RCD objective function

For the purpose of carrying on with the same type of the case with treatment applying on the animals, the cages are used as the blocks for groups of animals. The assumption is that different treatments applied on the animals in the same cages will not cause the dominance of the stronger animals over the weak animals. However, in practice, different treatments should not be applied on different animals in the same cages, because the fitter animals without perturbed by the diseases may over power the weaker animals. Hence, the same treatments should apply on the animals in the same cages in real experimental procedure.

The first case composed of the Phase 1 experiment with completely randomised design and Phase 2 experiment with randomised block design. The objective function for finding the optimal design for this case can be written as

where and denote the average efficiency factors of animals and treatments in the Within Runs stratum, respectively, the term allows the DF of treatment in the Between Animals Within Runs stratum to be maximised. The weights for each of these terms in the objective functions are 2/3, 1/9 and 2/9. This shows that the most essential term of this objective function is to have the average efficiency factor of animals to be as close to one as possible, this will enable the test for the treatment effects to be conducted. The second most important element is to have most of the DF associated with the treatment effects to be conducted. The final element is to obtain a design that the highest treatment information is been tested.

The second case consists of Phase 1 experiment with randomised block design and Phase 2 experiment with randomised block design. The objective function for finding the optimal designs for this case can be written as

where the term is to maximise the residual DF for conducting the test of the treatment effects. In addition, it can also push some tag information into the between cage stratum. The remaining terms are the same as in the objective function for the first case. Note that in this objective function, the pattern of the first two terms is the same as the last two terms are the same, but the weights are different. The weights for average efficiency factors of animals and treatment, terms maximising the DF associated with the treatment effects and residual mean squares are 5/9, 1/9, 2/9 and 1/9. Once again, the most important term is to get the average efficiency factor of the animals as close to one as possible to get a design that the test for the treatment effects can be conducted. The weights for the average efficiency factor of the treatment and the terms maximising the DF associated with the treatment effects are the same as the previous objective. The weight for the term maximising the DF associated with the residual MS is set to be 1/9.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Phase 1 Experiment | | | Technical Rep | n | Phase 2 Experiment | | DF of Phase 1 in the between Runs stratum (Trt DF) | | Tag orthogonal to Animal in the within runs stratum | DF of residual in between animals stratum | Tag orthogonal to Treatment | Animal | | Treatment | |
| Treat | Block | Bio Rep | Runs | Tags | Can Eff Factor | Ave Eff Factor | Can Eff Factor | Ave Eff Factor |
| Cage | Animal |
| 6 | 2 | 2 | 2 | 24 | 6 | 4 | 0 | 2(2) | Yes | 3 | Yes | 1(8) | 1 | 1(3), 3/4(2) | 15/17 |
| 3 | 3 | 36 | 9 | 1 | 3(3) | No (1DF) | 6 | No(1/9) | 1(12) | 1 | 1, 0.894, 0.889, 0.833, 0.606 | 0.8204 |
| 2 | 4 | 48 | 12 | 1 | 4(4) | No (1DF) | 12 | Yes | 1(18) | 1 | 1, 15/16(2), 13/16(2) | 0.8937 |
| 4 | 1 | 4(4) | Yes | 11 | Yes | 1(16) | 1 | 1, 15/16(2), 13/16(2) | 0.8937 |
| 5 | 5 | 60 | 15 | 2 | 5(4) | No (1DF) | 14 | No(1/25) | 1(20) | 1 | 24/25, 19/20, 17/20(2), 3/4 | 0.8650 |
| 2 | 6 | 72 | 18 | 1 | 7(4) | No (1DF) | 20 | Yes | 1(26) | 1 | 1, 7/8(4) | 0.8974 |
| 3 | 2 | 6(2) | No (1DF) | 21 | Yes | 1(27) | 1 | 1(3), 3/4(2) | 15/17 |
| 6 | 4 | 4(4) | No (1DF) | 16 | Yes | 1 (22) | 1 | 1, 7/8(4) | 0.8974 |
| 7 | 7 | 84 | 21 | 6 | 7(5) | No (1DF) | 20 | No(1/49) | 1(26) | 1 | 0.947, 0.919, 0.893, 0.854, 0.795 | 0.8784 |
| 2 | 8 | 96 | 24 | 1 | 10(5) | No (1DF) | 29 | Yes | 1(35) | 1 | 15/16(2), 7/8 (3) | 0.8990 |
| 4 | 6 | 8(5) | No (1DF) | 30 | Yes | 1(36) | 1 | 15/16(2), 7/8 (3) | 0.8990 |
| 8 | 4 | 7(4) | No (1DF) | 23 | Yes | 1(29) | 1 | 15/16(2), 7/8 (3) | 0.8990 |
| 3 | 9 | 108 | 27 | 2 | 11(5) | No (1DF) | 32 | No(1/81) | 1(38) | 1 | 0.937, 8/9(2), 0.884, 5/6 | 0.8851 |
| 9 | 8(3) | 5(5) | No (1DF) | 26 | No(0.010) | 1(32) | 1 | 0.936, 0.888, 0.886, 0.882, 0.831 | 0.8834 |
| 2 | 10 | 120 | 30 | 1 | 13(5) | No (1DF) | 38 | Yes | 1(44) | 1 | 9/10(5) | 9/10 |
| 5 | 4 | 10(5) | No (1DF) | 39 | Yes | 1(45) | 1 | 9/10(5) | 9/10 |
| 10 | 8(1) | 6(5) | No (1DF) | 30 | Yes | 1(36) | 1 | 0.9(4), 0.895 | 0.8990 |