Research & Reviews: Journal of Statistics and Mathematical Sciences

A Review of William's Method of Construction in Constructing Incomplete Sequence Balanced Crossover Design

Adebara Lanre*

Department of Mathematics and Statistics, Federal Polytechnic, Ado-Ekiti, Nigeria

Research Article

Received date: 29/11/2017

Accepted date: 01/02/2018

Published date: 05/02/2018

***For Correspondence**

Adebara Lanre, Department of Mathematics and Statistics, Federal Polytechnic, Ado-Ekiti, Nigeria.

E-mail: lanreadebara@gmail.com

Keywords: Crossover, Sequence, Carryover, Incomplete.

ABSTRACT

Crossover design is found several field such pharmaceutical industry, agricultural field with the presence of carryover effects of treatment in the present period of treatment application from proceeding period. In this paper, we reviewed method of construction of incomplete sequence balanced crossover design given Patterson and Lucas.

INTRODUCTION

Crossover design is an experiment in which subject (sequence) are exposed to different treatment at different time period. The subject can be animals or plots of land. This design has been used in many areas such as clinical trials, agricultural experiments, and etc. William's square for more than two treatments was given by Williams [1] using row and column approaches for the number of treatment v is even or odd.

Hedayat and Min Yang [2] used William's method of construction for more than two treatments column method approach to develop their method of construction called balanced uniform crossover designs in which they used the same procedure given by Williams [1] with the only difference is that of repeating the last row of a William's square once. Some of authors that have developed method of construction for incomplete crossover designs are Kanchan and Rumana [3] developed method for an incomplete block change-over balanced for first and second-order residual effect, Mithilesh and Archana [4] gave method of construction for balanced incomplete sequence crossover design for first order residual effect, and Patterson and Lucas [5] discussed method of construction for incomplete sequence balanced crossover designs. However, we shall review that of Patterson and Lucas [5] that used William's method of construction for more than two treatments column method approach to construction incomplete ssequence balanced crossover designs as shown in **Tables 1-4**.

METHODS OF CONSTRUCTION

Method of Construction of Balanced Crossover Design for more than Two Treatments Column Method Approach

For constructing a balanced CODs for v treatment in v sequences and v periods for number of v is even given by William [1]

For number of treatments, v is even

For sequence 1 treatment will be

i)1, 2,..., V/2 occur in the periods 1, 3,..., V-1 respectively

ii)V/2 + 1, V/2 + 2, ..., V occur in the periods V, V-2,..., 2 respectively

(iii) The assignments for sequences 2, 3, V are obtained through a cyclic development of the arrangement for sequence 1

Table 1. For the number of treatments, v = 4.

Period	1	2	3	4
1	1	2	3	0
2	0	1	2	3
3	2	3	0	1
4	3	0	1	2

For number of treatments, v is odd

For sequence 1 the treatment will be

1, 2, ..., (V+1)/2 occur in periods 1,3, ..., v respectively

(V+1)/2+1, (V+1)/2 + 2 ,..., V occur in periods V-1, V-3,...,2 respectively

The assignment for sequences 2, 3, V are obtained through a cyclic development of the arrangement for sequence 1.

The arrangement for sequence (V+1) is the mirror image sequence V

Table 2. For the number of treatments, v=5

Period	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	0	2	3	4	0	1
2	0	1	2	3	4	3	4	0	1	2
3	2	3	4	0	1	1	2	3	4	0
4	4	0	1	2	3	4	0	1	2	3
5	3	4	0	1	2	0	1	2	3	4

Method of Construction for Incomplete Sequence Balanced Crossover Designs

Consider block contents of each of the block of the Balanced Incomplete Block Design.

Take the first block and construct Williams's squares for the treatment in that block [5]

Example 1: For 5 treatments and block size 4, we consider the following BIBD with parameter (5, 5, 4, 4, 3)

1	2	3	4
1	2	3	5
1	2	4	5
1	3	4	5
2	3	4	5

Table 3. Experimental units.

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	2	3	4	1	2	3	5	1	2	4	5	1	3	4	5	2	3	4	5
2	4	1	2	3	5	1	2	3	5	1	2	4	5	1	3	4	5	2	3	4
3	2	3	4	1	2	3	5	1	2	4	5	1	3	4	5	1	3	4	5	2
4	3	4	1	2	3	5	1	2	4	5	1	2	4	5	1	2	4	5	2	3

The incomplete sequence balanced crossover design formed by using the block contents of this BIB design through balanced crossover design for more than two treatments column method approach for number of treatment v is odd. Thus we get incomplete sequence balanced crossover design with v=5, p=4 and n=20

Example 2: For 4 treatments and block size 3, we consider the following BIBD with parameter (4, 4, 3, 3, 2)

1	2	3
1	2	4
2	3	4
3	4	1

The incomplete sequence balanced crossover design formed by using the block contents of this BIB design through bal-

anced crossover design for more than two treatments column method approach for number of treatment v is even.

Table 4. Experimental units.

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	1	2	3	1	2	3	1	2	4	1	2	4	2	3	4	2	3	4	1	3	4	1	3	4
2	3	1	2	2	3	1	4	1	2	2	4	1	4	2	3	3	4	2	4	1	3	3	4	1
3	2	3	1	3	1	2	2	4	1	4	1	2	3	4	2	4	2	3	3	4	1	4	1	3

Thus we get incomplete sequence balanced crossover design with v=4, p=3 and n=24.

DISCUSSION

It was discovered that we can obtain incomplete sequence from balanced incomplete block design in which number of period is less than that of experimental units and also the number of experimental units double the number of treatment when block sizes is odd.

CONCLUSION

We therefore conclude that Patterson and Lucas method of construction for incomplete sequence balanced crossover designs is easier and straight forward to use than other methods of incomplete sequence crossover design.

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