F-test (Variance Ratio test)

* The following data is about the no of bulbs produced daily by two workers A and B.

A	B
40	39
30	38
38	41
41	33
38	32
35	39
	40
	34

$\alpha = 0.05$

Can we consider based on the data worker B is more stable and efficient?

* Why not mean here can be used to test?

→ Mean is same for both the samples.

So we will compare variances.
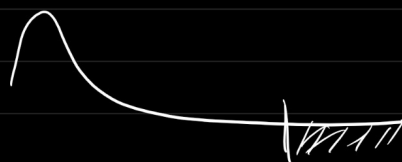
① $H_0 : S_1^2 = S_2^2$, $H_A = S_1^2 \neq S_2^2$

② F test , One tail test, $\alpha = 0.05$.

③ F statistic $= \dfrac{S_1^2}{S_2^2}$

Worker A.

X_1	$\bar{X}_1$	$(X_i - \bar{X}_1)^2$
40	37	9
30	37	49
38	37	1
41	37	16
38	37	1
35	37	4
$\bar{X}_1 = 37$		$\sum(X_i - \bar{X}_1)^2 = 80$

$S_1^2 = \dfrac{80}{n-1} = \dfrac{80}{(6-1)} = \dfrac{80}{5} = 16$

Worker B

X_2	$\bar{X}_2$	$(X_2 - \bar{X}_2)^2$
39	37	4
38	37	1
41	37	16
33	37	16
32	37	25
39	37	4
40	37	9
34	37	9
$\bar{X}_2 = 37$		$\sum X_2 - \bar{X}_2 = 84$

$S_2^2 = \dfrac{84}{8-1} = \dfrac{84}{7} = 12$

$$F_{statistics} = \frac{16}{12} \leftarrow = 1.33$$

④ $F_{critical}$ $\alpha = 0.05$, $\underline{dof_1 = 5}$ $\qquad$ $\underline{dof_2 = 7}$

$\qquad\qquad\qquad$ $\hookrightarrow$ in Numerator in f-table $\qquad$ $\hookrightarrow$ Denominator in f-table

$$F_{critical} \alpha = 0.05, \; dof(5,7) = 3.97$$

⑤ Conclusion

$\qquad$ F statistics is greater than 1.33,

$\qquad$ $1.33 < 3.97$

$\qquad\qquad$ we fail to

$\qquad\qquad$ reject the H_0 (Null hypothesis)

rejection region

$F_{critical} = 3.97$

$F_{stat} = 1.33$

Worker B is not more stable | effective as compared to A.