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r-partite self-complementary and almost self-complementary r-uniform hypergraphs

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Abstract

A hypergraph H is said to be r-partite r-uniform if its vertex set V can be partitioned into non-empty sets $V_1, V_2, ..., V_r$ so that every edge in the edge set $E(H)$, consists of precisely one vertex from each set V_i, $i = 1, 2, \ldots, r$. It is denoted as $H^r(V_1, V_2, \ldots, V_r)$ or $H^r_{(n_1,n_2,\ldots,n_r)}$ if $|V_i| = n_i$ for $i = 1, 2, \ldots r$. In this paper we define r-partite self-complementary and almost self-complementary r-uniform hypergraph. We prove that, there exists an r-partite self-complementary r-uniform hypergraph $H^r(V_1, V_2, \ldots, V_r)$ where $|V_i| = n_i$ for $i = 1, 2, \ldots, r$ if and only if at least one of $n_1, n_2, \ldots, n_r$ is even. And we prove that, there exists an r-pasc $H^r(V_1, V_2, \ldots, V_r)$ where $|V_i| = n_i$ for $i = 1, 2, \ldots, r$ if and only if $n_1, n_2, \ldots, n_r$ are odd. Further, we analyze the cycle structure of complementing permutations of r-partite self-complementary r-uniform hypergraphs and r-partite almost self-complementary r-uniform hypergraphs.

Keywords: r-partite r-uniform hypergraph; r-partite self-complementary r-uniform hypergraph; r-partite almost self-complementary r-uniform hypergraph; Complementing permutation

1. Introduction

Let V be a finite set with n vertices. By $\binom{V}{k}$ we denote the set of all k-subsets of V. A k-uniform hypergraph is a pair $H = (V; E)$, where $E \subset \binom{V}{k}$. V is called a vertex set, and E an edge set of H. Two k-uniform hypergraphs $H = (V; E)$ and $H' = (V'; E')$ are isomorphic if there is a bijection $\sigma : V \to V'$ such that σ induces a bijection of E onto E'. If $H = (V; E)$ is isomorphic to $H' = (V; \binom{V}{k} - E)$, then H is called a self-complementary k-uniform hypergraph. Every permutation $\pi : V \to V$ which induces a bijection $\pi' : E \to \binom{V}{k} - E$ is called a self-complementing permutation.

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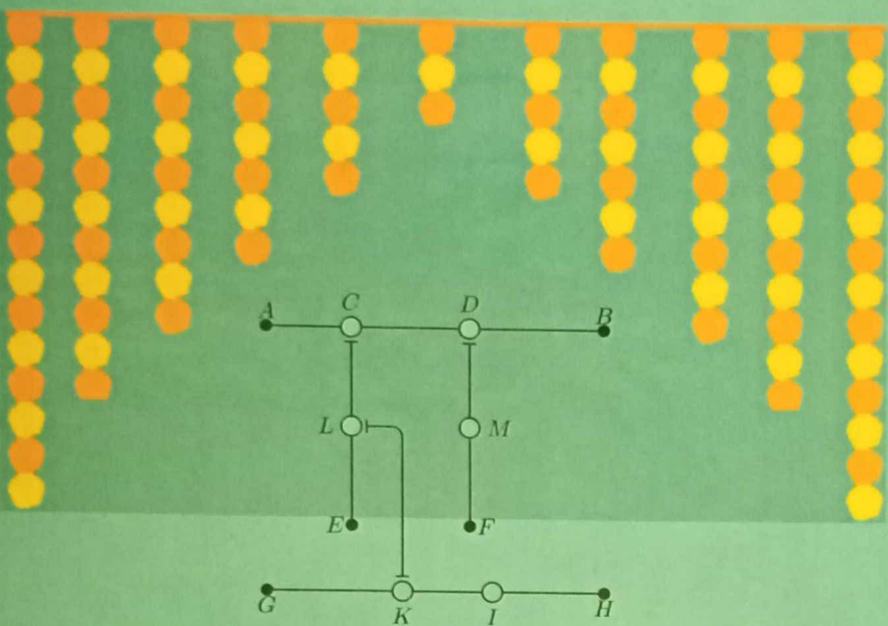

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z-ideals in lattices

Vinayak Joshi & Shubhangi Kavishwar

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Abstract

In this paper, we define z-ideals in bounded lattices. A separation theorem for the existence of prime z-ideals is proved in distributive lattices. As a consequence, we prove that every z-ideal is the intersection of some prime zideals. Lastly, we prove a characterization of dually semi-complemented lattices.

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Class group of the ring of invariants of an exponential map on an affine normal domain

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Abstract. Let k be a field and let B be an affine normal domain over k. Let ϕ be a non-trivial exponential map on B and let $A = B^{\phi}$ be the ring of ϕ-invariants. Since A is factorially closed in B, $A = K \cap B$ where K denotes the field of fractions of A. Hence A is a Krull domain. We investigate here a relation between the class group $\mathrm{Cl}(A)$ of A and the class group $\mathrm{Cl}(B)$ of B. In this direction, we give a sufficient condition for an injective group homomorphism from $\mathrm{Cl}(A)$ to $\mathrm{Cl}(B)$. We also give an example to show that $\mathrm{Cl}(A)$ may not be realized as a subgroup of $\mathrm{Cl}(B)$.

Keywords. Exponential map; ring of invariants; Krull domain; class group; Rees algebra.

Mathematics Subject Classification. Primary: 13N15, 13C20; Secondary: 14R20, 13A30.

1. Introduction

Let k be a field and let B be an affine normal domain over k. Let ϕ be a non-trivial exponential map on B and let $A = B^{\phi}$ be the ring of ϕ-invariants. Since A is factorially closed in B, $A = K \cap B$ where K denotes the field of fractions of A. As a consequence, A is a Krull domain. Moreover, if B is factorial then so also is A. Now suppose k is an algebraically closed field of characteristic zero and $B = k[X, Y, Z]/(XY - f(Z))$, $\quad f(Z) \in k[Z]\backslash k$. Then B is a two-dimensional affine normal domain over k and if $f(Z) \in k[Z]$ is a polynomial of degree $n > 1$, then B is not factorial. Let D be a nonzero locally nilpotent derivation on B such that $D(x) = 0$, $D(z) = x$ (x, z denote images of X, Z respectively in B). Since characteristic of k is zero, D induces a non-trivial exponential map ϕ on B such that $B^{\phi} = \mathrm{Ker}(D)$. It is easy to see that $\mathrm{Ker}(D) = k[x]$ (a polynomial algebra in one variable over k) and hence it is factorial. In view of these results, it is natural to ask the following question:

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ORIGINAL PAPER

Improved Upper Bounds for Identifying Codes in *n*-dimensional *q*-ary Cubes

N. V. Shinde[1] **· B. N. Waphare**[2]

Abstract

For a simple, undirected graph G with vertex set V, a subset D of V is called as an identifying code in G if the sets $N[u] \bigcap D$ are nonempty and distinct for all u in G, where $N[u]$ is a set of its neighbors along with itself. In this paper, we construct identifying codes in an n-dimensional cube $Z_{q_1} \Box Z_{q_2} \Box \ldots \Box Z_{q_n}$, where $Z_{q_i} (1 \leq i \leq n)$ is the ring of integers modulo q_i. The minimum number of vertices in an identifying code in $Z_{q_1} \Box Z_{q_2} \Box \ldots \Box Z_{q_n}$ is denoted by $M^n_{(q_1,q_2,\ldots,q_n)}$ and that in ${Z_q}^n$ is denoted by M^n_q. We improve upper bounds on M^n_q by constructing identifying codes in ${Z_q}^n$. Also, we find the exact value of $M^3_{(q_1,q_2,q_3)}$ for even integers $q_1, q_2, q_3 > 4$ and an upper bound on $M^n_{(q_1,q_2,\ldots,q_n)}$ for even integers $q_i > 4$, $1 \leq i \leq n$. In addition, we give few sufficient conditions on a subset of the vertex set of a graph G to be an identifying code in G.

Keywords Graph · Identifying code · Cartesian product · Cycle · Path

Mathematics Subject Classification 68R10 · 05C69 · 05C76

Introduction

Identifying codes are studied widely due to its various applications, such as fault diagnosis, location detection, and environmental monitoring, in addition to deep connections to information theory. These codes were introduced in [18] mainly for finding malfunctioning processors in multiprocessor systems. Numerous papers already dealt with identifying codes [1–5,8,10,15–17,20,21,27]. Several results about different types of product graphs are known [6,7,9,11,14,19,23–25]. We direct the reader to [22] for recent progress in this area and the references in its extensive bibliography.

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Algorithms in Linear Algebraic Groups

Sushil Bhunia, Ayan Mahalanobis*, Pralhad Shinde and Anupam Singh

Abstract. This paper presents some algorithms in linear algebraic groups. These algorithms solve the word problem and compute the spinor norm for orthogonal groups. This gives us an algorithmic definition of the spinor norm. We compute the double coset decomposition with respect to a Siegel maximal parabolic subgroup, which is important in computing infinite-dimensional representations for some algebraic groups.

Mathematics Subject Classification. Primary 11E57, 15A21; Secondary 20G05, 15A66.

Keywords. Symplectic similitude group, Orthogonal similitude group, Word problem, Gaussian elimination, Spinor norm, Double coset decomposition.

1. Introduction

Spinor norm was first defined by Dieudonné and Kneser using Clifford algebras. Wall [21] defined the spinor norm using bilinear forms. These days, to compute the spinor norm, one uses the definition of Wall. In this paper, we develop a new definition of the spinor norm for split and twisted orthogonal groups. Our definition of the spinor norm is rich in the sense, that it is algorithmic in nature. Now one can compute spinor norm using a Gaussian elimination algorithm that we develop in this paper. This paper can be seen as an extension of our earlier work in the book chapter [3], where we described Gaussian elimination algorithms for orthogonal and symplectic groups in the context of public key cryptography.

In computational group theory, one always looks for algorithms to solve the word problem. For a group G defined by a set of generators $\langle X\rangle = G$, the problem is to write $g \in G$ as a word in X: we say that this is the **word problem** for G (for details, see [18, Section 1.4]). Brooksbank [4] and Costi

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