Sets

Murat Osmanoglu

Definitions

- A set is an unordered (well-defined) collection of objects.

Definitions

- A set is an unordered (well-defined) collection of objects.

- These objects are called elements (or members) of the set.

Definitions

- A set is an unordered (well-defined) collection of objects.
- These objects are called elements (or members) of the set.
- $x \in A$, x is an element of the set A
- $x \notin A$, x is not an element of the set A

Definitions

- $Z = \{2, -22, 12, 0, 43, -1287, \ldots\}$
  $Z = \{\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots\}$

Definitions

- Z = {2, -22, 12, 0, 43, -1287, . . .}
  Z = {. . ., -3, -2, -1, 0, 1, 2, 3, . . .}

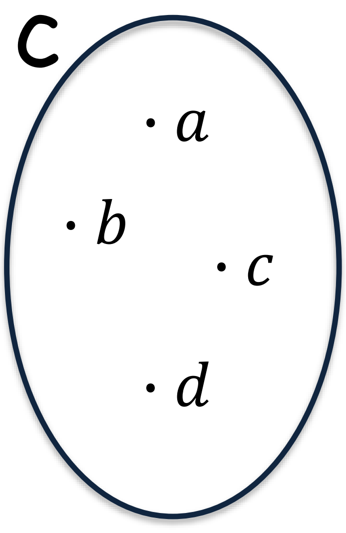
- $A = \{x \in Z^{+} | x < 10\}$ (set builder or common property)
  $B = \{x \in Z | x^{2} < 10\}$

Definitions

- Z = {2, -22, 12, 0, 43, -1287, . . .}
  Z = {. . ., -3, -2, -1, 0, 1, 2, 3, . . .}

- $A = \{x \in Z^{+} | x < 10\}$ (set builder or common property)
  $B = \{x \in Z | x^{2} < 10\}$

- Venn Diagram



Definitions

- Two sets are equal if and only if they have same elements. A and B are equal if and only if $\forall x(x \in A \leftrightarrow x \in B)$.

Definitions

- Two sets are equal if and only if they have same elements. A and B are equal if and only if $\forall x(x \in A \leftrightarrow x \in B)$.

  $A = \{x \in Z^+ | x < 6\}$ and $B = \{1, 2, 3, 4, 5\}$, A = B

Definitions

- Two sets are equal if and only if they have same elements. *A* and B are equal if and only if $\forall x(x \in A \leftrightarrow x \in B)$.

  $A = \{x \in Z^{+} | x < 6\}$ and $B = \{1, 2, 3, 4, 5\}$, **A = B**

- The universal set, denoted by U, contains all possible elements under the consideration

Definitions

- Two sets are equal if and only if they have same elements. A and B are equal if and only if $\forall x(x \in A \leftrightarrow x \in B)$.

  $A = \{x \in Z^{+} | x < 6\}$ and $B = \{1, 2, 3, 4, 5\}$, A = B

- The universal set, denoted by U, contains all possible elements under the consideration

- The empty set, denoted by $\emptyset$, has no element

Definitions

- A set A is a subset of a set B if and only if every element of A is also an element of B.

Definitions

- A set A is a subset of a set B if and only if every element of A is also an element of B.

$$A \subseteq B \leftrightarrow \forall x[x \in A \rightarrow x \in B]$$

Definitions

- A set A is a subset of a set B if and only if every element of A is also an element of B.

$A \subseteq B \leftrightarrow \forall x [x \in A \rightarrow x \in B]$

$A \nsubseteq B$

Definitions

- A set A is a subset of a set B if and only if every element of A is also an element of B.

$A \subseteq B \leftrightarrow \forall x[x \in A \rightarrow x \in B]$

$A \nsubseteq B \leftrightarrow \sim\forall x[x \in A \rightarrow x \in B]$

Definitions

- A set A is a subset of a set B if and only if every element of A is also an element of B.

$$A \subseteq B \leftrightarrow \forall x[x \in A \rightarrow x \in B]$$

$$\begin{aligned} A \not\subseteq B &\leftrightarrow \sim\forall x[x \in A \rightarrow x \in B] \\ &\leftrightarrow \exists x \sim[x \in A \rightarrow x \in B] \end{aligned}$$

Definitions

- A set A is a subset of a set B if and only if every element of A is also an element of B.

$$A \subseteq B \leftrightarrow \forall x[x \in A \rightarrow x \in B]$$

$$\begin{aligned} A \nsubseteq B &\leftrightarrow \sim\forall x[x \in A \rightarrow x \in B] \\ &\leftrightarrow \exists x\sim[x \in A \rightarrow x \in B] \\ &\leftrightarrow \exists x\sim[\sim x \in A \vee x \in B] \qquad (p \rightarrow q \equiv \sim p \vee q) \end{aligned}$$

Definitions

- A set A is a subset of a set B if and only if every element of A is also an element of B.

A⊆B $\leftrightarrow \forall x[x \in A \rightarrow x \in B]$

$$
\begin{aligned}
A \not\subseteq B &\leftrightarrow \sim\forall x[x \in A \rightarrow x \in B] \\
&\leftrightarrow \exists x \sim[x \in A \rightarrow x \in B] \\
&\leftrightarrow \exists x \sim[\sim x \in A \lor x \in B] \qquad (p \rightarrow q \equiv \sim p \lor q) \\
&\leftrightarrow \exists x[x \in A \land \sim x \in B]
\end{aligned}
$$

Definitions

- A set A is a subset of a set B if and only if every element of A is also an element of B.

$A \subseteq B \leftrightarrow \forall x[x \in A \rightarrow x \in B]$

$$
\begin{aligned}
A \not\subseteq B &\leftrightarrow \sim\forall x[x \in A \rightarrow x \in B] \\
&\leftrightarrow \exists x \sim[x \in A \rightarrow x \in B] \\
&\leftrightarrow \exists x \sim[\sim x \in A \vee x \in B] \qquad (p \rightarrow q \equiv \sim p \vee q) \\
&\leftrightarrow \exists x[x \in A \wedge \sim x \in B] \\
&\leftrightarrow \exists x[x \in A \wedge x \notin B]
\end{aligned}
$$

Definitions

- A set A is a subset of a set B if and only if every element of A is also an element of B.

  $A \subseteq B \leftrightarrow \forall x[x \in A \rightarrow x \in B]$

- $\emptyset \subseteq A$ and $A \subseteq A$.

Definitions

- A set A is a subset of a set B if and only if every element of A is also an element of B.

  $A \subseteq B \leftrightarrow \forall x [x \in A \rightarrow x \in B]$

- $\emptyset \subseteq A$ and $A \subseteq A$.

- $A = B$ if and only if $A \subseteq B$ and $B \subseteq A$

Definitions

- ... of A is

$A = \{x | x = 4k + 1 \; for \; some \; k \in Z \}$,
$B = \{x | x = 4k - 3 \; for \; some \; k \in Z \}$
Show that whether the sets A and B are equal or not.

Definitions

- of A is

$A = \{x | x = 4k + 1 \; for \; some \; k \in Z\}$,
$B = \{x | x = 4k - 3 \; for \; some \; k \in Z\}$
Show that whether the sets A and B are equal or not.

(A⊆B)

Definitions

- of A is

$A = \{x | x = 4k + 1 \ for\ some\ k \in Z\}$,
$B = \{x | x = 4k - 3 \ for\ some\ k \in Z\}$
Show that whether the sets A and B are equal or not.

(A⊆B) For any $x \in A$, $x = 4k + 1 \ for\ some\ k \in Z$

Definitions

of A is

$A = \{x | x = 4k + 1 \; for \; some \; k \in Z\}$,
$B = \{x | x = 4k - 3 \; for \; some \; k \in Z\}$
Show that whether the sets A and B are equal or not.

(A⊆B) For any $x \in A$, $x = 4k + 1 \; for \; some \; k \in Z$

$$x = 4k + 1 + 3 - 3$$

Definitions

- of A is

$A = \{x | x = 4k + 1 \; for \; some \; k \in Z\}$,
$B = \{x | x = 4k - 3 \; for \; some \; k \in Z\}$
Show that whether the sets A and B are equal or not.

(A⊆B) For any $x \in A$, $x = 4k + 1 \; for \; some \; k \in Z$

$$x = 4k + 1 + 3 - 3$$

$$x = 4(k + 1) - 3$$

Definitions

$A = \{x | x = 4k + 1 \ for \ some \ k \in Z\}$,
$B = \{x | x = 4k - 3 \ for \ some \ k \in Z\}$
Show that whether the sets A and B are equal or not.

(A⊆B) For any $x \in A$, $x = 4k + 1 \ for \ some \ k \in Z$

$$x = 4k + 1 + 3 - 3$$
$$x = 4(k + 1) - 3$$
$$x = 4m - 3 \ for \ some \ m \in Z, \text{ so } x \in B$$

of A is

Definitions

- … of A is

$A = \{x | x = 4k + 1 \; for \; some \; k \in Z\}$,
$B = \{x | x = 4k - 3 \; for \; some \; k \in Z\}$
Show that whether the sets A and B are equal or not.

(A⊆B) For any $x \in A$, $x = 4k + 1 \; for \; some \; k \in Z$

$$x = 4k + 1 + 3 - 3$$
$$x = 4(k + 1) - 3$$
$$x = 4m - 3 \; for \; some \; m \in Z, \text{ so } x \in B$$

(B⊆A)

Definitions

$A = \{x | x = 4k + 1 \; for \; some \; k \in Z\}$,
$B = \{x | x = 4k - 3 \; for \; some \; k \in Z\}$
Show that whether the sets A and B are equal or not.

(A⊆B) For any $x \in A$, $x = 4k + 1 \; for \; some \; k \in Z$

$$x = 4k + 1 + 3 - 3$$
$$x = 4(k + 1) - 3$$
$$x = 4m - 3 \; for \; some \; m \in Z$$, so $x \in B$

(B⊆A) For any $x \in B$, $x = 4k - 3 \; for \; some \; k \in Z$

Definitions

- of A is

$A = \{x | x = 4k + 1 \; for \; some \; k \in Z \}$,
$B = \{x | x = 4k - 3 \; for \; some \; k \in Z \}$
Show that whether the sets A and B are equal or not.

(A⊆B) For any $x \in A$, $x = 4k + 1 \; for \; some \; k \in Z$

$$x = 4k + 1 + 3 - 3$$
$$x = 4(k + 1) - 3$$
$$x = 4m - 3 \; for \; some \; m \in Z, \text{ so } x \in B$$

(B⊆A) For any $x \in B$, $x = 4k - 3 \; for \; some \; k \in Z$

$$x = 4k - 3 + 1 - 1$$

Definitions

- of A is

$A = \{x \mid x = 4k + 1 \; for \; some \; k \in Z\}$,
$B = \{x \mid x = 4k - 3 \; for \; some \; k \in Z\}$
Show that whether the sets A and B are equal or not.

(A⊆B) For any $x \in A$, $x = 4k + 1 \; for \; some \; k \in Z$

$$x = 4k + 1 + 3 - 3$$
$$x = 4(k + 1) - 3$$
$$x = 4m - 3 \; for \; some \; m \in Z$$, so $x \in B$

(B⊆A) For any $x \in B$, $x = 4k - 3 \; for \; some \; k \in Z$

$$x = 4k - 3 + 1 - 1$$
$$x = 4(k - 1) + 1$$

Definitions

of A is

$A = \{x | x = 4k + 1 \; for \; some \; k \in Z\}$,
$B = \{x | x = 4k - 3 \; for \; some \; k \in Z\}$

Show that whether the sets A and B are equal or not.

(A⊆B) For any $x \in A$, $x = 4k + 1 \; for \; some \; k \in Z$

$$x = 4k + 1 + 3 - 3$$
$$x = 4(k + 1) - 3$$
$$x = 4m - 3 \; for \; some \; m \in Z, \text{ so } x \in B$$

(B⊆A) For any $x \in B$, $x = 4k - 3 \; for \; some \; k \in Z$

$$x = 4k - 3 + 1 - 1$$
$$x = 4(k - 1) + 1$$
$$x = 4m + 1 \; for \; some \; m \in Z, \text{ so } x \in A$$

Definitions

of A is

$A = \{x | x = 4k + 1 \text{ } for \text{ } some \text{ } k \in Z \}$,
$B = \{x | x = 4k - 3 \text{ } for \text{ } some \text{ } k \in Z \}$
Show that whether the sets A and B are equal or not.

(A⊆B) For any $x \in A$, $x = 4k + 1 \text{ } for \text{ } some \text{ } k \in Z$

$$x = 4k + 1 + 3 - 3$$
$$x = 4(k + 1) - 3$$
$$x = 4m - 3 \text{ } for \text{ } some \text{ } m \in Z, \text{ so } x \in B$$

(B⊆A) For any $x \in B$, $x = 4k - 3 \text{ } for \text{ } some \text{ } k \in Z$

$$x = 4k - 3 + 1 - 1$$
$$x = 4(k - 1) + 1$$
$$x = 4m + 1 \text{ } for \text{ } some \text{ } m \in Z, \text{ so } x \in A$$

Thus, A=B.

Definitions

- A set A is a subset of a set B if and only if every element of A is also an element of B.

  $A \subseteq B \leftrightarrow \forall x[x \in A \rightarrow x \in B]$

- $\emptyset \subseteq A$ and $A \subseteq A$.

- $A = B$ if and only if $A \subseteq B$ and $B \subseteq A$

- A set A is a proper subset of a set B if and only if $A \subseteq B$ and $A \neq B$

Definitions

- A set A is a subset of a set B if and only if every element of A is also an element of B.

  $A \subseteq B \leftrightarrow \forall x[x \in A \to x \in B]$

- $\emptyset \subseteq A$ and $A \subseteq A$.

- $A = B$ if and only if $A \subseteq B$ and $B \subseteq A$

- A set A is a proper subset of a set B if and only if $A \subseteq B$ and $A \neq B$

$$B = \{x \in Z^+ | x < 10\} \text{ and } A = \{1, 2, 3, 4, 5\}$$

Definitions

- A set A is a subset of a set B if and only if every element of A is also an element of B.

  $A \subseteq B \leftrightarrow \forall x[x \in A \rightarrow x \in B]$

- $\emptyset \subseteq A$ and $A \subseteq A$.

- $A = B$ if and only if $A \subseteq B$ and $B \subseteq A$

- A set A is a proper subset of a set B if and only if $A \subseteq B$ and $A \neq B$

  $B = \{x \in Z^+ | x < 10\}$ and $A = \{1, 2, 3, 4, 5\}$, $A \subseteq B$

Definitions

- The cardinality of a set A is defined as the size of A. It's denoted by $|A|$. (only for finite set)

Definitions

- The cardinality of a set A is defined as the size of A. It's denoted by |A|. (only for finite set)

  For the set $A = \{x \in Z^+ | x < 10\}$, |A| = 9

Definitions

- The cardinality of a set A is defined as the size of A. It's denoted by |A|. (only for finite set)

  For the set $A = \{x \in Z^+ | x < 10\}$, |A| = 9

- The power set of a given set is the set of all possible subsets.

Definitions

- The cardinality of a set A is defined as the size of A. It's denoted by |A|. (only for finite set)

  For the set $A = \{x \in Z^+ | x < 10\}$, |A| = 9

- The power set of a given set is the set of all possible subsets.

  S={1} P(S)={∅, {1}}

Definitions

- The cardinality of a set A is defined as the size of A. It's denoted by |A|. (only for finite set)

  For the set $A = \{x \in Z^+ | x < 10\}$, |A| = 9

- The power set of a given set is the set of all possible subsets.

  S={1} P(S)={∅, {1}}

  S={a, b} P(S)={∅, {a}, {b}, {a, b}}

Definitions

- The cardinality of a set A is defined as the size of A. It's denoted by |A|. (only for finite set)

  For the set $A = \{x \in Z^{+} | x < 10\}$, |A| = 9

- The power set of a given set is the set of all possible subsets.

S={1}	P(S)={∅, {1}}	|P(S)|=2
S={a, b}	P(S)={∅, {a}, {b}, {a, b}}	|P(S)|=4

Definitions

- The cardinality of a set A is defined as the size of A. It's denoted by |A|. (only for finite set)

  For the set $A = \{x \in Z^+ | x < 10\}$, |A| = 9

- The power set of a given set is the set of all possible subsets.

  S={1} P(S)={∅, {1}} |P(S)|=2

  S={a, b} P(S)={∅, {a}, {b}, {a, b}} |P(S)|=4

- If |S|=n, then |P(S)|=2^n

Set Operations

Set Operations

- The union of *A* and B, denoted by *A*∪B, contains elements that are either in *A* or B.

$$\mathrm{A}\cup\mathrm{B} = \{x | x \in A \ \ \vee \ \ x \in B\}$$

Set Operations

- The union of A and B, denoted by $A \cup B$, contains elements that are either in A or B.

$$\mathrm{A} \cup \mathrm{B} = \{x | x \in A \ \lor \ x \in B\}$$

- The intersection of A and B, denoted by $A \cap B$, contains elements that are in both A or B.

$$\mathrm{A} \cap \mathrm{B} = \{x | x \in A \ \land \ x \in B\}$$

Set Operations

- The union of A and B, denoted by $A\cup B$, contains elements that are either in A or B.

$$\mathrm{A}\cup\mathrm{B} = \{x | x \in A \ \vee \ x \in B\}$$

- The intersection of A and B, denoted by $A\cap B$, contains elements that are in both A or B.

$$\mathrm{A}\cap\mathrm{B} = \{x | x \in A \ \wedge \ x \in B\}$$

The sets A and B are called disjoint sets if $\mathrm{A}\cap\mathrm{B} = \emptyset$

Set Operations

- The union of A and B, denoted by A∪B, contains elements that are either in A or B.

$$\mathrm{A \cup B} = \{x | x \in A \ \ \vee \ \ x \in B\}$$

- The intersection of A and B, denoted by A∩B, contains elements that are in both A or B.

$$\mathrm{A \cap B} = \{x | x \in A \ \ \wedge \ \ x \in B\}$$

The sets A and B are called disjoint sets if $\mathrm{A \cap B} = \emptyset$

- The difference of A and B, denoted by A-B, contains elements that are in A but not in B

$$\mathrm{A \cap B} = \{x | x \in A \ \ \wedge \ \ x \notin B\}$$

Set Operations

- The union of A and B, denoted by A∪B, contains elements that are either in A or B.

$$\mathrm{A{\cup}B} = \{x | x \in A \;\; \vee \;\; x \in B\}$$

- The intersection of A and B, denoted by A∩B, contains elements that are in both A or B.

$$\mathrm{A{\cap}B} = \{x | x \in A \;\; \wedge \;\; x \in B\}$$

The sets A and B are called disjoint sets if $\mathrm{A{\cap}B} = \emptyset$

- The difference of A and B, denoted by A-B, contains elements that are in A but not in B

$$\mathrm{A{\cap}B} = \{x | x \in A \;\; \wedge \;\; x \notin B\}$$

- The complement of A, denoted by $\overline{\mathrm{A}}$, contains elements that are in U but not in A.

$$\overline{\mathrm{A}} = \{x \in U | x \notin A\}$$

Set Operations

- $A \cup \emptyset = A$
  $A \cap U = A$

Set Operations

- $A \cup \emptyset = A$
  $A \cap U = A$

- $A \cup U = U$
  $A \cap \emptyset = \emptyset$

Set Operations

- $A \cup \emptyset = A$
  $A \cap U = A$

- $A \cup U = U$
  $A \cap \emptyset = \emptyset$

- $A \cup A = A$
  $A \cap A = A$

Set Operations

- $A \cup \emptyset = A$
  $A \cap U = A$

- $A \cup U = U$
  $A \cap \emptyset = \emptyset$

- $A \cup A = A$
  $A \cap A = A$

- $A \cup B = B \cup A$
  $A \cap B = B \cap A$

Set Operations

- $A \cup \emptyset = A$
  $A \cap U = A$
- $A \cup U = U$
  $A \cap \emptyset = \emptyset$
- $A \cup A = A$
  $A \cap A = A$
- $A \cup B = B \cup A$
  $A \cap B = B \cap A$
- $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

Set Operations

- $A \cup \emptyset = A$
  $A \cap U = A$

- $A \cup U = U$
  $A \cap \emptyset = \emptyset$

- $A \cup A = A$
  $A \cap A = A$

- $A \cup B = B \cup A$
  $A \cap B = B \cap A$

- $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

- $A \cap \overline{A} = \emptyset$
  $A \cup \overline{A} = U$

Set Operations

- $A \cup \emptyset = A$
  $A \cap U = A$

- $A \cup U = U$
  $A \cap \emptyset = \emptyset$

- $A \cup A = A$
  $A \cap A = A$

- $A \cup B = B \cup A$
  $A \cap B = B \cap A$

- $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

- $A \cap \overline{A} = \emptyset$
  $A \cup \overline{A} = U$

- $\overline{(\overline{A})} = A$

Set Operations

- $A \cup \emptyset = A$
  $A \cap U = A$
- $A \cup U = U$
  $A \cap \emptyset = \emptyset$
- $A \cup A = A$
  $A \cap A = A$
- $A \cup B = B \cup A$
  $A \cap B = B \cap A$
- $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
- $A \cap \bar{A} = \emptyset$
  $A \cup \bar{A} = U$
- $\overline{(\bar{A})} = A$
- $\overline{(A \cup B)} = \bar{A} \cap \bar{B}$ (De Morgan)
  $\overline{(A \cap B)} = \bar{A} \cup \bar{B}$

Set Operations

- $A \cup \emptyset = A$
  $A \cap U = A$

  $p \vee 0 \equiv p$
  $p \wedge 1 \equiv p$

- $A \cup U = U$
  $A \cap \emptyset = \emptyset$

  $p \vee 1 \equiv 1$
  $p \wedge 0 \equiv 0$

- $A \cup A = A$
  $A \cap A = A$

  $p \vee p \equiv p$
  $p \wedge p \equiv p$

- $A \cup B = B \cup A$
  $A \cap B = B \cap A$

- $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

- $A \cap \bar{A} = \emptyset$
  $A \cup \bar{A} = U$

  $p \wedge \sim p \equiv 0$
  $p \vee \sim p \equiv 1$

- $\overline{(\bar{A})} = A$

  $\sim(\sim p) \equiv p$

- $\overline{(A \cup B)} = \bar{A} \cap \bar{B}$ (De Morgan)
  $\overline{(A \cap B)} = \bar{A} \cup \bar{B}$

  $\sim(p \vee q) \equiv \sim p \wedge \sim q$
  $\sim(p \wedge q) \equiv \sim p \vee \sim q$

Set Operations

- $A \cup \emptyset = A$
  $A \cap U = A$
- $A \cup U = U$
  $A \cap \emptyset = \emptyset$
- $A \cup A = A$
  $A \cap A = A$
- $A \cup B = B \cup A$
  $A \cap B = B \cap A$
- $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
- $A \cap \overline{A} = \emptyset$
  $A \cup \overline{A} = U$
- $\overline{(\overline{A})} = A$
- $\overline{(A \cup B)} = \overline{A} \cap \overline{B}$ (De Morgan)
  $\overline{(A \cap B)} = \overline{A} \cup \overline{B}$

$$\boxed{|A \cup B| = |A| + |B| - |A \cap B|}$$

Cartesian Products

- The cartesian product of A and B, denoted by AxB, is the set of all pairs (x,y) where $x \in A$ and $y \in B$

Cartesian Products

- The cartesian product of A and B, denoted by AxB, is the set of all pairs (x,y) where $\mathrm{x} \in A$ and $y \in B$

$$A\,x B = \{(x, y) | x \in A \;\; \wedge \;\; y \in B\}$$

Cartesian Products

- The cartesian product of A and B, denoted by AxB, is the set of all pairs (x,y) where $x \in A$ and $y \in B$

$$A \, x B = \{(x, y) | x \in A \;\; \wedge \;\; y \in B\}$$

- A={a,b}, B={1, 2, 3}

Cartesian Products

- The cartesian product of A and B, denoted by AxB, is the set of all pairs (x,y) where $x \in A$ and $y \in B$

$$A\,x\,B = \{(x, y) | x \in A \;\; \wedge \;\; y \in B\}$$

- A={a,b}, B={1, 2, 3}

AxB = {(a, 1), (a, 2), (a, 3), (b, 1), (b, 2), (b, 3)}

Cartesian Products

- The cartesian product of A and B, denoted by AxB, is the set of all pairs (x,y) where $x \in A$ and $y \in B$

$$A\, x B = \{(x, y) | x \in A \ \ \wedge \ \ y \in B\}$$

- A={a,b}, B={1, 2, 3}

AxB = {(a, 1), (a, 2), (a, 3), (b, 1), (b, 2), (b, 3)}

$$\boxed{|AxB| = |A| \,.\, |B|}$$

Cartesian Products

- The cartesian product of A and B, denoted by AxB, is the set of all pairs (x,y) where $\mathrm{x} \in A$ and $y \in B$

$$A\,x B = \{(x, y)|x \in A \quad \wedge \quad y \in B\}$$

- A={a,b}, B={1, 2, 3}

AxB = {(a, 1), (a, 2), (a, 3), (b, 1), (b, 2), (b, 3)}

$$\boxed{|AxB| = |A| \,.\, |B|}$$

- *The Cartesian products of the sets $A_1, A_2, \ldots, A_n$ is the set of ordered n-tuples $(a_1, a_2, \ldots, a_n)$ where $a_1 \in A_1, a_2 \in A_2, \ldots, a_n \in A_n$.*

Cartesian Products

- The cartesian product of A and B, denoted by AxB, is the set of all pairs (x,y) where $\mathrm{x} \in A$ and $y \in B$

$$A\,x B = \{(x, y) | x \in A \ \ \wedge \ \ y \in B\}$$

- A={a,b}, B={1, 2, 3}

AxB = {(a, 1), (a, 2), (a, 3), (b, 1), (b, 2), (b, 3)}

$$\boxed{|AxB| = |A| \,.\, |B|}$$

- *The Cartesian products of the sets $A_1, A_2, \ldots, A_n$ is the set of ordered n-tuples $(a_1, a_2, \ldots, a_n)$ where $a_1 \in A_1, a_2 \in A_2, \ldots, a_n \in A_n$.*

$$A_1 x \ldots x A_n = \{(a_1, a_2, \ldots, a_n) | a_i \in A_i, i = 1..n\}$$