Discrete Math for Computing

Ch 2.1 Basic Structures: Sets

- What are sets?
- Sets - collection of objects, used to group objects together with similar properties
- Fundamental discrete structure on which all other discrete structures are built

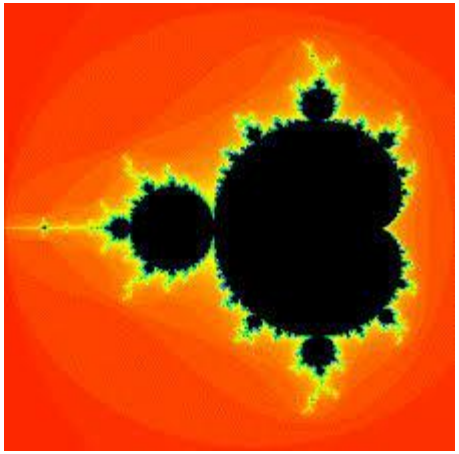
Practical examples

$20 Saint-Gaudens Double Eagle

$10 Indian Eagle

$5 Indian Half Eagle

$2.50 Indian Quarter Eagle



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Sets

- Sets

  An unordered collection of objects.
- German mathematician Georg Cantor in 1895
- Elements

  Objects in a set, a.k.a. members
- A set ‘contains’ its elements

Sets

- Notations

  a $\in$ A to denote that a is an element of the set A

- a $\notin$ A to denote that a is not an element of the set A

- Lower case letters are usually used to denote elements of sets

Sets

- Notations

Describe a set : List all the members of a set, within braces

- The set V of all vowels in the English alphabet can be written as V = {a, e, i, o, u}
- The set O of odd positive integers less than 10 can be written as O = {1, 3, 5, 7, 9}

Sets

- Notations

Ellipses (…) are used when the general pattern of elements is obvious.

Set of positive integers less than 100 can be denoted by {1, 2, 3,…, 99}

Sets

- Often we are dealing with sets where it is impossible to list all of their elements.
- In set builder notation, we give a rule that characterizes all members of a set.

  $S = \{x \mid x \text{ is the square of an integer}\}$

- "S is the set of all x such that x is the square of an integer".

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Sets

- Boldfaced notation is used to describe sets
- **N** = {0, 1, 2, 3,…}, the set of natural numbers

  Z = {…, -2, -1, 0, 1, 2,…}, the set of integers

  $\mathbf{Z}^+$ = {1, 2, 3,…}, the set of positive integers

  Q = {p/q | p € Z, q € Z, q ≠0}, the set of rational numbers

  R, the set of real numbers

  $\mathbf{R}^+$, the set of positive real numbers

  C, the set of complex numbers

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Sets

- Set Builder Notation

States the property or properties elements must have to be members

The set ‘O’ of all odd positive integers less than 10

$O = \{x \mid x \text{ is an odd positive integer less than } 10\}$

$O = \{x \in \mathbf{Z}^+ \mid x \text{ is odd and } x < 10\}$