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A REVIEW OF MITHILESH - ARCHANA METHODS OF BALANCED INCOMPLETE SEQUENCE CROSSOVER DESIGN OF FIRST ORDER RESIDUAL EFFECT

Adebara Lanre, Ilugbusi Ayokunle Oluwatosin and Rotipin Ademola Joseph
Department of Mathematics and Statistics
The Federal Polytechnic, Ado-Ekiti, Nigeria
Corresponding author: Adebara Lanre

ABSTRACT

Crossover design is an experimental design with different treatment sequences receive by subject at different period one at a time. In this paper, two methods of universally optimal of balanced incomplete sequence crossover design of first order residual effect (treatment effect that persist only for one period after period of treatment application) given by Mithilesh and Archana were reviewed. Algorithm that contained primitive root x=2 and x=3 were used to allocate treatment to initial blocks for design construction for both the first and second design construction methods respectively, first design showed that each other treatment preceded each treatment once while second design showed that each other treatment preceded each treatment six times. It is concluded that measurement of first order residual effect increases as the number of sequences increase.

KEYWORDS: Crossover design, Sequence, Period, Universally optimal

1. INTRODUCTION

Crossover design is an experimental design with different treatment sequences receive by subject at different period one at a time where treatment effect continues in the next period after period of treatment application. This design also called change- over design and has been found useful in field of research, among which are clinical trials, nutrition experiments and pharmaceutical investigations. Balanced Design is a design in which every treatment preceded by each other treatment the same number of time Douglas (2001). Balanced Incomplete Block Design is a situation in which occurrence of all the treatments is impossible and pair of treatment occur together equally Douglas (2001). A lot of authors have come with method of balanced incomplete sequence crossover design, incomplete means all treatment are not in the block.

Hedayat and Yang (2004) disussed selected crossover designs for universally optimal (UO).
Hedayat and Zheng (2010) and Wei (2013) presented design which is optimal and efficient for testing a subject effect is random for test control.

Bose and Dey (2009), Cheng and Wu (1980) discussed result for estimation of residual effect over designs

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classes for universally optimal design.

Sprott (1954) presented method of construction for balanced incomplete sequence crossover design based on Bose's BIBD note, where design showed that number of period is less than number of treatment v which is prime.

Patterson and Lucas (1962) discussed a construction method for k treatments of BIBD that form with considered parameters t,b,r,k, with b block arrange in b rows.

Mithilesh and Archana (2015) presented construction methods of universally optimal for balanced incomplete sequence crossover design (BISCOD) of first order residual effects for selected treatments number which are prime that satisfy primitive root x=2 and x=3. First order residual effect is the treatment effect that persist only for one period after period of treatment application. Universally optimal in the sense that (i) no treatment appears twice on a subject (ii) equally replicated of treatments in the first p-1 periods. The design parameter symbol are v, n, k for treatment, sequence and number of treatment per sequence. In this paper we shall review two construction methods discussed by Mithilesh and Archana.

2.0 MATERIAL AND METHOD

2.1 CONDITIONS FOR BALANCED CROSSOVER DESIGN

- Each treatment symbol should occur once in a given sequence
- Each treatment symbol should occur in a period in the same number of time
- Each ordered succession of two treatment symbol occur in the same number of sequence
- Every pair of treatment symbols occur together in the same number of curtailed sequences formed by omitting the final period.

3.0 CONSTRUCTION

Mithilesh and Archana (2015) considered a BIBD with parameters v=4m+1, b= 2(4m+1), r= 4m, k= 2m, λ = 2m-1, m being positive integer and with two initial blocks.

3.1 PROCEDURE

- Choose anyone block from initial blocks
- Obtain the (t-1) initial sequences from the above block by multiplying with every non-zero elements of GF(v).
- By developing the initial sequences mod (t), we get a universally optimal balanced crossover design which is (UOBCOD) of first order with parameter v= 4m+1, N=4m(4m+1), k= 2m

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3.2 DESIGN CONSTRUCTION METHOD 1

Let v= 4m + 1 be a prime and let x be a primitive root of GF(t).Consider a BIBD with the parameters v=4m+1, b= 2(4m+1), r= 4m, k= 2m, λ = 2m-1, m being positive integer and with the initial blocks..

$I_1 = (x^0, x^2, x^4, \ldots, x^{4m-2})$, m= 0.5, 1, 1.5, …

$I_2 = (x, x^3, x^5, \ldots, x^{4m-1})$, m= 0.5, 1, 1.5, …

Example 1

Let v=5, m=2, k=2, x=2 then a BIBD with the two initial blocks exists

$I_1 = (x^0, x^2, x^4, \ldots, x^{4m-2}) = = 2^0, 2^2 = 1, 4$

$I_2 = (x, x^3, x^5, \ldots, x^{4m-1}) = 2^1, 2^3 = 2, 3$

two initial blocks are (1, 4) and (2, 3)

note that the values of above initial blocks are obtained through mod 5

Consider first initial block (1, 4)

Multiply with every non- zero element to obtain 4 initial sequences

1x1=1 1x2=2 1x3=3 1x4=4

4x1=4 4x2=8 4x3 12 4x4=16

Mod5 for four initial sequences = 1 2 3 4

4 3 2 1

By developing the above four initial mod 5, a universally optimal BISCOD is obtain cyclically of first order residual effects with parameters v = 5, n = 20, k = 2.

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

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

4 0 1 2 3

1 2 3 4 0

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each treatment is preceded by each other treatment once

3.3 DESIGN CONSTRUCTION METHOD 2

Let v=6m+1 be a prime and x be a primitive element of GF(v) with the set of initial blocks

$I_i = (x^{i-1}, x^{2m+i-1}, ,.., x^{4m+i-1})$, i= 1,2, …, m

Add treatment 0 to chosen block and follow the rest procedure in the above design construction method 1

Example 2

Let v=7, m=1, k=4, x=3 then a BIBD with the two initial blocks exists

$I_i = (x^{i-1}, x^{2m+i-1}, ,.., x^{4m+i-1})$

i=1, 3^0, 3^2, 3^4 = 1, 2, 4 i=2, 3^1, 3^3, 3^{55} = 3, 6, 5

two initial blocks are (1, 2, 4) and (3, 6, 5)

note that the values of above initial blocks are obtained through mod 5

Consider second initial block (3, 6, 5) and Add treatment 0 to each block

Multiply with every non- zero element to obtain 6 initial sequences

0x1 0x2 0x3 0x4 0x5 0x6

3x1 3x2 3x3 3x4 3x5 3x6

6x1 6x2 6x3 6x4 6x5 6x6

5x1 5x2 5x3 5x4 5x5 5x6

Mod 7 for 6 initial sequences = 0 0 0 0 0 0

3 6 2 5 1 4

6 5 4 3 2 1

5 3 1 6 4 2

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By developing the above six initial mod 7, a universally optimal BISCOD is obtain cyclically of first order residual effects with parameters v = 7, n = 42, k = 4.

0 1 2 3 4 5 6 0 1 2 3 4 5 6
3 4 5 6 0 1 2 6 0 1 2 3 4 5
6 0 1 2 3 4 5 5 6 0 1 2 3 4
5 6 0 1 2 3 4 3 4 5 6 0 1 2

0 1 2 3 4 5 6 0 1 2 3 4 5 6
2 3 4 5 6 0 1 5 6 0 1 2 3 4
4 5 6 0 1 2 3 3 4 5 6 0 1 2
1 2 3 4 5 6 0 6 0 1 2 3 4 5

0 1 2 3 4 5 6 0 1 2 3 4 5 6
1 2 3 4 5 6 0 4 5 6 0 1 2 3
2 3 4 5 6 0 1 1 2 3 4 5 6 0
4 5 6 0 1 2 3 2 3 4 5 6 0 1

each treatment is preceded by each other treatment three times

4.0 RESULT

It is discovered from design1 constructed that each treatment occurs as the first treatment in a sequence and occurs in the design four and eight times respectively takes and also, each other treatment preceded each treatment once. From design 2 constructed each treatment occurs as the first treatment in a sequence and occurs in the design six and twenty-four times respectively and also each other treatment preceded each treatment three times

5.0 DISCUSSION

From above result of design1 constructed which says each treatment occurs as the first treatment in a sequence depicts that the measurement of first order residual effect for each treatment in the design occurs four times. From design 2 constructed the measurement of first order residual for each treatment occurs eighteen time due to increase in sequence and multiple number of periods, it means effect of each treatment on immediate next periods take place four and eighteen times for design 1 and design 2 respectively.

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6.0 CONCLUSION

It is concluded that to construct design for number of treatment that satisfy primitive root x=2, design construction method 1 should be used and for number of treatment that satisfy primitive root x=3, design construction method 2 should be used. Also it shows that measurement of first order residual effect increases as the number of sequences increase.

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