

**PRIME LABELLING OF CENTRELESS DOUBLE WHEEL GRAPHS ( $CDW_{2n}$ )**

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Graph labelling is a prominent research area in Graph theory and a considerable amount of open problems are available in the literature for various types of graphs. Prime labelling is one of the most interesting categories of graph labelling. A graph  $G = (V(G), E(G))$  with  $|V(G)|$  number of vertices is said to have *prime labelling* if there exists a bijective mapping  $f : V(G) \rightarrow \{1, 2, 3, \dots, |V(G)|\}$  such that for each edge  $e = uv \in E(G)$ , the greatest common divisor of  $f(u)$  and  $f(v)$  is 1. In our previous work, the prime labelling of the Tripartite graph, Roach graph, Crab graph, and Scorpion graph have been discussed, and we found the cases where each of the graphs have prime labelling. In the present work, the prime labelling method has been introduced for the Centreless double wheel graph  $CDW_{2n}$  with  $2n$  vertices when  $n$  is even. The graph obtained from cyclic graph  $C_{n-1}$  by joining each vertex to a new vertex  $v$  is the *wheel* on  $n$  number of vertices, denoted by  $W_n$ . The Centreless double wheel graph is obtained by using Cartesian product of  $C_n$  with  $n$  vertices and complete graph of the form  $K_2$  and is denoted by  $CDW_{2n}$  (i.e  $C_n \times K_2 = CDW_{2n}$ ). This is also isomorphic to the graph obtained by joining the end vertices by two edges of the Ladder graph. We proved that  $CDW_{2n}$  is a prime graph for two special cases when  $n$  is an even integer and  $n + 1$  is prime, and when  $n$  is an even integer and  $2n + 1$  is prime. In addition, the cyclic vertex labelling method in the clockwise direction and anti-clockwise direction have been introduced. Moreover, proofs of the two theorems related to the above two cases are given. We used the theorem on ladder graphs in the work by A.H. Berlineer et al in this proof. Furthermore, as future work we are interested in considering prime labelling of centreless  $n$ -wheel graphs and to apply the prime labelling method when  $n$  is odd.

**Keywords:** Centerless double wheel graph, Greatest common divisor, Prime labelling