The parameter :-

$t=7,\ b=7,\ r=3,\ K=3$

$\lambda =$ no of blocks in which a pair of treatment occurs together.

$$\lambda = \frac{r(K-1)}{t-1} \Rightarrow \frac{3(3-1)}{7-1} = \frac{6}{6} = 1$$

Hypothesis :-

H_0^1 :

H_1^1 :

H_0^2 :

H_1^2 :

$$CF = \frac{G^2}{n} = \frac{Y_{..}^2}{bK} \Rightarrow \frac{(2715)^2}{7 \times 3} = \frac{7371225}{21}$$

$CF = 351010.7143$

Total sum of squares TSS

$$TSS = \sum_i \sum_j Y_{ij}^2 - CF$$

$= 353611 - 351010.7143$

$TSS = 2600.2857$

Blocks s.s (unadjusted)

$$BSS = \frac{\sum Y_{.j}^2}{K} - CF$$

$$= \frac{1056375}{3} - CF$$

BSS = ~~3~~ 1114.2857 //.

Adjusted treatment totals

$$Q_i = Y_{i.} - \frac{1}{K}\left(\sum_{j=1}^{b} I_{ij} Y_{.j}\right)$$

where $I_{ij} = \begin{cases} 1, & \text{if } i^{th} \text{ treatment appears in } j^{th} \text{ block} \\ 0, & \text{otherwise} \end{cases}$

$$Q_1 = 351 - \frac{1}{3}(1 \times 381 + 381 + 378)$$

$$Q = -29$$

$$Q_2 = 365 - \frac{1}{3}(1 \times 381 + 402 + 372)$$

$$Q_2 = -20$$

$$Q_3 = 388 - \frac{1}{3}(1 \times 402 + 366 + 378)$$

$$= 6$$

$$Q_4 = 419 - \frac{1}{3}(1 \times 381 + 366 + 435)$$

$$Q_4 = 25$$

$$Q_5 = 438 - \frac{1}{3}(1 \times 402 + 435 + 381)$$

$$Q_5 = 32$$

$Q_6 = 361 - \frac{1}{3}(1 \times 366 + 381 + 372)$

$Q_6 = -12$

$Q_7 = -2$

$\therefore$ adjusted treatments

$Tr.ss\ adj = \frac{K \sum Q_i^2}{\lambda t}$

$= \frac{3 \times 2963074}{1 \times 7}$

$= \frac{888}{7} = 1317.43$

unadjusted T.SS. $= \frac{\sum Y_{i.}^2}{r} - CF$

$= \frac{1059145}{3} - 35100.7143$

unadjusted TSS $= 2037.6190$

ESS = TSS − BSS(unadjusted) − Trss (adjusted)

$= 2600.2857 - 1114.2857 - 1317.43$

ESS $= 168.58$

ANOVA.

	d.f	S.S	MSS	F-ratio
...ment (...st)	t−1=6	1317.43	219.571	10.4197
...k (...S)	b−1=6	1114.2857	185.7142	8.0

$(bk-1)-(t-1)-(b-1)=8$ $\quad 168.58 \quad 21.0725$

$bk-1=20$ $\quad 2600.2857 \quad 130.0142$

$F_{cal} > F_{(0.05)}(6,8)$

$F_{cal} > \cancel{10.4197}\ 3.58$

$10.4197 \geq 3.58$

$\therefore$ we reject H_0, since all concentration are not same.

$BSS(adj) = Trss(adj) + BSS(unadjusted) - Trss(unadj) = 394.0967$

ANOVA.

S.V	d.f	S.S	MSS	F-ratio
Treat (adj)	6	2037.6190	339.6031	
(unadj)	6	394.08	65.68	3.11
Error	8	168.58	21.0725	
Total	20	2600.2857	130.014	

$F_{cal} > F_{0.05}(6,8)$

$F_{cal} > 3.58$

$3.11 < 3.58$

$\therefore$ we donot reject H_0.

$\therefore$ all days are same.

H_0^1: all concentration (treatments) are same

H_1^1: all concentration are not same.

H_0^2: all days (blocks) are same

H_1^2: all days (blocks) are not same

(iv) $S.E(\hat{\alpha}_i - \hat{\alpha}_j) = \sqrt{\dfrac{2k\hat{\sigma}^2}{\lambda t}} = \sqrt{\dfrac{2K\, MSSE}{\lambda t}}$

i – bl...
k = tr...s.

$$\sqrt{\frac{2 \times 3 \times 21.0725}{1 \times 7}} = \sqrt{18.0621}$$

$$S.E(\hat{\alpha}_i - \hat{\alpha}_{i'}) = 4.2$$

(3). Model :-

$$y_{ijk} = \mu + \alpha_i + \beta_j + \delta_k$$

where, $\alpha_i =$, $\beta_j =$)

$i = 1, ---, t$
$j = 1, ---, b$
$k = 1, ---, r$

Assumptions:-

i) α_i's, β_j's & δ_k's are fixed effect
ii) $\epsilon_{ijk} \overset{iid}{\sim} N(0, \sigma^2)$

Hypothesis :-

H_0^1 ; The four manorial treatment are same
H_1 ; The four manorial treatment are not same.

H_0^2
H_1^2 ;

$$\lambda = \frac{r(k-1)}{t-1} = \frac{3(3-1)}{4-1} = \frac{6}{3} = 2$$

H_0^3
H_1^3 ;

$t = 4$, $b = 4$, $r = 3$, $K = 3$, $n = b \times k = 12$

Treatm.

	A	B	C	D
	432	442	540	340
	468	490	562	384
	568	584	556	526
$y_{i..}$	1468	1516	1658	1250

$$CF = \frac{G^2}{n} = \frac{34715664}{12} = 2892972$$

$$TSS = \Sigma\Sigma y_{ijk}^2 - CF$$

$$= 2961104 - CF$$

$$TSS = 68132.$$

~~BSS(~~ $RSS = \frac{\Sigma y_{..k}^2}{b} - CF$

$$RSS = 30150$$

$$BSS(unadj) = \frac{\Sigma y_{.j.}^2}{k} - CF$$

$$BSS(un) = 11150.666$$

1445.333

adjusted treatment totals

$$Q_i = y_{i..} - \frac{\Sigma n_{ij} y_{.j.}}{K} \quad , i=1,---,t$$

where $n_{ij} = \begin{cases} 1, & \text{if } i^{th} \text{ treatment appears in block } j \\ 0, & \text{o.w} \end{cases}$

$$Q_1 = 1468 - \left(\frac{1372 + 1572 + 1392}{3}\right)$$

$Q_1 = 22.67$

$Q_2 = 9.33$

$$Q_3 = 1658 - \frac{(1372+1562+1556)}{3}$$

$Q_3 = 158$

$$Q_4 = 1250 - \frac{(1372+1556+1392)}{3}$$

$Q_4 = -190$

adjusted Tr. ss is,

$$Trss(adj) = \frac{k}{\lambda t} \sum_{i=1}^{t} Q_i^2$$

$$= \frac{3}{2 \times 4} \times 61664.9778$$

$Trss(adj) = 23124.3666$

$$ESS = TSS - \underset{unadj}{(BSS)} - \underset{(adj)}{Tr.ss} - RSS.$$

$= 68132 - 11150.666 - 23124.366 - 30150$

$ESS = 3706.974$

ANOVA.

~~Total~~ SV	d.f	S.S.	MSS.	F ratio
Treat (adj)	4-1=3	23124.366	7708.122	6.23
Row	3-1=2	30150	15075	
Block (und	4-1=3	11150.66	3716.88	
Error	(3+2+3-11) = 3	3706.974	1235.658	
Total	n-1=12-1 11	68132		

$F_{cal} \geq F_{\alpha}(3,3)$

$6.23 \geq 9.28$

$\therefore$ we donot reject H_0.

The ~~ws~~ four manorial treatments are same.

(iii) $S.E(\hat{\alpha}_i - \hat{\alpha}_j) = \sqrt{\frac{2K\,MSSE}{\lambda t}}$

$= \sqrt{\frac{2 \times 3 \times \cancel{7708.122}\ 1235.658}{2 \times 4}}$

$= \cancel{\sqrt{5781.0915}}\ \sqrt{926.7435}$

$S.E(\hat{\alpha}_i - \hat{\alpha}_j) = 30.44$ //.

(2) ANOVA TABLE

S.V.	d.f.	S.S	M.SS	F value	P-value
Treat	4	7.6133	1.9033	3.1263	0.04445
Block	9	3.5124	0.39027	0.6410	0.74734
Residuals	16	9.7409	0.60881		

Hypothesis

H_0 : Treatment effects are same V/S

H_1 : Treatment effects are not same.

conclusion :- $F_1 = 3.1263$

$F_1 \geq F_{cal}$

$3.1263 \geq F_\alpha(4,16)$

$3.1263 \geq 3.01$

Hence we reject H_0, Hence all the treatment effect are not same.

$F_\alpha \geq F_{cal}$

$0.6410 \geq F(9,16)$

$0.6410 \geq 2.54$

we do not reject H_0, Hence all the treatment effect are same.

P – 4

(1)
(i) the model is

$$y_{ij} = \mu + \alpha_i + \beta(x_{ij} - \bar{x}_{..}) + \varepsilon_{ij} \quad , i = 1, \ldots, t \quad j = 1, \ldots, r$$

where

y_{ij} :- value of observation for the jth response variable for the ith treatment

μ :- overall mean.

α_i :- ith Treatment effect

β :- linear regression coefficient of Y on X

x_{ij} :- jth observation on the covariate for the ith treatment.

$\bar{x}_{..}$:- sample mean of x observation

ε_{ij} :- random errors.

Assumptions

$\varepsilon_{ij} \sim N(0, \sigma^2)$

$\sum \alpha_i = 0$

Calculation:

$r = 5,\ t = 3,\ n = r \times t = 5 \times 3 = 15$

$X_{..} = 185 \qquad Y_{..} = 714.9$

$$C.F_{XX} = \frac{X_{..}^2}{n} = \frac{185^2}{15} = 2281.666$$

$$CF_{YY} = \frac{Y_{..}^2}{n} = \frac{714.9^2}{15} = 34072.134$$

$$CF_{XY} = \frac{X_{..}Y_{..}}{n} = \frac{185 \times 714.9}{15} = 8817.1$$

$$TSS_{XX} = \sum\sum X_{ij}^2 - CF_{XX} = 2317 - 2281.666$$

$$TSS_{XX} = 35.334$$

$$TSS_{YY} = \sum\sum Y_{ij}^2 - CF_{YY} =$$

$$TSS_{YY} = 49.296$$

$$TSS_{XY} = \sum\sum X_{ij} Y_{ij} - CF_{XY}$$

$$= 8783.4 - CF_{XY} = -33.7$$

$$Tr.SS_{YY} = \frac{\sum Y_{ij}^2}{t} - CF_{YY} =$$

$$= \frac{102263.52}{3} - 34072.134 = 15.706$$

$$Tr.SS_{xx} = \frac{\Sigma x_{i.}^2}{r} - CF_{xx}$$
$$= \frac{11427}{5} - 2281.666$$
$$= \cancel{1527.334}\ 3.734$$
$$Tr.SS_{xy} = \frac{\Sigma x_{i.} y_{i.}}{r} - CF_{xy}$$
$$= \frac{44056.3}{5} - CF_{xy}$$
$$= -5.84.$$
$$E_{yy} = TSS_{yy} - Tr.SS_{yy}$$
$$= 49.296 - 15.706$$
$$= 33.159$$
$$E_{xx} = TSS_{xx} - Tr.SS_{xx}$$
$$= 35.334 - 3.734$$
$$= 31.6$$
$$E_{xy} = TSS_{xy} - Tr.S_{xy}$$
$$= -33.7 - (-5.84)$$
$$= -27.86$$

(ii). Hypothesis

$H_0 : \beta = 0$ v/s $H_1 : \beta \neq 0$

H_0: there is no effect of covariate.

H_1: the effect of covariate is there

$$SSE = E_{yy} - \frac{E_{xy}^2}{E_{xx}} \Rightarrow 33.159 - \frac{(-27.86)^2}{31.6}$$

$$= 33.15 - 24.5626$$

$$SSE = 8.5874$$

$$MSE = \frac{SSE}{n-t-1} = \frac{8.5874}{15-3-1} = 0.78$$

$$F_{cal} = \frac{E_{xy}^2 / E_{xx}}{MSE} \sim F_{(B, n-t-1)}$$

$$= \frac{24.5626}{0.78} \sim F^{(0.05)}_{(1,11)}$$

$$= 31.49$$

$$\therefore F^{(0.05)}_{(1,11)} = 4.84$$

$$\therefore F_{cal} > F_{tab}$$

Conclusion $31.49 > 4.84$

$\therefore$ we reject H_0

$\therefore$ the effect of covariate is there.

(ii) $H_0: \alpha_1 = 0 \quad \forall i$

~~H_0 the glue formulations are~~ not significant.

H_0: there is no significant difference in the glue formation.

$H_1: \alpha_1 \neq 0$

there is a significant difference in glue formation.

$T_{SSS} = SSE - SSE$

$$SSE' = TSS_{YY} - \frac{TSS_{XY}^2}{TSS_{XX}}$$

$$= 49.296 - \frac{(-33.7)^2}{35.334}$$

$$= 49.296 - 32.1415$$

$$SSE' = 17.1545$$

$$F_0 \frac{(SSE' - SSE)/t-1}{MSSE} \sim F_{(t-1, n-t-1)}$$

$$F_0 = \frac{(17.1545 - 8.5874)/3-1}{0.78}$$

$$F_0 = \frac{4.28355}{0.78} = 5.491$$

$F_{(t-1, n-t-1)} \Rightarrow F_{(3-1, 15-3-1)} \Rightarrow F_{(2,11)} = 3.98$

~~ANOVA Table~~

$\therefore F_{cal} > F_{tab}$

$\therefore 5.491 > 3.98$

$\therefore$ we reject H_0

$\therefore$ there is a significant difference in glue formation

S.V.

~~Treatm~~

Treatm

Error

Total

dof tre

(PV

ANCOVA Table.

S.V.	Sum of Squares & Cross products x	xy	y	d.f	Adjusted treatment SS for Regression S.S	MSS	F_{cal}
Treatment	$T_{xx}=3.734$	-5.84	15.706	.			
Error	$E_{xx}=31.6$	-27.86	33.15	$n-t-1=11$	$SSE = 8.5874$	0.78	
Total	$T_{SS}=35.334$	-33.7	49.296	$n-2=13$	$SSE' = 17.1545$		$F_0 = 5.49$
Treatment				$t-1=2$	$Tr.SS = SSE' - SSE$ 4.28355		

(iv) SE of adj $(\bar{y}_{i.} - \bar{y}_{j.}) = \sqrt{MSE\left(\frac{2}{r} + \frac{\bar{x}_{i.} - \bar{x}_{j.}}{E_{xx}}\right)}$

$\bar{x}_{1.} \to$ 1 treatment mean.

$\bar{x}_{j.} \to$ 2 treatment mean. 0.67

$$= \sqrt{MSE\left(\frac{2}{5} + \frac{6}{31.6}\right)}$$

$$= 0.68$$

(d). The linear model is,

$$Y_{ij} = \mu + \alpha_i + \xi_j + \beta(x_{ij} - \bar{x}_{..}) + \varepsilon_{ij}$$

$$i = 1, \ldots, t$$

$$j = 1, \ldots, b$$

where, $Y_{ij} =$, $\mu =$, $\alpha_i =$, $\xi_j =$, $\beta =$, $\varepsilon_{ij} =$

Hypothesis.

$H_0 : \beta = 0 \quad v/s \quad H_1 : \beta \neq 0$

~~Yob~~ $\omega r \cdot t = 3,\ b = 4,\ n = tb = 12.$

$$CF_{xx} = \frac{X_{..}^2}{n} = \frac{290^2}{12} = 7008.33$$

$$CF_{yy} = \frac{Y_{..}^2}{n} = \frac{483^2}{12} = \frac{233289}{12} = 19440.75$$

$$CF_{xy} = \frac{X_{..}Y_{..}}{n} = \frac{290 \times 483}{12} = \cancel{995.75}\ 11672.5$$

$$TSS_{xx} = \sum\sum X_{ij}^2 - CF_{xx}$$

$$= 7262 - CF_{xx} = 253.67$$

$$TSS_{yy} = \sum\sum Y_{ij}^2 - CF_{yy}$$

$$TSS_{yy} = 19781 - 19440.75 = 340.25$$

$$TSS_{xy} = \sum\sum X_{ij} Y_{ij} - CF_{xy}$$

$$= 11949 - 11672.5$$

$$TSS_{xy} = 276.5$$

$$Tr_{yy} = \frac{\sum Y_{i.}^2}{b} - CF_{yy}$$

$$= \frac{78597}{4} - 19440.75$$

$$= 19649.25 - 19440.75$$

$$Tr_{yy} = 208.5$$

$$Tr_{xx} = \frac{\sum X_{i.}^2}{b} - CF_{xx} \Rightarrow$$

$$Tr_{xx} = \frac{28468}{4} - CF_{xx} = 7117 - CF_{xx} = 108.67$$

$$Tr_{xy} = \frac{\Sigma X_{i\cdot} Y_{i\cdot}}{b} - CF_{xy} = \frac{47292}{4} - CF_{xy}$$

$$Tr_{xy} = 11823 - CF_{xy} \Rightarrow 150.5$$

$$B_{yy} = \frac{\Sigma Y_{\cdot j}^2}{t} - CF_{yy} = \frac{58463}{3} - CF_{yy}$$

$$= 19487.666 - CF_{yy}$$

$$B_{yy} = 46.9166$$

$$B_{xx} = \frac{\Sigma X_{\cdot j}^2}{t} - CF_{xx} = \frac{21146}{3} - CF_{xx} = 40.33$$

$$B_{xy} = \frac{\Sigma X_{\cdot j} Y_{\cdot j}}{t} - CF_{xy}$$

$$= \frac{35140}{3} - 11672.5 = 11713.33 - CF_{xy}$$

$$B_{xy} = 40.833$$

$$E_{yy} = TSS_{yy} - TrSS_{yy} - B_{yy}$$

$$= 340.25 - 208.5 - 46.9166$$

$$= 84.8334$$

$$E_{xx} = TSS_{xx} - TrSS_{xx} - B_{xx}$$

$$= 253.67 - 108.67 - 40.33$$

$$= 104.67$$

$$E_{xy} = TSS_{xy} - TrSS_{xy} - B_{xy}$$

$$= 276.5 - 150.5 - 40.833$$

$$= 85.167$$

$$\hat{\beta} = \frac{E_{xy}}{E_{xx}} = \frac{85.167}{104.67} = 0.8136$$

P-2

the model.,

$$y_{ij} = \mu + \alpha_i + \beta_j + \varepsilon_{ij} \qquad i = 1, \ldots t$$
$$j = 1, \ldots b$$

$\alpha_i =$, $\beta_j =$, ε_{ij}

assumptions

— u —

hypothesis :-

$H_0^1 = \alpha_1 = \alpha_2 = \ldots = \alpha_t = 0$ (overall)

$H_1^1 =$

$H_0^2 = \beta_1 = \beta_2 = \ldots = \beta_b = 0$

$H_1^2 =$

estimate the missing observation

$$\hat{y}_{ij} = \frac{t\,y'_{i.} + b\,y'_{.j} - y'_{..}}{(b-1)(t-1)}$$

where,

$y'_{i.}$ = sum of known observations for i^{th}.

$y'_{.j}$ = sum of known observation for j^{th}.

$y_{..}$ = sum of all known observations

Given, $b = 4$, $t = 3$

$$\hat{y}_{22} = \frac{3(109.4) + 4(58.7) - 377}{3 \times 2}$$

1
2
3
4
Y_{ij}

$$\hat{y}'_{22} = \frac{186}{6}$$

$$\hat{y}'_{22} = 31$$

	A	B	C	$Y_{i.}$
1	32.4	35.6	38.7	106.7
2	28.8	31	29.9	89.7
3	36.5	37.6	29.1	103.2
4	34.4	36.2	37.8	108.4
$Y_{.j}$	132.1	140.4	135.5	

$$C.F = \frac{Y_{..}^2}{b \times t} = \frac{(408)^2}{4 \times 3} = \frac{166464}{12} = 13872$$

$$SST_r = \frac{\sum Y_{i.}^2}{b} - CF$$

$$= \frac{132.1^2 + 140.4^2 + 135.5^2}{4} - CF$$

$$= 13880.705 - 13872$$

$$SST_r = 8.705$$

$$SSB = \frac{\sum Y_{.j}^2}{t} - CF$$

$$= \frac{(106.7^2 + 89.7^2 + \dots 108.4^2)}{3} - CF$$

TSS =

$= 13943.9266 - 13872$

$SSB = 71.926$

$SST = \sum_i \sum_j y_{ij}^2 - CF$

$= 14014.72 - 13872$

$SST = 142.72$

$SSE = TSS - (SST_r + SSB)$

$= 142.72 - 8.705 - 71.926$

$SSE = 62.089$

ANOVA TABLE

SV	d.f	S.S.	MSS	F-ratio
Treatmt	$t-1 = 82$	8.705	4.3525	0.3505
Block	$b-1 = 3$	71.926	23.9753	1.93072.
Error	$(t-1)(b-1)-1 = 5$	62.089	12.4178	
Total	$bt-2 = 10$	142.72	14.272.	

For treatmt :- $F_{0.05}(2,5)$

$F_{cal} \geq F_{0.05}(2,5)$

$0.3505 \geq 5.79.$

$\therefore$ we donit reject H_0 for treatment

Hence α_i's dont differ. significantly

[illegible]

Standard error of difference [illegible]

$SE(\bar{y}_A - \bar{y}_B) = $ [illegible]

$SE(\bar{y}_A - \bar{y}_B) = $ [illegible]

Stand error of difference [illegible]

$SE(\bar{y}_A - \bar{y}_C) = $ [illegible]

$SE(\bar{y}_A - \bar{y}_C) = $ [illegible]

$d^3(r-1)$

$= \frac{(3.86)^2}{d^3(r-1)} = \cdot$

T.S =

$\lambda = \frac{r(k-1)}{(t-1)}$ $\lambda = \frac{r(k-1)}{(k-1)}$

(2). LSD.

the missing observations.

$$y_{ijk} = \frac{m(y'_{i..} + y'_{.j.} + y'_{..k}) - 2(y'_{...} + \text{initial estimate})}{(m-1)(m-2)}$$

$$y^{(0)} = \frac{\sum y'_{i..}}{m-1}$$

A	B	C	D	E	F
92	220	160	149	282	98
74	213.15	228	168	238	282
119.5	176	279	188	278	118
64	222	213	104	295	163
66	188	187	90	242	96
124	109	195	79	211	90
$y'_{i..}$ 420 (539.5)	915 (1128.15)	1262	778	1546	847

						$y'_{.j.}$
220	98	149	92	282	160	1001
74	238	213.15	228	282	168	990 (1203.15)
188	279	118	278	176	119.5	1039 (1158.5)
295	222	64	104	213	163	1061
187	90	242	96	66	188	869
90	124	195	109	79	211	808
$y'_{..k}$ 1054	1051	768 (811.15)	907	1098	890 (1009.5)	

For missing value of K,

$$\hat{y}'_{i,j,k.} = \frac{6(420+1039+\cancel{768}^{890}) - 2(5768+84)}{5\times4}$$

$$= \frac{\cancel{11362} - 11704}{20}$$

$$\hat{y}'_{i,j,k} = \cancel{82.9}\ \frac{2390}{20}$$

$\hat{y}'_{A36}$ $\hat{y}'_{i,j,k.} = 119.5$

$$y^{(0)} = \frac{\Sigma y'_{i..}}{m-1} = \frac{420}{5} = 84$$

For missing value of B,

$$\hat{y}_{ijk.} = \frac{6(915+768+990) - 2(5768+119.5)}{20}$$

$$= \frac{16038 - 11775}{20}$$

$\hat{y}_{B23} = 213.15$

A	B	C	D	E	F
92	220	160	149	2	

$$CF = \frac{y_{..}^2}{m^2} = \frac{(6100.65)^2}{6\times6} = 1033831.401$$

$$SST = \Sigma\Sigma\Sigma y^2_{ijk} - CF$$

$$= (220^2 + 98^2 + \cdots 211^2) - CF$$

$$= (461077.9225 + 472808.25 + 274693) - CF$$

$$= 1208579.173 - 1033831.401$$

$\wedge = \frac{0 \ldots}{(6-1)}$

$SST = 174747.7715$

$SSR = \frac{\sum y_{.j.}^2}{m} - CF$

$= \frac{6325439.173}{6} - CF$

$= 1054239.862 - 1033831.401$

$SSR = 20408.46108$

$SSc = \frac{\sum y_{..k}^2}{m} - CF$

$= \frac{6225515.573}{6} - CF$

$= 1037585.929 - CF$

$SSC = 3754.5277$

$SStr = \frac{\sum y_{i..}^2}{m} - CF$

$= \frac{6869235.673}{6} - CF$

$= 1144872.612 - 1033831.401$

$SSt_r = 111041.2111$

$SSE = SST - SSR - SSC - SSt_r$

$= 174747.7715 - 20408.46108 - 3754.5277$
$- 111041.2111$

$SSe = 39543.57162$

S.V
treatment
Row
column
Error
total

Re

Co

Ts

ii) Tr

wi

d

1. Eff
2.
3. Tre
det

$\overline{2^p(r-1)}$ =

$SS_{w/t} = \frac{(386)^2}{2^2(2-1)} = \cdot$

TSS =

d, lag=10, type="Ljung

test

resid

19.37, df = 10, p-value < 2.2e-16

SBBS

ANOVA TABLE

S.V	d.f	S.S	MSS	F ratio
treatment	$t-1=5$	111041.2111	22208.24222	70.20182
Row	$r-1=5$	20408.46108	4081.6922	12.9025
Column	$c-1=5$	3754.5277	750.90554	2.37366
Error	$(t-1)(r-1)(c-1)=125$	39543.57162	316.3485	
Total	$trc-2=214$	174747.7715	816.5783	

Row:- Since, $12.9025 > \cancel{8.75}$ 4.39, we ~~fail to~~ reject H_0,

Column:- Since, $2.373 < 4.39$ we don't reject H_0

Treatment:- Since, $70.2018 > 4.39$ we reject H_0.

P-3

Ji) The linear model

$$Y_{ij} = \mu + \alpha_i + \beta_j + \varepsilon_{ij} \qquad i=1,\dots,t$$
$$j=1,\dots,b$$

where,

Y_{ij}: observation for ith treatment in the jth block of it units.

$\alpha_i =$, $\beta_j =$, ε_{ij}

Assumption:- Same as RBD — " — ".

~~Hypothesis and parameters~~:-

1. ε_{ij}'s are iid random variables with $N(0,\sigma^2)$ dist^n
2. Treatment & block effects are fixed effects
3. All the observations are independent.

$\lambda = \frac{r(k-1)}{(t-1)}$ $\quad \lambda = \frac{r(t-1)}{(k-1)}$