THE COMPLETE RANDOMIZED BLOCK DESIGN

The completely Randomized Design

A	B	C
470	520	610
510	570	550
540	530	620
560		590
580		

$SStot = SST + SSE \Rightarrow$

$\Rightarrow SSE = SStot - SST$

$SSTot = SST + SSB + SSE \Rightarrow$

$\Rightarrow SSE = SSTot - SST - SSB$

Driver	A	B	C		
1	470	510	520	$B_1 = 1500$	$\bar{x}_{B_1} = 500$
2	530	540	550	$B_2 = 1620$	$\bar{x}_{B_2} = 540$
3	560	570	580	$B_3 = 1710$	$\bar{x}_{B_3} = 570$
4	590	610	620	$B_4 = 1820$	$\bar{x}_{B_4} = 606.7$
	T_1	T_2	T_3		
	2150	2230	2270		
	$\bar{x}_{T_1}$	$\bar{x}_{T_2}$	$\bar{x}_{T_3}$		
	537.50	557.50	567.50		

$\bar{\bar{x}} = 554.17$

Step 1 $H_0: \mu_{T_1} = \mu_{T_2} = \mu_{T_3}$

H_a: At least two treatment means differ

Step 2 Test statistic $F = \dfrac{MST}{MSE}$

$$SST = \sum_{i=1}^{k} b(\bar{x}_{T_i} - \bar{x})^2 = \sum_{i=1}^{3} 4(\bar{x}_{T_i} - \bar{x})^2 =$$

$$= 4(\bar{x}_{T_1} - \bar{x})^2 + 4(\bar{x}_{T_2} - \bar{x})^2 + 4(\bar{x}_{T_3} - \bar{x})^2$$

$$= 4(537.5 - 554.17)^2 + 4(557.5 - 554.17)^2 + 4(567.5 - 554.17)^2$$

$$= 1,866.67$$

$$SSB = \sum_{i=1}^{b} k(\bar{x}_{B_i} - \bar{x})^2 = \sum_{i=1}^{4} 3(\bar{x}_{B_i} - \bar{x})^2 =$$

$$= 3(\bar{x}_{B_1} - \bar{x})^2 + 3(\bar{x}_{B_2} - \bar{x})^2 + 3(\bar{x}_{B_3} - \bar{x})^2 + 3(\bar{x}_{B_4} - \bar{x})^2 =$$

$$= 3(500 - 554.17)^2 + 3(540 - 554.17)^2 + 3(570 - 554.17)^2 +$$

$$+ 3(606.7 - 554.17)^2 = 18,425$$

$$SST_{OT} = \sum_{i=1}^{n} (x_i - \bar{x})^2 = \sum_{i=1}^{12} (x_i - \bar{x})^2$$

$$= (470 - 554.17)^2 + \cdots + (620 - 554.17)^2 = 20,691.67$$

$$SSTot = SST + SSB + SSE \Rightarrow \boxed{SSE = SST_{ot} - SST - SSB}$$

$$SSE = 20,691.67 - 1,866.67 - 18,425 = 400$$

$$MST = \frac{SST}{k-1} = \frac{1866.67}{3-1} = 933.34$$

$$MSE = \frac{SSE}{n-1-(k-1)-(b-1)} = \frac{SSE}{n-b-k+1} = \frac{400}{6} = 66.67$$

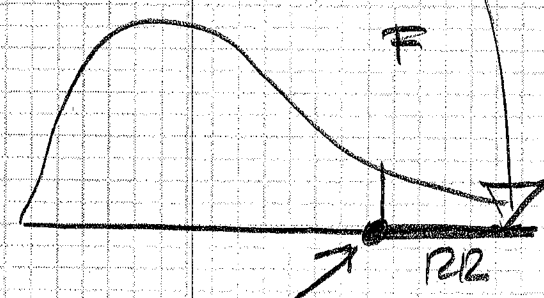
$$F = \frac{MST}{MSE} = \frac{933.34}{66.67} = 14$$

Step 3 Rejection Region

$\alpha = .05$

$df_{num} = v_1 = k-1 = 2$

$df_{denom} = v_2 = 6$



C.V. = 5.14

RR: $F > 5.14$

Step 4 Decision

Reject H_0

Step 5 Conclusion

"The data provide sufficient evidence to conclude that at least two gasoline brands differ in the mean miles per gallon, at $\alpha = .05$"