

New results on modular Golomb rulers, optical orthogonal codes and related structures*

Marco Buratti [†] 

Dipartimento di Matematica e Informatica, Università di Perugia, 06123, Perugia, Italy

Douglas Robert Stinson [‡] 

*David R. Cheriton School of Computer Science, University of Waterloo,
Waterloo, Ontario, N2L 3G1, Canada*

Received 4 July 2020, accepted 12 October 2020, published online 26 November 2020

Abstract

We prove new existence and nonexistence results for modular Golomb rulers in this paper. We completely determine which modular Golomb rulers of order k exist, for all $k \leq 11$, and we present a general existence result that holds for all $k \geq 3$. We also derive new nonexistence results for infinite classes of modular Golomb rulers and related structures such as difference packings, optical orthogonal codes, cyclic Steiner systems and relative difference families.

Keywords: Golomb ruler, optical orthogonal code, difference family.

Math. Subj. Class.: 05B10

*We would like to thank Dieter Jungnickel and Hugh Williams for helpful comments and pointers to the literature. We also thank Shannon Veitch for assistance with programming. Finally, we thank a referee for pointing out a mistake in Corollary 3.4.

[†]This work has been performed under the auspices of the G.N.S.A.G.A. of the C.N.R. (National Research Council) of Italy.

[‡]D. R. Stinson's research is supported by NSERC discovery grant RGPIN-03882.

E-mail addresses: buratti@dmi.unipg.it (Marco Buratti), dstinson@uwaterloo.ca (Douglas Robert Stinson)

Novi rezultati o modularnih Golombovih ravnilih, optičnih ortogonalnih kodah in sorodnih strukturah*

Marco Buratti † 

Dipartimento di Matematica e Informatica, Università di Perugia, 06123, Perugia, Italy

Douglas Robert Stinson ‡ 

*David R. Cheriton School of Computer Science, University of Waterloo,
Waterloo, Ontario, N2L 3G1, Canada*

Prejeto 4. julija 2020, sprejeto 12. oktobra 2020, objavljeno na spletu 26. novembra 2020

Povzetek

V tem članku dokažemo nove eksistenčne in neeksistenčne rezultate v zvezi z modularnimi Golombovimi ravnili. Popolnoma določimo, katera modularna Golombova ravnila reda k obstajajo, in sicer za vse $k \leq 11$, ter predstavimo splošni eksistenčni rezultat, ki velja za vse $k \geq 3$. Izpeljemo tudi nove neeksistenčne rezultate za neskončne družine modularnih Golombovih ravnilih in sorodnih struktur, kot so diferenčna pakiranja, optične ortogonalne kode, ciklični Steinerjevi sistemi in relativne diferenčne družine.

Ključne besede: Golombovo ravnilo, optična ortogonalna koda, diferenčna družina.

Math. Subj. Class.: 05B10

*Rada bi se zahvalila Dieterju Jungnickelu in Hughu Williamsu za koristne pripombe in opozorila na reference iz literature. Rada bi se zahvalila tudi Shannonu Veitchu za pomoč pri programiranju. Nazadnje, zahvaljujema se recenzentu za opozorilo na napako v Posledici 3.4.

†Ta raziskava je bila izpeljana pod okriljem G.N.S.A.G.A. iz C.N.R. (National Research Council) of Italy.

‡D. R. Stinsonova raziskava je podprta s strani NSERC raziskovalne dotacije RGPIN-03882.

E-poštna naslova: buratti@dma.unipg.it (Marco Buratti), dstinson@uwaterloo.ca (Douglas Robert Stinson)