1:20 pm – 1:35 pm

*Concurrent, Distributed, and Parallel Sunset Generation*

**William Czubakowski and Colin Messinger**

Research in the field of additive combinatorics often requires the quick computation of sunsets. However, the computation of sunsets has not been widely implemented or improved upon despite the development of the tools *Samsets* (used for cyclic groups) and *Irsets* (used for non-cyclic groups) several years ago. The current programs have serious speed and memory limitations when given relatively large inputs, and there appears to be no distributed or parallel version of the programs in existence. We have designed an improved tool that not only utilizes improved algorithms, but is also designed to run concurrently, in parallel, and distributed across multiple systems in order to provide increased computational scalability for fast and effective computation of even very large cyclic and non-cyclic sunsets. While not perfect, our current proposed solution for sunset generation offers a significant improvement in speed and memory when compared to *Samsets* and *Irsets*, while also allowing the possibility for distributed and parallel processing in order to compute even larger sunsets.

1:35 pm – 1:50 pm

*Examining the Maximum Size of Restricted Zero-Free Sunsets*

**Cody Kiefer**

This work provides some lower bounds for the maximum size of restricted zero-free sunsets. Our results are a generalization of the result of Marchan, Ordaz, Ramos, and Schmid, where we evaluate \( \tau^c(Z_c \times Z_{ck}, ck) \) for each positive integer \( k \) and \( c > 2 \).

1:50 pm – 2:05 pm

*Determining the maximum size of a signed zero-sum-free subset of rank 2 is 1*

**Takahiro Fukuhara**

A subset \( A \) of a given finite non-cyclic group \( Z_{n_1} \times Z_{n_2} \) is called signed zero-sum-free if every sum of absolute value of 1 to \( t \) not necessarily distinct elements of \( A \) is not equal to 0. We are interested in finding the maximum size of the subset \( A \) of \( Z_{n_1} \times Z_{n_2} \) which is denoted as

\[
\tau_{\pm}(Z_{n_1} \times Z_{n_2}, [1, t]) = \max\{|A| \subseteq G, O \notin [1, t]_{\pm} A\}.
\]

We want to investigate the groups for which \( \tau_{\pm}(Z_{n_1} \times Z_{n_2}, [1, t]) = 1 \).

2:05 pm – 2:20 pm

*Maximum Restricted Rho: Two-fold Sunsets*

**Elijah Carrick**

The function, \( \rho^c(G, m, 2) \) is defined as the minimum size of a 2-fold restricted sunset of a subset with size \( m \). When we fix \( m \), and consider any group \( G \), this function has a max value. We call this function \( \rho^c(m, 2)_{\max} \).

2:20 pm – 2:35 pm

*Rho, Rho, Rho Your Boat: On the minimum size of a 3-fold restricted sunset of an \( m \)-element subset of \( \mathbb{Z}_p^r \)*

**Bailey Heath**

We are interested in finding the minimum size of a 3-fold restricted sunset of an \( m \)-element subset of \( \mathbb{Z}_p^r \) for some prime number \( p \), given by the notation \( \rho^c(\mathbb{Z}_p^r, m, 3) \). Here, we find upper bounds for \( \rho^c(\mathbb{Z}_p^r, m, 3) \) for all \( m \) and \( p \).