lower is 0.992.