Yates Method for 2^2 factorial design experiment

Treatment combination (1)	Total from all replicates (2)	(3)	(4)	Effect total (5)
a&b	[a+b]	[(a+b)]−[1]+[b]	[(a+b)+[b]]−[[a]+[1]]	[a&b]

Yields (lbs per plot)

Block				
II	143	125	112	138
II	480	128	136	128
IV	129	120	130	120
V	134	131	124	128

Treatment combination

	I	II	III	IV		
(1)	−46	−33	80	−41	−90	1100
(a)	−34	77	−19	12	−44	16
(b)	−77	−10	−29	−45	−100	1900
(ab)	79	−9	11	55	124	5976
	−86	247	−77	11	80	
	664	5976	1289		

H_0: The data is homogeneous w.r.t the blocks & treatment

H_1: not H_0.

$RSS = \sum\sum Y_{ij}^2 = (-6)^2 + (-3)^2 + \dots (5)^2$

$= 36 + 9 + 0 + 1 + 16 + 49 + 81 + 4 + 49 + 121 + 81 + 25 +$
$\qquad\qquad 81 + 81 + 1 + 25$

$= 660$

$CF = \dfrac{G^2}{n} = 0$

$TSS = RSS - CF = 660 - 0 = 660$

$SSB = \dfrac{1}{4} \sum_j B_j^2 - CF$

$= \dfrac{1}{4}\left[64 + 576 + 289 + 1 \right] - 0$

$= \dfrac{930}{4} = 232.5$

$SST = \dfrac{1}{4}\left[100 + 16 + 100 + 576 \right] - CF$

$= \dfrac{1}{4}\left[\dfrac{792}{\cancel{720}} \right] - 0$

$= \cancel{197.5}\ 198$

$SSE = TSS - SSB - SST = 660 - 232.5 - 198 = 229.5$

As in each of the cases the computed value of F is less than the corresponding tabulated value then are no significant main or interaction effects present in the experiment. So, the blocks as well as treatments do not differ significantly.

YATES TABLE

	Total yield from all blocks	(3)	(4)	(5)
I	−110	−14	0 [I]	0/16 = 0
K	−4	14	−40 [K]	−40/16 = −1.00
P	−100	6	−28 [P]	−28/16 = −1.40
KP	−14	14	−28 [KP]	−28/16 = −1.40

ANOVA TABLE (Derived)

SV	d.f	SS	MSS	F
Block	4+3	232.5	77.5	19.0089
Treatment	3	198		
K	1	100	100	3.2921
P	1	49	49	1.1821
KP	1	49	49	1.1821
Error	60	295.5	295.5	
Total	15	680		

Error $7n - 7$ S_E^2

                   $= 7(n-1)$

Total $8n - 1$

Question for 2^3

Block 1

nkk	kkp	pp	npp
2991	3391	3382	3173

11	kk	nn	nkkp
1091	2655	1046	4590

Block 2

kkp	p	kn	npp
4497	3374	2772	3556

m	nkkp	npp	11
989	4449	3188	1056

Block 3

p	11	npp	kkp
3523	887	3324	4323

nkk	kk	nn	nkkp
3344	2679	3328	4771

Block 4

npp	nkk	nn	pp
3861	2772	1083	3324

kk	11	nkkp	kkp
3032	1331	4537	4835

	I	II	III	IV	
I					425
n					426
h					1118
nk					1203
p					1283

$m = 4, \quad \overline{y} = 232$

$c = 3324$

$c.c.F = \dfrac{9504^2}{3 \cdot 32} = \ldots$

Table	Treatment	Treatment mean (2)	(2(3)6)	(4/4)	(5/5)	s.s.s
I I	4325	8151	317372	33324	EEGF
n n	4326	232321	616052	34310	368615·5
k k	11119	2413079	886	222664	150300178
nknk	12203	343473	25854	11212	33302
p p	12283	1 1	141870	222230	17277013·5
nmp	13136	8225	77494	12668	88882
kpkp	166666	11313	8894	-67676	148232·5
nkpl	180007	14141	2628	-556	208

ANOVA TABLE

SV	df	SS	MSS	f		F-tab
Block	3	843	281	0.7827	<	3.07
Treatment	7	456955.5	65279.35	181.8367	>	2.049
n	1	3612.5	3612.5	10.0627	>	4.32
k	1	160178	160178	446.178	>	4.32
nk	1	392	392	1.0919	<	4.32
p					>	4.32
npp	1	882	882	2.456	<	4.32
kpp	1				>	4.32
npk	1	98	98		<	4.32
Error	21	7532	359			
Total	31	465357.5				