Dokuz Eylül University Faculty of Science
Department of Mathematics

SEMINAR

On Complete Maps and Value Sets of Polynomials Over Finite Fields

Leyla Işık

Salzburg University
email: isikleyla@sabanciuniv.edu

ABSTRACT

The well-known Chowla and Zassenhaus conjecture, proven by Cohen in 1990, states that for any $d \geqslant 2$ and any prime $p > (d^2 - 3d + 4)^2$ there is no complete mapping polynomial in $\mathbb{F}_p[x]$ of degree d.

For arbitrary finite fields $\mathbb{F}_q$, we give a similar result in terms of the Carlitz rank of a permutation polynomial rather than its degree. We prove that if $n < \lfloor q/2 \rfloor$, then there is no complete mapping in $\mathbb{F}_q[x]$ of Carlitz rank n of small linearity. We also determine how far permutation polynomials f of Carlitz rank $n < \lfloor q/2 \rfloor$ are from being complete, by studying value sets of $f(x) + x$. We provide examples of complete mappings if $n = \lfloor q/2 \rfloor$, which shows that the above bound cannot be improved in general.

In this talk, we will also present a new method for constructing complete mappings of finite fields. We give a sufficient condition for the construction of a family of complete mappings of Carlitz rank at most n. Moreover, for $n = 4, 5, 6$ we obtain an explicit construction of complete mappings.

Finally, we discuss value sets of particular classes of polynomials over finite fields. We consider a class $\mathcal{F}_{q,n}$ of polynomials of the form $F(x) = f(x) + x$, where f is a permutation polynomial of Carlitz rank at most n. The study of the spectrum of $\mathcal{F}_{q,n}$ enables us to obtain a simple description of polynomials $F \in \mathcal{F}_{q,n}$ with prescribed the value set V_F, especially those avoiding a given set, like cosets of subgroups of the multiplicative group $\mathbb{F}_q^*$. The value set count for such F can also be determined. This yields polynomials with evenly distributed values, which have small maximum count.

Date & Time: 24 May 2016, Tuesday at 11:00

Seminar Room: B206

[1]Adress: Department of Mathematics, Faculty of Science, Dokuz Eylül University, Tınaztepe Campus, 35390, Buca, İzmir, Turkey