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A Procedure for Obtaining a $(2+c)$-Regular Graph from a Given Cycle Graph

In this project, we devise a procedure to obtain a $(2+c)$-regular graph of minimum order from a given cycle graph C_n, where $c, n \in \mathbb{Z}^+$ and $n \geq 3$. We employ the use of cases to determine the minimum number of vertices that must be added to C_n such that the resulting graph R is $(2+c)$-regular. The results of this project demonstrate that if $c \leq n - 3$, then our desired graph R can be obtained by adding at most 1 vertex. Additionally, if $c > n - 3$, our findings indicate that R can be obtained by adding $3 + c - n$ vertices. Some additional results regarding the size and Hamiltonian property of R are also presented at the end of this project.