

## Report on a Survey of Relative Difference Sets

I recommend publication of the cited article in the RHIT Undergraduate Math Journal provided the author makes the following revisions

**General** The paper does not sufficiently motivate why one would want to study relative difference sets. Since the audience is undergraduate students, more time should be spent at the beginning of the article on how the difference sets link to other parts of mathematics. After reading this introductory material, the typical reader may wish to follow the technical details to the end of the paper. Here are some specific suggestions on improving this.

- Abstract: at the end of the first paragraph include one sentence on the link between difference sets, relative difference sets and symmetric designs. This sets the context for the material very early on in the paper.
- Introduction: change the title of this section to Introduction – Difference Sets and Symmetric Designs
- Introduction, para 1: Immediately after the definition of a difference set the link to symmetric designs should be made, This is easily achieved by moving the last two paragraphs of the introduction into this location. It might be useful to add one more application of symmetric designs to the paragraph on projective geometry paragraph
- The remainder of the introduction can be left as is.
- One more sentence in the introduction to establish the contribution the paper. For example, does the paper exhaustively determine the relative difference sets with a small parameter? The main results of the paper should be summarized in a sentence or two.
- It would be helpful to illustrate how a difference set and a relative difference set are used in constructing designs. An appropriate place to put this would be after the definitions of difference sets and relative difference sets are given. This can be done in 2-3 sentences and would help illustrate why difference sets and relative difference sets have their specific definitions.

### Specific

- Abstract, line 8, “A proof” instead of “Next, A proof”
- section 2 change the title to “Basics of Difference Sets”.
- The Definition, Lemma, Proof, and Theorem headers are all indented. It would look better if they were not. The Definitions, Lemmas, Proofs, and Theorems should be numbered.

- In the proof of the first lemma it should be stipulated that  $r_1$  and  $r_2$  are distinct.
- page 3: don't display  $k^2 - mn\lambda$ , it looks odd otherwise.
- page 3: the reference location of the proof of the theorem [3] should appear at the beginning of the theorem and not at the end.
- In 3.2 give an upper bound on the size of  $G/N$  for which the enumeration method is practical
- In 3.4 say these “representations will be used instead of “The purpose of these representations is”
- Define the extension of the representation from the group to the group ring and say that  $\Phi : ZG \rightarrow M_n(\mathbb{C})$  is an algebra homomorphism. Hence  $\Phi$  can be applied to the equation  $RR^{-1} = k \cdot 1 = \lambda(G - N)$ .
- In 3.4 first theorem “Then either  $\Phi$  is trivial on  $N$ ” rather than “ $\Phi(N)$  is trivial”.
- The theorem is only true for irreducible representations. Irreducible representations need to be defined. This is not a big problem since only irreducible representations were discussed in the paper.
- The consequence that  $\Phi(G - N) = 0$  if  $\Phi$  is not trivial on  $N$  should be explicitly stated. This should be done immediately before the example to make the calculation more easily understood.