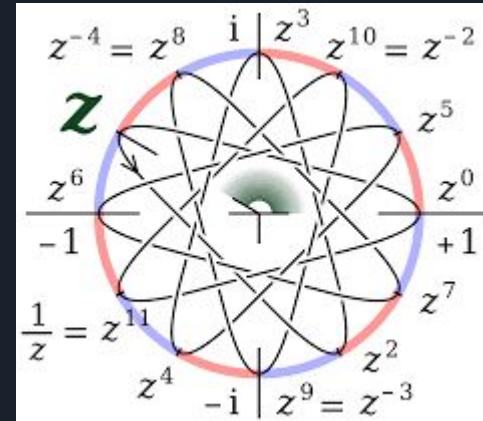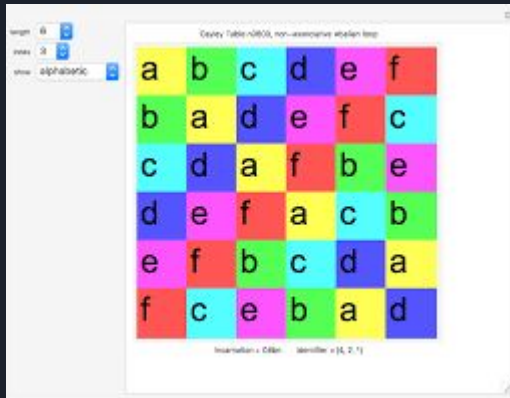# Group Structure in Code

By Rohan Chanani

Terms

- Data Structures - digital representations of abstract or real world phenomena, in this case groups
- Procedures - algorithms used in order to complete a specified task, in this case the generation of groups and other associated tasks

Terms (cont.)

- Group - A set of elements equipped with an operation which allows you to combine any two elements to form a third
  - Identity - $E * I = E$
  - Associativity - $(A*B) * C = A * (B*C)$
  - Closure - $A \in G, B \in G \to A*B \in G$
  - Inverse - $A * A^{-1} = I$
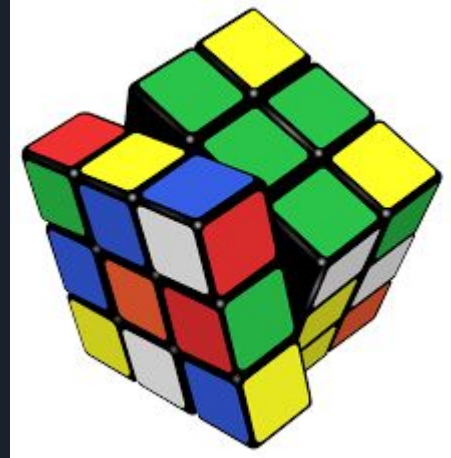
Terms (cont.)

- Cyclic - A group that can be "generated" by only one element
- Abelian - A group whose operation is commutative
- Direct Product - A group which results from combining two groups by directly applying the operation of each group to ordered pairs from each group (X)
- Semidirect Product - A group which results from combining two groups by applying a variation of the operation of each group to ordered pairs from each group (⋊)

Terms (the dreaded morphisms)

- Homomorphism - A map from one group to another which preserves the group structure of the first group
- Automorphism - A homomorphism which maps a group to itself such that each element is mapped to an element in the group
- Isomorphism - A reversible homomorphism between two groups such that each element in both groups is mapped to exactly one element in the other group. If an isomorphism is possible between two groups, these groups are equal "up to isomorphism"