F-TEST ASSIGNMENT

① BANKER

Data on no. of transactions.

Hyd: 156, 278, 134, 202, 236, 198, 187, 199, 143, 165, 223

Mumbai: 345, 332, 309, 367, 338, 312, 355, 363, 381

Apply F-distribution to find out variance?

Solⁿ Hyd $n = 11$

Mum $n = 9$

$$F_{test} = \frac{S_1^2}{S_2^2} \quad \text{where } S_1^2 > S_2^2$$

$$\text{Variance } S^2 = \frac{\Sigma (x-\bar{x})^2}{n-1}$$

$$\bar{x} = \frac{\Sigma x_i}{n} = \frac{2121}{11} = 192.81$$

$$\bar{y} = \frac{\Sigma y_i}{n} = \frac{3102}{9} = 344.66$$

Hyd x	Mumbai y	$(x-\bar{x})$	$(x-\bar{x})^2$	$(y-\bar{y})$	$(y-\bar{y})^2$
156	345	-36.818	1355.57	0.33	0.111
278	332	85.181	7255.92	-12.66	160.44
134	309	-58.818	3459.57	-35.66	1272.11
202	367	9.181	84.305	22.33	498.77
236	338	43.181	1864.669	-6.66	44.44
198	312	5.181	26.85123	-32.66	1067.11
187	355	-5.818	33.8512	10.33	106.77
199	363	6.181	38.21	18.33	336.11
143	381	-49.818	2481.8	36.33	1320.11
165		-27.818	773.85		
223		30.181	910.94		

$$\Sigma (x-\bar{x})^2 = 17374.69$$

$$\Sigma (y-\bar{y})^2 = 3485.888$$

$$S_x^2 = \frac{\Sigma (x-\bar{x})^2}{n-1} = \frac{17374.69}{10} = 1737.46$$

$$S_y^2 = \frac{\Sigma (y-\bar{y})^2}{n-1} = \frac{3485.888}{8} = 435.736$$

$$F_{test} = \frac{S_x^2}{S_y^2} = \frac{1737.46}{435.736} = 3.9874$$

$df(\nu_1) = 11 - 1 = 10$

$df(\nu_2) = 9 - 1 = 8$

$F_{test}\ (df = 10,\ df = 8) = 3.35$

As $F\text{-test} = 3.35 < F_{calc} = 3.98$, hence we reject H_0.

So, the no of customers in her new branch is more variable than the no of customers she used to work.

PRODUCTION LINES.

② Let $\mu_1 = \mu_2 = \mu_3$ be the mean of the 3 production lines. Please test the hypothesis $\alpha = 0.05$.

Step 1 $H_0 : \mu_1 = \mu_2 = \mu_3$

H_1 : Not all μ_s are equal.

Step-2 $\alpha = 0.05$

Step-3 df $n = 6$ $N = 18$

$df_{between} = a - 1 = 3 - 1 = 2$

$df_{within} = N - a = 18 - 3 = 15$

$df_{Total} = N - 1 = 18 - 1 = 17$

Step-4 $F_{critical}\ (df_1 = 2, df_2 = 15) = 3.68$.

Step-5

	Line 1	Line 2	Line 3.
	210	180	145
	215	160	170
	205	195	165
	180	190	160
	175	170	155
	190	155	175
Total	1175	1050	970
Mean	195.83	175	161.66

$$SS_{between} = \sum \frac{(\sum a_i)^2}{n} - \frac{T^2}{N}$$

$$= \frac{1175^2 + 1050^2 + 970^2}{6} - \frac{(1175 + 1050 + 970)^2}{18}$$

$$= 570670.88 - 567112.5$$

$$= 3558.33$$

$$SS_{within} = \sum Y^2 - \sum \frac{(\sum a_i)^2}{n}$$

$= $ Sum of sq of all nos $- 570670.83$

$= 573925 - 570670.83$

$= 3254.16667$.

$$F_{calc} = \frac{MS_{bet}}{MS_{with}} = \frac{SS_{bet}/df_{bet}}{SS_{with}/df_{with}} = \frac{3558.33/2}{3254.166/15} = \frac{1779.16}{216.94}$$

$= 8.2010$

$F_{critical} (df = 2, df = 15) = 3.68$

As $F_{calc} > F_{crit}$, hence we reject H_0.

③ POPULATION - MEN & WOMEN

Randomly select 7 women & 12 men from a population of women & men. Table shows the SD of in each sample and in each population.

Pop	Men	Women
Pop SD (σ)	50	30
Sample SD (S_d)	45	35

Compute f-statistic.

S_d = sample SD ; σ = pop SD.

$$f \text{ statistic} = \frac{S_1^2/\sigma_1^2}{S_2^2/\sigma_2^2}$$

Considering women's data in numerator

$$f_{stat} = \frac{35^2/30^2}{45^2/50^2} = \frac{1225/900}{2025/2500} = 1.68$$

df for $v_1 = 7 - 1 = 6$

$v_2 = 12 - 1 = 11$

Considering men's data in numerator,

$$f_{stat} = \frac{45^2/50^2}{35^2/30^2} = \frac{2025/2500}{1225/900} = \frac{0.81}{1.361} = 0.59$$

df $v_1 = 12 - 1 = 11$

$v_2 = 7 - 1 = 6.$

3.09
1.68
1.41

④ Cumulative probability.

From the F distribution calculator, the cumulative probability for $f_{stat} = 1.68$, $v_1 = 6$, $v_2 = 11$ is 0.78.

Also, CP = 0.22 if $F_{stat} = 0.59$, $v_1 = 11$, $v_2 = 6$

(5) HIGHWAY GAS MILEAGE

Summary of highway gas mileage for several observations, to decide if the average highway gas mileage is same for midsize cars, SUV's & pick up trucks. Test the appropriate hypothesis at $\alpha = 0.01$ level.

	N	Mean	Std Dev.
Midsize	31	25.8	2.56
SUV's	31	22.68	3.67
Pickups	14	21.29	2.76
	76		

Sol^n Step-1 $H_0 : \mu_1 = \mu_2 = \mu_3$

H_1 : Not all means are equal.

Step-2 $\alpha = 0.01$

Step-3 $df_{between} = a-1 = 3-1 = 2$

$df_{within} = N - a = 76 - 3 = 73.$

Step-4 For $\alpha = 0.01$, $d\nu_1 = 2$ & $\nu_2 = 73$,

$F_{critical} =$

	Count	Sum	Avg.	SD	Var
Midsize	31	$25.8 \times 31 = 799.8$	25.8	2.56	6.55
SUV	31	703.08	22.68	3.67	13.46
Pickup	14	298.06	21.29	2.76	7.61

$$SS_{between} = \frac{\Sigma (\Sigma a_i)^2}{n} - \frac{T^2}{N}$$

$$= \frac{799.8^2 + 703.08^2 + 298.06^2}{} - 44429.92$$

$$= 1,22,2,841.29$$