F - TEST

Introduction & formula

Objective of F-Test :

- To find out whether the two independent estimates of population variance differ significantly OR
- To find out whether the two samples may be regarded as drawn from the normal populations having same variance.
- To perform the test of significance, we have to compute the ratio of F.

$$F = \frac{\delta_1^2}{\delta_2^2} \quad \text{OR} \quad F = \frac{S_1^2}{S_2^2} \text{ (in case of samples)}$$

$$\therefore \delta_1^2 > \delta_2^2 \qquad S_1^2 > S_2^2$$

- Variance $= \delta_1^2 = \frac{\Sigma(x-\mu)^2}{n}$, $S_2^2 = \frac{\Sigma(x-\bar{x})^2}{n-1}$

- F can be written as:

$$F = \frac{\text{Larger estimate of variance}}{\text{Smaller estimate of variance}}$$

- Degree of freedom (v)

v_1 (Numerator) $= n_1 - 1$ & v_2 (denominator) $= n_2 - 1$

↳ (Larger variance) ↳ (Smaller variance)

- Now the F value will be compared with tabulated F value for v_1 & v_2 at 1% or 5% level of significance.

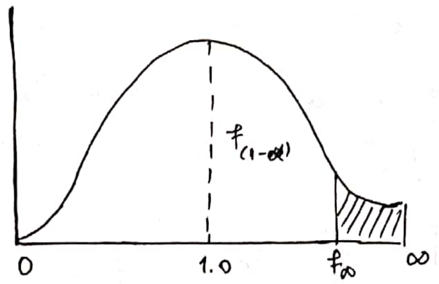
① Calc; F value < Tab; F value: → H_0 is accepted & No significant difference between the two variance (S^2)

if Calc F value > Tab; F value Then

H_0 is rejected & There will be significant difference between The two variance (S^2).

- Hence, F-Test is based on The ratio of The 2 variance, it is also known as The ("Variance ratio test")

PROPERTIES OF F-DISTRIBUTION



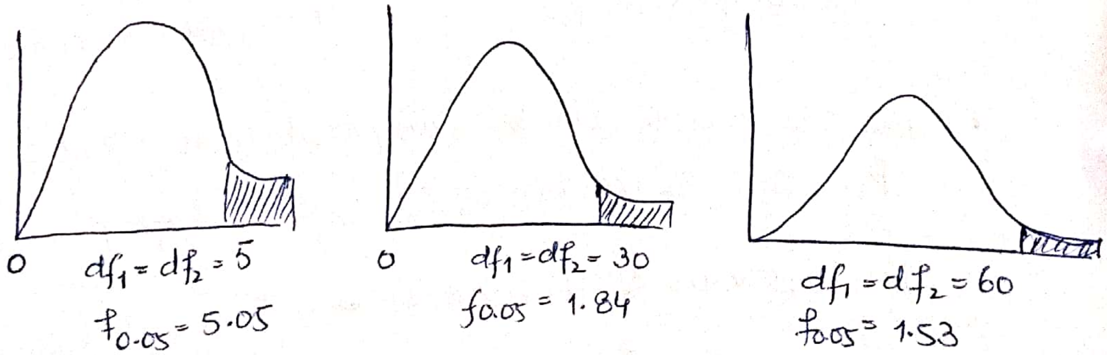
F-distribution curve for n-degree of freedom.

1:- F-distribution curve is skewed towards right with range 0 to ∞ and having a median value roughly = 1.0

2:- Value of F will always be more than 0.

3:- Shape of F-distribution curve is dependent
- dof of Numerator & dof of denominator

4: F-distribution curve is never symmetrical but if dof increases then it will be more similar to the symmetrical shape.



Degree of skewness decreases with increase in degree of Freedom (v) for numerator (v_1) & denominator (v_2).

6. Shape of the curve will be more symmetrical ~~by~~ with the increase in degree of freedom.

- In F-test variance will be compared from randomly drawn samples and the observations are dependent.

Q NO: 01 Given data

A: 16, 17, 25, 26, 32, 34, 38, 40, 42 $n = 9$

B: 14, 16, 24, 28, 32, 35, 37, 42, 43, 45, 47 $n = 11$

$$H_0 : \sigma_1^2 = \sigma_2^2 \quad ; \quad H_a : \sigma_1^2 > \sigma_2^2$$

$$F = s_1^2 / s_2^2 \quad , \quad s^2 = \frac{\Sigma (x-\bar{x})^2}{n-1}$$

As we studied above that s1^2 will be greater than s2^2 for F value greater than 0. so alternative hypothesis Ha= s1&2 > s2^2

A	$(x-\bar{x}_A)$	$(x-\bar{x}_A)^2$	B	$(x-\bar{x}_B)$	$(x-\bar{x}_B)^2$
16	-14	196	14	-19	361
17	-13	169	16	-17	289
25	-5	25	24	-9	81
26	-4	16	28	-5	25
32	2	4	32	-1	01
34	4	16	35	2	4
38	8	64	37	4	16
40	10	100	42	9	81
42	12	144	43	10	100
			45	12	144
			47	14	196

$\Sigma A = 270$ $\quad \Sigma(x-\bar{x}_A)^2 = 734$ $\quad \Sigma_B = 363$ $\quad \Sigma(x-\bar{x}_B)^2 = 1298$

$\bar{x}_A = 270/9 = 30$ $\quad \bar{x}_B = 363/11 = 33$

$S_2^2 = 734/_{9-1} = 91.75$ $\qquad S_1^2 = \frac{1298}{10} = 129.8$

$F = \frac{129.8}{91.75} = 1.4147$ (calculated F value)

Degree of freedom $(\nu) = ?$

$\nu_1 = 11 - 1 = 10$

$\nu_2 = 9 - 1 = 8$

$f_{0.05} = 3.35$ (Tabulated Value)

Calcullated f value < Tabulated f value.

Ho is correct & accepted. We can say that the two populations have same variance.

Q No: 02

Given data.

$n = 9$; $\Sigma(x-\bar{x})^2 = 64$ (sum of the squared deviation)

$n = 11$; $\Sigma(x-\bar{x})^2 = 88$

Hypothesis

$H_o : \sigma_1^2 = \sigma_2^2$; $H_a : \sigma_1^2 > \sigma_2^2$

$F = \frac{S_1^2}{S_2^2}$, $S_1^2 > S_2^2$

$S^2 = \frac{\Sigma(x-\bar{x})^2}{n-1}$ $\Rightarrow$ $S_2^2 = \frac{64}{9-1} = \frac{64}{8} = 8$

$S_1^2 = \frac{88}{11-1} = \frac{88}{10} = 8.8$

$F = \frac{8.8}{8} = 1.1$ (calculated F value)

Degree of freedom (ν) : ?

$\nu_1 = 10$ $\nu_2 = 8$

$F_{0.05} = 3.35$ (Tabulated F value)

∴ Ho is accepted. No significance in the variance.

QUESTION

Given data: $S_1^2 = 130$
$n_1 = 61$ (no; of women)
$S_2^2 = 70$
$n_2 = 31$ (no; of men)

Hypothesis :

$H_0 : \delta^2_{(women)} = \delta^2_{(men)}$

$H_a : \delta^2_{(women)} > \delta^2_{(men)}$

$F = S_1^2 / S_2^2 \Rightarrow F = 130/70 = 1.857$ (calculated F-value)

Degree of freedom (ν) = ?

$\nu_1 = n_1 - 1 = 60$

$\nu_2 = n_2 - 1 = 30$

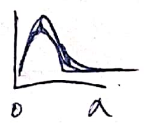
$F_{(0.05)} = 1.74$ (Tabulated value)

H_a is accepted & H_0 is rejected;

Hence, the result of the research support the belief that women have a greater variation in attitude towards political issues than men.

Properties :

1) Range: $0 \to \infty$



2) $\mu = \dfrac{v_1}{v_2 - 2}$ $\because v_2 > 2$

3) $\sigma^2 = \dfrac{2v_2^2(v_1+v_2-2)}{v_1(v_2-2)^2(v_2-4)}$ for $v_2 > 4$

4) Homogenity of several means.

5) Unimodel

6) Skewed to the right

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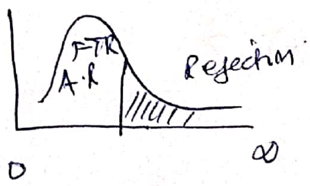

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