Article

A study of the total graph in genetic code algebra

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Abstract
Suppose R be a commutative ring and $Z(R)$ its set of zero-divisors. Total graph is the (undirected) graph where set of all elements of R is taken as the vertex set and two vertices say x and y ($x \neq y$) in R are adjacent if and only if their sum is zero-divisor. Genetic code is the blueprint for protein synthesis. In this paper we discuss total graph in the genetic code algebra.

Keywords genetic code; amino acid; mutation; total graph.

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1 Introduction

Genetic code is the rule defining the sequence of nucleotides in DNA (Deoxyribonucleic acid) or mRNA (Messenger ribonucleic acid) that determines the specific amino acid sequence in the synthesis of protein. The DNA consists of two complementary long chains of nucleotides, viz. Adenine (A), Cytosine (C), Guanine (G) or Thymine (T) (Uracil (U) in case of mRNA). Deoxyribonucleic acid (DNA) stores genetic information about how to construct or synthesize proteins. Amino acids are the building blocks of proteins. Each amino acid is a triplet code of four possible bases (nucleotides). Three consecutive DNA nucleotides form a codon. Each codon specifies a particular amino acid. Mathematically DNA can be considered as a sequence of four letters that is A, G, C and U (or T). As there are four bases, this gives us 64 codons. In the evolutionary importance of genetic code, the second base is considered as biologically most significant base, where as third base is least significant base in a codon. Different kinds of mutations are possible in codons namely, point mutation, deletion, insertion, inversion. In this paper we will consider only the case of point mutation. In case of a point mutation, there is a simple change in one base of the gene sequence. It replaces a single base nucleotide with another nucleotide of the genetic material, DNA or mRNA. 64 codons make up the genetic code, though there are only 20 amino acids. This means that there are some overlap i.e., more than one codon code for the same amino acid. The codons that code for the same amino acids are known as synonymous codons. We can consider this as a function of many to one carrying codons to amino acids.

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