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 : (10 6-10 1-5)

.	(1-5)	:	$a_1b_1c_1$
.	(6-10)	:	$a_1b_1c_2$
.	10	:	$a_1b_1c_3$
.	(1-5)	:	$a_1b_2c_1$
.	(6-10)	:	$a_1b_2c_2$
.	10	:	$a_1b_2c_3$
.	(1-5)	:	$a_2b_1c_1$

$$\begin{array}{rcl}
 & (6-10) & : a_2 b_1 c_2 \\
 & & . \\
 . & 10 & : a_2 b_1 c_3 \\
 . & (1-5) & : a_2 b_2 c_1 \\
 . & (6-10) & : a_2 b_2 c_2 \\
 . & 10 & : a_2 b_2 c_3
 \end{array}$$

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$$\begin{array}{rcl}
 A &) & \\
 B &) & (\quad a_2 \quad a_1 \\
 & b_2 & \quad b_1 \\
 & & C \quad) \quad (\\
 & c_3 \quad 6-10 & c_2 \quad 1-5 \quad c_1 \\
 & & (\quad 10 \\
 & -: & (\quad) \\
 & & (\quad) \\
 & & - \\
 & & - \\
 & & - \\
 & & -
 \end{array}$$

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$$y_{ijks} = \mu + R_s + A_i + B_j + C_k + AB_{ij} + AC_{ik} + BC_{jk} + ABC_{ijk} + e_{ijkl} \quad \begin{cases} i=1,2,\dots,a \\ j=1,2,\dots,b \\ k=1,2,\dots,c \\ s=1,2,\dots,r \end{cases} \dots(1)$$

$$\begin{array}{rcl}
 b & k & j & i & s & & : y_{ijks} \\
 & A & & & a & . & C & B & A
 \end{array}$$

blocks	3	$\frac{\sum Y_{i...}^2}{bcr} - \frac{(Y_{...})^2}{abcr}$		
(A)	$a-1=1$	$\frac{\sum Y_{.j..}^2}{acr} - \frac{(Y_{...})^2}{abcr}$		
(B)	$b-1=1$	$\frac{\sum Y_{..k.}^2}{abr} - \frac{(Y_{...})^2}{abcr}$		
(C)	$c-1=2$	$\frac{\sum Y_{ij..}^2}{cr} - \frac{\sum Y_{i...}^2}{bcr} - \frac{\sum Y_{.j..}^2}{acr} + \frac{(Y_{...})^2}{abcr}$		
$A \times B$		$\frac{\sum Y_{i.k.}^2}{br} - \frac{\sum Y_{i...}^2}{bcr} - \frac{\sum Y_{..k.}^2}{abr} + \frac{(Y_{...})^2}{abcr}$		
$A \times C$	$(a-1)(b-1)=1$	$\frac{\sum Y_{.jk.}^2}{ar} - \frac{\sum Y_{.j..}^2}{acr} - \frac{\sum Y_{..k.}^2}{abr} + \frac{(Y_{...})^2}{abcr}$		
$B \times C$	$(a-1)(c-1)=2$	$\frac{\sum Y_{ijk}^2}{r} - \frac{\sum Y_{ij.}^2}{cr} - \frac{\sum Y_{ik.}^2}{br} - \frac{\sum Y_{.jk.}^2}{ar} + \frac{\sum Y_{i...}^2}{bcr} + \frac{\sum Y_{.j..}^2}{acr} + \frac{\sum Y_{..k.}^2}{abr} - \frac{(Y_{...})^2}{abcr}$		
$A \times B \times C$	$(b-1)(c-1)=2$			
	$(a-1)(b-1)(c-1)=2$			
	$(abc-1)(r-1)=33$			

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	$\frac{abcr-1}{47}$	$\sum y_{ijk}^2 - \frac{(Y_{...})^2}{abcr}$		
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(SSR) shortest significant range

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$$LSR = \sqrt{\frac{MSE}{r}} SSR$$

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MSE

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LSR

LSR

LSR

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S.O.V.	D.F.	S.S.	M.S.	F
(A) (B) (C) $A \times B$ $A \times C$ $B \times C$ $A \times B \times C$	3	40.824	13.608	14.970**
	1	7.245	7.245	7.970**
	1	5.956	5.956	6.552**
	2	20.726	10.363	11.400**
	1	5.923	5.923	6.516**
	2	18.923	9.462	10.409**
	2	25.007	12.504	13.755**
	2	20.781	10.391	11.431**
	33	29.997	0.909	
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t_i	$\bar{Y}_i$	LSR	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$
		0.05	-	-	-	-	-	-	-	-	-	-	-
			4.	8.	8.	10	12	13.1	14.1	14	14	16	19
			0	1	7	.0	.2			.2	.3	.9	.3

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$a_1b_2c_3$	24 .5	1.62	20 .5 *	16 .4 *	15 .8 *	14 .5 *	12 .3 *	11.4 *	10.4 *	10 .3 *	10 .2 *	7. 6*	5. 2*
$a_1b_2c_2$	19 .3	1.61	15 .3 *	11 .2 *	10 .6 *	9. 3*	7. 1*	6.2*	5.2*	5. 1*	5. 0*	2. 4*	
$a_2b_2c_2$	16 .9	1.61	12 .9 *	8. 8*	8. 2*	6. 9*	4. 7*	3.8*	2.8*	2. 7*	2. 6*		
$a_2b_1c_3$	14 .3	1.60	13 .9 *	6. 2*	0. 6*	4. 3*	2. 1*	1.2	0.2	0. 1			
$a_2b_1c_2$	14 .2	1.58	10 .2 *	6. 1*	5. 5*	4. 2*	2. 0*	1.1	0.1				
$a_2b_2c_1$	14 .1	1.57	10 .1 *	6. 0*	5. 4*	4. 1*	1. 9*	1					
$a_1b_2c_1$	13 .1	1.55	9. 1*	5. 0*	4. 4*	3. 1*	0. 9						
$a_2b_1c_1$	12 .2	1.53	8. 2*	4. 1*	3. 5*	2. 2*							
$a_1b_1c_3$	10 .0	1.49	6. 0*	1. 9*	1. 3								
$a_1b_1c_2$	8. 7	1.45	4. 7*	0. 6									
$a_1b_1c_1$	8. 1	1.38	4. 1*										

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$a_2b_2c_2$

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$$. \quad a_1 b_2 c_1 \quad a_2 b_2 c_1 \quad a_2 b_1 c_2$$

(4)

S.O.V.	D.F.	S.S.	M.S.	F
()	3	29.215	9.738	14.981**
(A)	1	13.271	13.271	20.417**
(B)	1	11.302	11.302	17.388**
(C)	2	27.928	13.964	21.483**
	1	1.216	1.216	1.871
$A \times B$	2	28.290	14.145	21.762**
$A \times C$	2	0.911	8.956	0.701
$B \times C$	2	13.173	6.785	10.133**
$A \times B \times C$	33	21.450	0.650	
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t_i	$\bar{Y}_i$	LSR	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$
		0.05	-	-	-	-	-	-	-	-	-	-	-
			5.	8.	9.	11	12	13.3	13.5	14	14	15	19
			1	5	1	.2	.7			.3	.7	.4	.4
$a_1 b_2 c_2$	23	1.37	18	15	14	12	10	10.2	10.0	9.	8.	8.	4.

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	.5		.4 *	.0 *	.4 *	.3 *	.8 *	*	*	2*	8*	1*	1*
$a_1b_2c_3$	19 .4	1.37	14 .3 *	10 .9 *	10 .3 *	8. 2*	6. 7*	6.1*	5.9*	5. 1*	4. 7*	3. 98 *	
$a_2b_2c_2$	15 .4	1.36	10 .3 *	6. 9*	6. 3*	4. 2*	2. 7*	2.12 *	1.92 *	1. 12	0. 72		
$a_1b_2c_1$	14 .7	1.35	9. 6*	6. 2*	5. 6*	3. 5*	2. 0*	1.4*	1.2	0. 4			
$a_2b_1c_2$	14 .3	1.34	9. 2*	5. 8*	5. 2*	3. 1*	1. 6*	1.0	0.8				
$a_1b_1c_2$	13 .5	1.33	8. 4*	5. 0*	4. 4*	2. 3*	0. 8	0.2					
$a_2b_1c_3$	13 .3	1.31	8. 2*	4. 8*	4. 2*	2. 1*	0. 6						
$a_1b_1c_3$	12 .7	1.29	7. 6*	4. 2*	3. 6*	1. 5							
$a_1b_1c_1$	11 .2	1.26	6. 1*	2. 7*	2. 1*								
$a_2b_2c_1$	9. 1	1.23	4. 0*	0. 6									
$a_2b_1c_1$	8. 5	1.16	3. 4*										

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 $a_1b_2c_3$.
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 $a_2b_2c_2$
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S.O.V.	D.F.	S.S.	M.S.	F
() (A) (B) (C) $A \times B$ $A \times C$ $B \times C$ $A \times B \times C$	3	42.251	14.084	41.181**
	1	4.197	4.197	12.272**
	1	6.701	6.701	19.594**
	2	8.661	4.331	12.664**
	1	7.921	7.921	23.161**
	2	9.287	4.644	13.579**
	2	12.707	6.354	18.579**
	2	8.251	4.126	12.064**
	33	11.286	0.342	
	47			

0.01

.(7)

(7)

t_i	$\bar{Y}_i$	LSR 0.05	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$
			- 7. 0	- 7. 3	- 8. 2	- 9. 1	- 9. 2	- 13.2	- 15.7	- 17. 1	- 18. 2	- 18. 3	- 19. 2
$a_1 b_2 c_2$	19 .8	1.50	12 .8 *	18 .5 *	11 .6 *	10 .7 *	10 .6 *	6.6*	4.1*	2. 7*	1. 6*	1. 3	0. 6
$a_1 b_2 c_3$	19 .2	1.49	12 .2 *	11 .9 *	11 .0 *	10 .1 *	10 .0 *	6.0*	3.5*	2. 1*	1. 0	0. 9	

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$a_1b_2c_1$	18 .3	1.49	11 .3 *	11 .0 *	10 .1 *	9. 2*	9. 1*	5.1*	2.6*	1. 2	0. 1		
$a_2b_2c_2$	18 .2	1.48	11 .2 *	10 .9 *	10 .0 *	9. 1*	9. 0*	5.0*	2.5*	1. 1			
$a_2b_1c_3$	17 .1	1.46	10 .1 *	9. 8*	8. 9*	8. 0*	7. 9*	3.9*	1.4				
$a_1b_1c_2$	15 .7	1.45	8. 7*	8. 4*	7. 5*	6. 6*	6. 5*	2.5*					
$a_2b_2c_1$	13 .2	1.43	6. 2*	5. 9*	5. 0*	4. 1*	4. 0*						
$a_1b_1c_3$	9. 2	1.41	2. 2*	1. 9*	1. 0	0. 1							
$a_2b_1c_1$	9. 1	1.38	2. 1*	1. 8*	0. 9								
$a_1b_1c_1$	8. 2	1.34	1. 2	0. 9									
$a_2b_1c_2$	7. 3	1.27	0. 3										

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$a_1b_2c_3$

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$a_1b_2c_1$

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S.O.V.	D.F.	S.S.	M.S.	F
()	3			
	1	0.917	0.917	7.054**
	1	1.625	1.625	12.500**
(A)	2	3.296	1.648	12.677**

(B)	1	0.270	0.270	2.077**
	2	5.266	2.633	20.254**
(C)	2	2.613	1.307	10.054**
	2	2.891	1.446	11.119**
$A \times B$	33	31.209	0.130	
$A \times C$				
$B \times C$				
$A \times B \times C$				
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0.01

.(9)

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t_i	$\bar{Y}_i$	LSR 0.05	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$	$\bar{Y}_i$
			- 7. 9	- 8. 2	- 9. 3	- 10 .2	- 10 .3	- 11.3	- 13.7	- 14 .2	- 14 .9	- 15 .4	- 16 .9
$a_1b_2c_3$	17 .3	0.61	9. 4*	9. 1*	8. 0*	7. 1*	7. 0*	6.0*	3.6*	3. 1*	2. 4*	1. 9*	0. 4
$a_1b_1c_2$	16 .9	0.61	9. 0*	8. 7*	7. 6*	6. 7*	6. 6*	5.6*	3.2*	2. 7*	2. 0*	1. 5*	
$a_2b_2c_1$	15 .4	0.61	7. 5*	7. 2*	6. 1*	5. 2*	5. 1*	4.1*	1.7*	1. 2*	0. 5		
$a_2b_1c_3$	14 .9	0.60	7. 0*	6. 7*	5. 6*	4. 7*	4. 6*	3.6*	1.2*	0. 7*			
$a_1b_2c_2$	14 .2	0.60	6. 3*	6. 0*	4. 9*	4. 0*	3. 9*	2.9*	0.5				
$a_2b_1c_1$	13 .7	0.59	5. 8*	5. 5*	4. 4*	3. 5*	3. 4*	2.4*					
$a_1b_2c_1$	11 .3	0.59	3. 4*	3. 1*	2. 0*	1. 1*	1. 0*						
$a_1b_1c_1$	10 .3	0.58	2. 4	2. 1	1. 0	0. 1							

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$a_1b_1c_3$	10 .2	0.56	2. 3*	2. 0*	0. 9*								
$a_2b_2c_2$	9. 3	0.55	1. 4*	1. 1*									
$a_2b_1c_2$	8. 2	0.52	0. 3										

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0.195	16.9	62.5	444183	16.9
-0.3	17	46.5	674565	17
0.794	38.5	148.9	306087	38.5
-0.58	8.8	26.7	21996	8.8
0.78	9.4	79.2	53001	9.4
1.274	140.7	24.1	73737	140.7
4.371	143.1	149.3	41521	143.1
0.157	31.2	118.4	689470	31.2
1.052	16.9	114.5	383041	16.9
0.264	17.8	98.5	341946	17.8
0.951	30.6	102.6	551061	30.6
1.027	15.1	76	540528	15.1
0.248	26.1	52.4	372041	26.1
1.119	5.1	57	78529	5.1
1.684	6.8	42.4	152278	6.8
0.989	28.1	110	548931	28.1
-0.023	7.8	77.2	64052	7.8
1.979	4.7	28.7	56602	4.7
0.057	5.5	5.6	69546	5.5
1.079	27.4	84.4	783194	27.4
0.505	24.4	88.2	169922	24.4
-0.216	29.7	28.3	234720	29.7
-0.36	3.2	57.5	220374	3.2
1	27.7	77.4	101604	27.7
0.605	16.4	20.7	104461	16.4
-0.373	17.9	19	157532	17.9
0.953	142.6	50.4	365421	142.6
0.12	19.7	70	418001	19.7
-0.475	21.4	24.4	731571	21.4
-0.443	68.7	83	845795	68.7
0.94	17.5	29.2	35777	17.5
0.63	111.5	74.2	118769	111.5
-0.502	147.5	12	93519	147.5
-0.706	201.2	43.9	40320	201.2
-0.246	25.1	89.3	1725543	25.1
-0.155	25.8	96.7	964269	25.8
-0.013	240.7	97.2	976812	240.7
-0.176	47	84.7	1292242	47
-0.236	21.3	58.1	1180188	21.3
0.761	50.3	92.3	931573	50.3
-0.172	12.3	47.2	162079	12.3
-0.278	10.1	30.6	280442	10.1
-0.432	49.5	62.5	1320442	49.5
-0.64	12.1	27.8	90373	12.1
0.355	6.1	38.9	78696	6.1
0.143	4.7	6.4	114721	4.7
0.015	39.1	85.7	2680996	39.1
-0.278	35.6	63.7	384766	35.6
0.746	32.2	49.4	288449	32.2
-0.27	49.1	42	358412	49.1
-0.341	3.4	51	262106	3.4
0.725	13.5	35.7	156272	13.5
-0.105	25.7	17	218665	25.7
0.067	228.8	53.8	672698	228.8
-0.266	20	51.4	556285	20

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0.246	10	30.4	789501	10
-0.613	6.2	32.1	2169802	6.2
-0.983	61.7	0.5	36032	61.7
-0.171	249.6	61.5	171254	249.6
0.975	176.3	23.7	122595	176.3
-0.007	235.7	43.6	48084	235.7
-0.006	143.7	88.8	5145472	143.7
-0.256	45.9	71.9	1524565	45.9
0.034	0.9	100.5	2541349	0.9
-0.11	64.2	75.4	3177089	64.2
-0.485	34.9	29.9	1452600	34.9
-0.031	107.9	64	2653809	107.9
0.144	16.5	54	275754	16.5
-0.065	12.6	28.6	386006	12.6
-0.187	71.4	50.8	1690962	71.4
0.169	13.3	32.5	134207	13.3
-0.216	9.7	30.5	153368	9.7
-0.984	5.3	0.1	114098	5.3
5.299	37.5	539.8	4869502	37.5
0.137	52.7	72.4	1028617	52.7
-0.545	40.9	22.5	401114	40.9
0.25	59.3	52.5	394785	59.3
-0.053	50.5	48.3	557731	50.5
0.176	12.3	42	235364	12.3
-0.241	39.5	12.9	284295	39.5
-0.018	302.8	43.9	1153527	302.8