

GDD $(n_1, n, n + 1, 4; \lambda_1, \lambda_2)$ for $n_1 = 1$ or 2 **Kasifa Namyaloa, Dinesh G. Sarvateb and Li Zhang c****Mbarara University of Science and Technology, Uganda****Abstract**

The main subject matter for this paper is GDDs with three groups of sizes $1, n, (n \geq 2)$ and $n + 1$, respectively, and block size four. A block has Configuration $(1, 1, 2)$, means the block has the point from the group of size 1 and one point from one of the other two groups and the remaining two points from the third group. A block has configuration $(2, 2)$ if the block has exactly two points from each of the two groups of sizes n and $n + 1$. First, we prove that these GDDs do not exist if we require that the number of the blocks having Configuration $(1, 1, 2)$ is equal to the number of block shaving Configuration $(2, 2)$. Then we provide necessary conditions for the existence of a GDD $(\{1, n, n + 1\}, 3, 4; \lambda_1, \lambda_2)$ and prove that these conditions are sufficient for several families of GDDs. We also prove several nonexistence results, where these usual necessary conditions are satisfied.

Key words: Group Divisible Designs (GDDs), Blocks and Configuration.