Discrete Mathematics

Set Theory

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Equal and Equivalent Sets

Difference between equal sets and equivalent sets

- Consider the sets **A** and **B**

$$\mathbf{A} = \{1, 2, 3, 4, 5, 6\}$$

$$\mathbf{B} = \{1, 2, 3, 4, 5, 6\}$$

- **A** and **B** are **equal** sets because **all** their elements are precisely the **same**.

Equal and Equivalent Sets

Difference between equal sets and equivalent sets

- Consider the sets **C** and **D**

$$\mathbf{C} = \{a, b, c, d, e, f\}$$

$$\mathbf{D} = \{3, 4, 5, 6, 7, 8\}$$

- **C** and **D** are **equivalent** sets because the cardinality of both the sets is the same (i.e. 6.)
- However **C** and **D** are not equal, as they are comprised of different elements.

Equal and Equivalent Sets

- Necessarily all equal sets are equivalent sets.
- But are equivalent sets equal sets?
- No, because equivalent sets are sets that have the **same** cardinality but equal sets are sets that all their elements are precisely the **same**.

Example:

- **X**=$\{p,q,r\}$ and **Y**=$\{1,2,3\}$ are equivalent sets
- **E** =$\{m,n,o,p\}$ and **F**=$\{m,n,o,p\}$ are equal and equivalent sets

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Set Operations

Let $U = \{1, 2, \ldots, 9\}$ be the universal set, and let

- $A = \{1, 2, 3, 4, 5\}$,
- $B = \{4, 5, 6, 7\}$,
- $C = \{5, 6, 7, 8, 9\}$
- $D = \{1, 3, 5, 7, 9\}$,
- $E = \{2, 4, 6, 8\}$,
- $F = \{1, 5, 9\}$.

Set Operations

Find:

(a) $A \cup B$ and $A \cap B$,

(b) $C \cup D$ and $C \cap D$,

(c) $E \cup F$ and $E \cap F$.

Set Operations

Find:

(a) $A \cup B$ and $A \cap B$,

- $A = \{1, 2, 3, 4, 5\}$
- $B = \{4, 5, 6, 7\}$

Set Operations

Find:

(b) $C \cup D$ and $C \cap D$,

- $C = \{5, 6, 7, 8, 9\}$
- $D = \{1, 3, 5, 7, 9\}$

Set Operations

Find:

(c) $E \cup F$ and $E \cap F$.

- $E = \{2, 4, 6, 8\}$
- $F = \{1, 5, 9\}$

Discrete Mathematics

Set Theory : Finite Sets

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Finite Sets

Determine which of the following sets are finite:

(a) Set of Prime numbers

(b) Set of two digit Prime numbers

(c) Letters in the English alphabet.

(d) Integers which are multiples of 5.

(e) Days of the week

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Set Theory

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Set Theory

Given the set **A** is contructed as follows

$$[\{a, b\}, \{c\}, \{d, e, f\}].$$

(a) List the elements of **A**.

(b) Find the cardinality of **A** : $n(\mathbf{A})$.

(c) Find the power set of **A**.

Set Theory

$$\mathbf{A} = [\{a, b\}, \{c\}, \{d, e, f\}].$$

(a) List the elements of $\mathbf{A}$.

Set Theory

$$\mathbf{A} = [\{a, b\}, \{c\}, \{d, e, f\}].$$

(b) Find the cardinality of $\mathbf{A}$: $n(\mathbf{A})$.

Set Theory

$$\mathbf{A} = [\{a, b\}, \{c\}, \{d, e, f\}].$$

(c) Find the power set of $\mathbf{A}$.

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Consider the set **A**, which is a subset of the the universal set of real numbers $\mathbb{R}$

$$\mathbf{A} = \{4, \sqrt{2}, 2/3, -2.5, -5, 33, \sqrt{9}, \pi\}$$

Using formal set notation, write the sets of:

(a) natural numbers in **A**

(b) integers in **A**

(c) rational numbers in **A**

(d) irrational numbers in **A**

$$\mathbf{A} = \{4,\ \sqrt{2},\ 2/3,\ -2.5,\ -5,\ 33,\ \sqrt{9},\ \pi\}$$

(a) natural numbers in **A**

(b) integers in **A**

(c) rational numbers in **A**

(d) irrational numbers in **A**

$$\mathbf{A} = \{4,\ \sqrt{2},\ 2/3,\ -2.5,\ -5,\ 33,\ \sqrt{9},\ \pi\}$$

(a) natural numbers in **A**

Answer: $\{4,\ 33,\ \sqrt{9}\}$

(b) integers in **A**

(c) rational numbers in **A**

(d) irrational numbers in **A**

$$\mathbf{A} = \{4,\ \sqrt{2},\ 2/3,\ -2.5,\ -5,\ 33,\ \sqrt{9},\ \pi\}$$

(a) natural numbers in **A**

Answer: $\{4,\ 33,\ \sqrt{9}\}$

(b) integers in **A**

Answer: $\{4,\ -5,\ 33,\ \sqrt{9}\}$

(c) rational numbers in **A**

(d) irrational numbers in **A**

$$\mathbf{A} = \{4,\ \sqrt{2},\ 2/3,\ -2.5,\ -5,\ 33,\ \sqrt{9},\ \pi\}$$

(a) natural numbers in **A**

Answer: $\{4,\ 33,\ \sqrt{9}\}$

(b) integers in **A**

Answer: $\{4,\ -5,\ 33,\ \sqrt{9}\}$

(c) rational numbers in **A**

Answer: $\{4,\ 2/3,\ -2.5,\ -5,\ 33,\ \sqrt{9}\}$

(d) irrational numbers in **A**

$$\mathbf{A} = \{4,\ \sqrt{2},\ 2/3,\ -2.5,\ -5,\ 33,\ \sqrt{9},\ \pi\}$$

(a) natural numbers in **A**

Answer: $\{4,\ 33,\ \sqrt{9}\}$

(b) integers in **A**

Answer: $\{4,\ -5,\ 33,\ \sqrt{9}\}$

(c) rational numbers in **A**

Answer: $\{4,\ 2/3,\ -2.5,\ -5,\ 33,\ \sqrt{9}\}$

(d) irrational numbers in **A**

Answer: $\{\sqrt{2},\ \pi\}$

End of Slide Set