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ABSTRACTS

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International Congress

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PREFACE

International Congress MASSEE'2003

September 15 – September 21, 2003

The Congress is organized by

the Mathematical Society of Southeastern Europe (MASSEE)

and

the Institute of Mathematics and Informatics of the Bulgarian Academy of Sciences.

Its goal is to revive the traditional collaboration in Mathematics and Informatics between the Southeastern European Countries. The Congress venue is Hotel "Samokov" at the famous summer and winter resort of Borovets.

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INVITED TALKS

On homogeneity of products of compact spaces

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A space X is power-homogeneous if X^τ is homogeneous, for some $\tau > 0$ [4]. Which spaces are power-homogeneous is interesting to know in connection with the following problems: is arbitrary compact Hausdorff space a continuous image of a homogeneous compact Hausdorff space? Is there a homogeneous compact Hausdorff space with the Souslin number greater than 2^ω (E. van Douwen)?

We show that, under some very general restrictions, a necessary condition for power homogeneity of X is that the character in X does not increase under the closure operator. Such spaces are called *character closed.* This is an effective tool in proving that many spaces are not power-homogeneous. The key role belongs to the following notion:

A *τ-twister* at a point e of a space X is a binary operation on X satisfying the following conditions:

a) $ex = xe = x$, for each $x \in X$;

b) for every $y \in X$ and every G_τ-subset V in X containing y, there is a G_τ-subset P of X such that $e \in P$ and $xy \in V$, for each $x \in P$ (that is, $Py \subset V$) (this is the G_τ-continuity of the operation at e on the right); and

c) if $e \in \overline{B}$, for some $B \subset X$, then, for every $x \in X$, $x \in \overline{xB}$ (this is the continuity of the operation at e on the left).

If a space X has a τ-twister at a point $e \in X$, we say that X is *τ-diagonalizable (respectively, at e)*. A version of diagonalizability was first introduced and studied in [1,2].

A space X is of *point-countable type* if every point of X is contained in a compact subspace $F \subset X$ such that F has a countable base of neighbourhoods in X.

Theorem 1. For every Hausdorff power-homogeneous space of point-countable type and every infinite cardinal number τ, the set C_τ of all G_τ-points in X is closed.

Example. Let X be a Hausdorff space of point-countable type with a G_δ-subspace Y which is one of the following: 1) $\omega_1 + 1$ or any larger ordinal space; 2) $\beta\omega$ or the Stone-Čech-compactification of a non-compact metrizable space; 3) the Alexandroff one-point compactification of an uncountable discrete space; 4)

Theorem 1. Let K be a nonextendable (n, w)-arc in $PG(k-1, q)$, $q = p^s$, with $(n-w, q) = 1$ and with spectrum $\{a_i\}_{i\geq 0}$. Let θ denote the maximal number of hyperplanes of multiplicity $\not\equiv w \pmod q$ incident with a subspace of codimension 2 of H, where H is a hyperplane with $K(H) \equiv w \pmod q$. Then $\sum_{i\not\equiv n,w} a_i > q^{k-3} \cdot r(q)/(\theta - 1)$, where $q + r(q) + 1$ is the size of the smallest non-trivial plane blocking set. In particular, we have $\sum_{i\not\equiv n,w} a_i > q^{k-3} \cdot r(q)/(q-1)$.
Theorem 2. Let K be a (n, w)-arc in $PG(k, q)$ and let every $(n-i, w-i)$-arc in $PG(k-1, q)$, $i = 1, \ldots, \gamma_0$, be quasidivisible. If $n > w(q-1)$, K is extendable to a $(n+2, w+1)$-arc in $PG(k, q)$.

We apply this result to rule out the existence of some optimal linear codes over the field with five elements and derive a classification of certain arcs related to the $(17, 2)$-cap in $PG(3, 4)$.

Minimization of exclusive-or sums-of-products for a class of Boolean functions

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Minimization of Boolean functions has been one of the most important tasks in circuit design from the beginning till the modern VLSI's. The minimization of Disjunctive Normal Forms (DNF), also known as Sums of Products (SOP), has been extensively researched and various algorithms have been developed, including some with proven optimality. That is why significant progress in minimization of SOP expressions is not expected in the future. One possible alternative is minimization of functions represented in polynomials modulo 2 (with both complemented and uncomplemented variables), also known as Exclusive-OR Sums of Products (ESOP).

However, treatment of ESOP expressions is difficult, because of the properties of the Exclusive-OR operation. Some new approaches are possible and some algorithms are developed but there is no algorithm efficient enough with corresponding definitive theorem about the optimality of the result. Each existing algorithm performs well (either achieving speed or shorter formulae) only for a specific class of Boolean functions.

In this work we define a class of Boolean functions (we call them "cheese" functions) and specify a new algorithmic idea that achieves results whose complexity is expected to be very close to the theoretical minimum. Some examples are given to illustrate the idea and the algorithmic scheme is described. Our results are compared with standard benchmark set of functions MCNC. The main efforts are dedicated to identify and to prove the properties of the minimized Boolean function that could make the algorithm more efficient. The more such properties are identified the more efficiency will be achieved and the more precise will be the definition of the class of Boolean function treated successfully.

Treatment effects in factorial designs

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Factorial block design is defined as an ordered triple $D = (G, B, f)$, where $G = G_1 \times G_2 \times cdots \times G_n$ and $G_1, G_2, \ldots, G_n$ are nonempty mutually disjoint finite sets (called factors), B is nonempty set (called blocks) and $f : G \times B \to N_0$ is a mapping.

The treatment effects are considered, defining recursively interactions of order $p \leq n$, and a basis for the space of contrasts of treatment effects is obtained.

Existence of one class of Steiner block-schemas and their application in the agricultural experiment organization

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The conditions of existence of one's combinatorial configuration block-scheme are in the base of determining the posibility some experiment organization in many science disciplines and so in agriculture. With the block-scheme

$$B(v, r_1, \ldots r_v, b, k_1, \ldots, k_b, l_{12}, \ldots, l_{v-1,v})$$

like one combinatorial configuration can be presented organization one's experiment in them participate finite number v elements of some basic sets, which should organise in the b block-scheme from defined number k_b elements these basic sets but so that every of these elements are exactly in r_v block-schemes and every pair of these different elements are in $l_{v-1,v}$ block-schemes.

In this paper are considered the condition of prezentation and also existence of one "narrower" class of block-schemes – the so-called balanced incomplete block-schemes Steiner system which are balanced incomplete block-schemes with $l_{v-1,v} = 1$. Also in the paper is given and one example of the application of block-schemes Steiner system in agricultural experiment organization.