Since calculated value of F for blocks is less than 2·59, the tabulated value of F for (7, 31) *d.f.* at 5% 'level of significance', we fail to reject the null hypothesis.

H_0 : *Confounding is not effective.*

Hence, we conclude that confounding is not effective.

6·10·2. Partial Confounding. Let us consider a 2^3 factorial experiment (where each replicate is divided into two blocks of 4 units each) replicated r times, (say). In such a case the experimenter is absolutely free to confound any factorial effect in any replicate. In other words, it is not necessary to confound the same interaction effect in all the replicates and several factorial effects may be confounded in one single experiment. For example, the following plan (2^3 experiment replicated 4 times) in *Table 6·56* confounds the interactions *ABC, AB, BC* and *AC* in the replications *I, II, III* and *IV* respectively.

TABLE 6·56 : PARTIALLY CONFOUNDED 2^3 DESIGN

Block	*Rep I*		*Rep II*		*Rep III*		*Rep IV*	
	1	2	3	4	5	6	7	8
	abc	*ab*	*abc*	*ac*	*abc*	*ab*	*abc*	*ab*
	a	*ac*	*ab*	*bc*	*bc*	*ac*	*ac*	*bc*
	b	*bc*	*c*	*a*	*a*	*b*	*b*	*a*
	c	(1)	(1)	*b*	(1)	*c*	(1)	*c*
Interaction Confounded	*ABC*		*AB*		*BC*		*AC*	

In the above arrangement, the main effects *A, B* and *C* are orthogonal with block totals and are entirely free from block effects. The interaction *ABC* is completely confounded with blocks in replicate 1, but in the other three replicates, the *ABC* is orthogonal with blocks and consequently an estimate of *ABC* may be obtained from replicates II, III and IV. Similarly it is possible to recover information on the other confounded interactions *AB* (from replicates I, III, IV), *AC* (from replicates I, II, III) and *BC* (from replicates I, II, IV).

When an interaction is confounded in one replicate and not in another, the experiment is said to be *Partially Confounded.* Since the partially confounded interactions are estimated from only a portion of the observations, they are determined with a lower degree of precision than the other effects.

Analysis of Partially Confounded 2^3-Experiment. Let us suppose that a number of repetitions, say r, of the above pattern or layout are performed such that the positions of the replications, blocks within replications, and plots within blocks are randomised. The analysis of 2^3-partially confounded design differs from that of the ordinary 2^3-factorial experiment replicated 4 times only in the calculation of the partially confounded interactions, each interaction being estimated only from the three replicates in which the given interaction is not confounded. Thus, the S.S. for the interaction *AB*, say, is calculated from the replications I, III and IV, the divisor for $(AB)^2$ being 24 instead of 32. Similarly we can obtain the S.S. for the interaction *AC* (from replicates I, II, III) and *BC* (from replicates I, II, IV). The S.S. from blocks and for the unconfounded effects (Main effects *A, B* and *C*) are obtained in the usual manner.

Remarks **1.** The above confounding scheme provides full information regarding the unfounded effects *A, B* and *C* and partial (3/4th) information regarding the confounded interactions *AB, AC, BC* and *ABC* (since only 3 of the 4 replicates provide estimates of *AB, AC, BC* and *ABC*).

2. *Analysis of 2^3 partially confounded design with 4 replications and 'r' such repetitions.* Let us suppose that a number of repetitions, say, r, or the above pattern or layout are performed such that the positions of the replications, blocks within replications and plots within blocks are randomised. Then the structure of the ANOVA Table will be as given in *Table 6·57*.

TABLE 6·57 : ANOVA TABLE FOR *AB*, *AC*, *BC* AND *ABC* PARTIALLY CONFOUNDED WITH 'r' REPETITIONS IN 2^3-DESIGN

Source of Variation	*d.f.*	*Sum of Squares*
(*a*) Block	$8r - 1$	$\frac{1}{4}\sum(\text{total of block})^2 - \frac{(\text{Grand total})^2}{32r}$
(*i*) Replicates	$4r - 1$	$\frac{1}{8}\sum(\text{total of replicate})^2 - \frac{(\text{Grand total})^2}{32r}$
(*ii*) Blocks within replicates	$4r$	(By difference)
(*b*) *A*	1	$[A]^2/32r$
B	1	$[B]^2/32r$
C	1	$[C]^2/32r$
AB	1	$[AB]^2/24r$
AC	1	$[AC]^2/24r$
BC	1	$[BC]^2/24r$
ABC	1	$[ABC]^2/24r$
Error	$24r - 7$	(By difference)
	$32r - 1$	Total S.S.

3. ***Calculation of S.S. due to Confounded Effects.*** It has already been explained that S.S. for confounded effects are to be obtained from those replications only in which the given effect is not confounded. From practical point of view, these S.S. can be obtained from the table of *Yates' Method for all the four replications* by applying some *adjusting factor* (A.F.) to the confounded effects. The adjusting factor for any confounded effect is computed as follows :

(*i*) Note the replication in which the given effect is confounded.

(*ii*) Note the sign of (1) in the corresponding algebraic expression of the effect to be confounded.

If the sign is positive then

A.F. = [Total of the block containing (1) of the replicate in which the effect is confounded] – [Total of the block not containing (1) of replicate in which the effect is confounded]. ...(6·245)

$= T_1 - T_2$, say

If the sign is negative, then ...(2·245*a*)

A.F. $= T_2 - T_1$

This adjusting factor will be subtracted from the factorial effects totals of the confounded effects obtained from Yates Method for all the 4 replicates.

Example 6·12. *Analyse the following 2^3-Factorial experiment in blocks of 4 plots, involving three fertilisers N, P and K, each at two levels.*

Replicate I

Block 1	*np* 101	*npk* 111	*(1)* 75	*k* 55
Block 2	*p* 88	*n* 90	*pk* 115	*nk* 75

Replicate II

Block 3	*(1)* 125	*npk* 95	*nk* 80	*p* 100
Block 4	*n* 53	*npk* 76	*p* 65	*k* 82

Replicate III

Block 5	*pk* 75	*nk* 100	*(1)* 55	*np* 92
Block 6	*np* 53	*npk* 76	*p* 65	*k* 82