# LISA 2. ELEMENTAARTEHETEGA SEOTUD OLULISEMAD VÕRDUSED, OMADUSED JA VENN'I DIAGRAMMID

## 1. OLULISEMAD VÕRDUSED, OMADUSED

$X \cup Y = \{\alpha \mid \alpha \in X \vee \alpha \in Y\}$ *(hulkade ühend)*

$(\alpha \in X \cup Y) \Leftrightarrow (\alpha \in X \vee \alpha \in Y)$

$\mathbf{A \cup B \cup C \cup \ldots \cup D} \int \bigcup\{\mathbf{A,B,C,\ldots,D}\}$

***Iga ühendatav hulk on vastava ühendi osahulgaks.***

***Kui on teada, et*** $H \subseteq T$, ***siis*** $H \cup T = T$

$H \cup H = H$ *(ühendi idempotentsus)*

$X \cup Y = Y \cup X$ *(ühendi kommutatiivsus)*

$X \cup (Y \cup Z) = (X \cup Y) \cup Z$ *(ühendi assotsiatiivsus)*

***Suvalise kahe lõpliku hulga A ning B korral*** $E(A \cup B) \leq E(A) + E(B)$ .

$X \cap Y = \{\alpha \mid \alpha \in X \ \& \ \alpha \in Y\}$ *(hulkade ühisosa)*

$(\alpha \in X \cap Y) \Leftrightarrow (\alpha \in X \ \& \ \alpha \in Y)$

$\mathbf{A \cap B \cap C \cap \ldots \cap D} \int \bigcap\{\mathbf{A,B,C,\ldots,D}\}$

$A \cap B \subseteq A$ ***ning*** $A \cap B \subseteq B$

***Kui on teada, et*** $H \subseteq T$, ***siis*** $H \cap T = H$.

$A \cap B \subseteq A \cup B$

$H \cap H = H$ (*ühisosa idempotentsus*)

$X \cap Y = Y \cap X$ (*ühisosa kommutatiivsus*)

$X \cap (Y \cap Z) = (X \cap Y) \cap Z$ (*ühisosa assotsiatiivsus*)

*Suvalise kahe lõpliku hulga A ja B korral* $E(A \cap B) \le E(A)$ ja $E(A \cap B) \le E(A)$.

*Suvalise kahe lõpliku hulga A ja B korral* $E(A \cup B) = E(A) + E(B) - E(A \cap B)$.

$A = A \cup (A \cap B)$ **ja** $A = A \cap (A \cup B)$ (*neelduvusseadused*)

*Ühisosa ja ühendi distributiivsuse seadused*:
$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$,

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

$H \cup (A \cap B \cap \ldots \ldots \cap X) = (H \cup A) \cap (H \cup B) \cap \ldots \ldots \cap (H \cup X)$,

$H \cap (A \cup B \cup \ldots \ldots \cup X) = (H \cap B) \cup (H \cap B) \cup \ldots \ldots \cup (H \cap X)$.

$A - B = \{x \mid x \in A \ \& \ x \notin B\}$ (*hulkade vahe*)

$(x \in A - B) \Leftrightarrow (x \in A \ \& \ x \notin B)$

$A - B \subseteq A$

*Lõplike hulkade A ning B korral* $\mathbf{E(A - B) \le E(A)}$.

$\mathbf{A - (A - B) = A \cap B}$

*Lõplike hulkade A ning B korral* $E(A - B) = E(A) - E(A \cap B)$.

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

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

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

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

**NB!** ***Leiduvad hulgad A, B ja C, mille korral*** $(A - C) \cup (B - C) \ne (A \cap B) - C$.

**NB!** ***Leiduvad hulgad A, B ja C, mille korral*** $(A - C) \cap (B - C) \ne (A \cup B) - C$.

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



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

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

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

*Kui* **N** *on universaalne hulk, siis mistahes hulga A korral* $N \cap A = A$.

$A' = N - A$ (*hulga A täiend ehk täiendhulk*)

$\alpha \in A' \Leftrightarrow \alpha \in N - A$ **ehk** $\alpha \in A' \Leftrightarrow (\alpha \in N \ \& \ \alpha \notin A)$ **ehk** $\alpha \in A' \Leftrightarrow \alpha \notin A$

$\alpha \notin A' \Leftrightarrow \alpha \in A$

$(A')' = A$

*Lõpliku universaalhulga N korral* $E(A') = E(N) - E(A)$.

*Mistahes kahe hulga A ning B korral,* *kui* $A \subseteq B$, *siis* $B' \subseteq A'$.

*De Morgani seadused: mistahes kahe hulga A ning B korral* $(A \cup B)' = A' \cap B'$,

$(A \cap B)' = A' \cup B'$.

$(A - B)' = A' \cup B$

$A' - B' = B - A$

$A \,\Delta\, B = \{x \mid (x \in A \vee x \in B) \ \& \neg (x \in A \ \& \ x \in B)\}$ (*hulkade erisosa*)

$x \in A \Delta B \Leftrightarrow [(x \in A \vee x \in B) \ \& \neg (x \in A \ \& \ x \in B)]$

$(A \,\Delta\, B = \varnothing) \Leftrightarrow (A = B)$

$A \,\Delta\, B = (A \cup B) - (A \cap B)$

*Suvalise kahe lõpliku hulga A ning B korral* $E(A \,\Delta\, B) = E(A) + E(B) - 2E(A \cap B)$.

$A \,\Delta\, B = (A - B) \cup (B - A)$

$(A \,\Delta\, B)' = (A \cup B)' \cup (A \cap B)$

$A' \Delta B' = A \,\Delta\, B$

***Lõplike hulkade A ning B erinevuse absoluutne mõõt:*** $\mathbf{D(A,B) = E(A \Delta B)}$

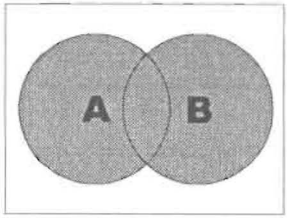
$0 \le \mathbf{D(A,B)}$

***Lõplike** hulkade A ning B erinevuse relatiivne (ehk suhteline) mõõt*:

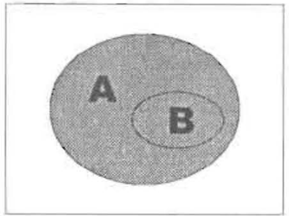
- $d(A,B) = E(A\Delta B) : E(A\cup B)$ *ehk* $d(A,B) = D(A,B) : E(A\cup B)$ , *kui* $A\cup B\neq\varnothing$
- $d(A,B) = 0$, *kui* $A\cup B=\varnothing$

$0 \le d(A,B) \le 1$.

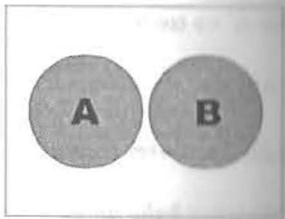
## 2. VENN'I DIAGRAMMID.



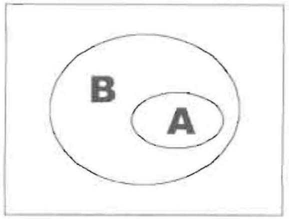
$A\cup B$



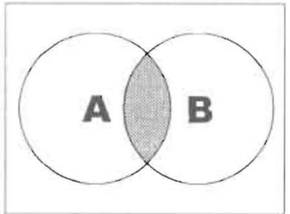
$A\cup B$



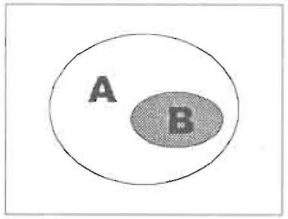
$A\cup B$



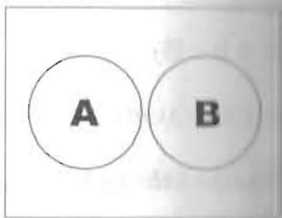
$A\cup B= \varnothing$



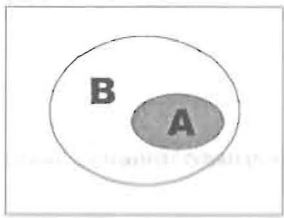
$A\cap B$



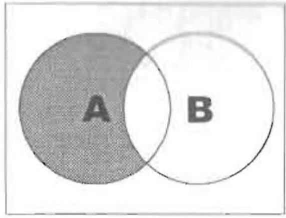
$A\cap B$



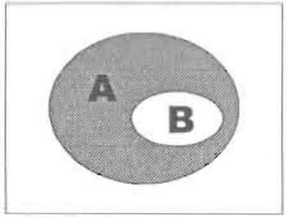
$A\cap B= \varnothing$





$A-B$



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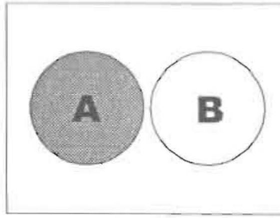
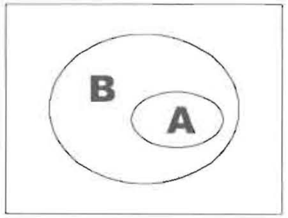
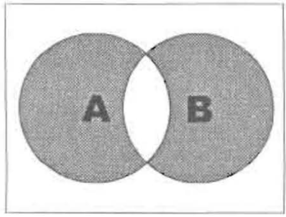


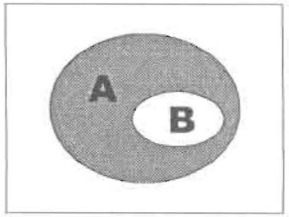
$A-B$



$B-A= \varnothing$



$A \Delta B$



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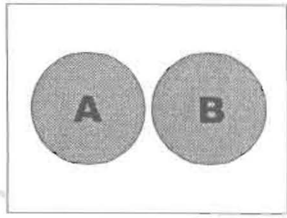

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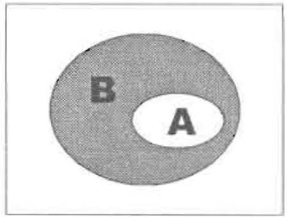

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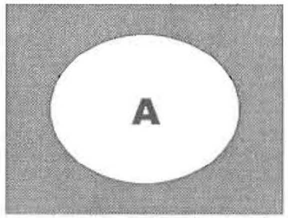
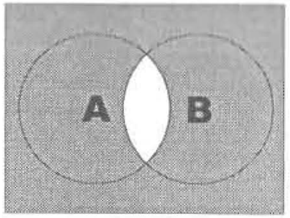
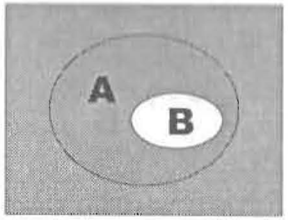


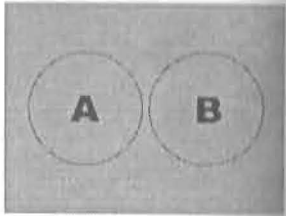
$A'$




$A' \cup B'$




$A' \cup B'$

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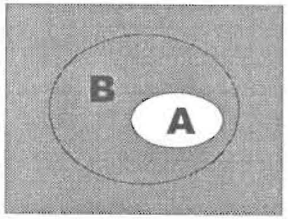
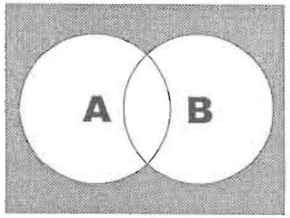
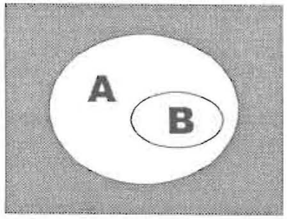


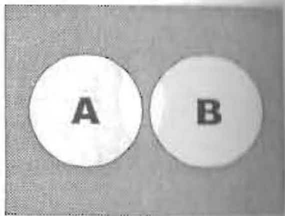

$A' \cup B'$



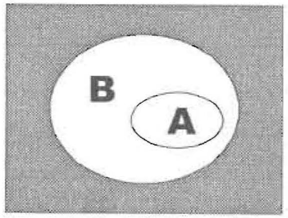

$A' \cap B'$



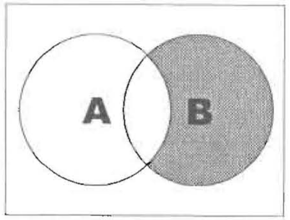

$A' \cap B'$



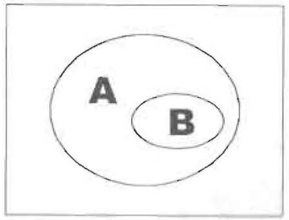

$A' \cap B'$



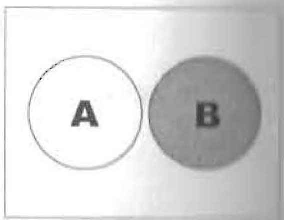

$A' \cap B'$




$A' - B'$

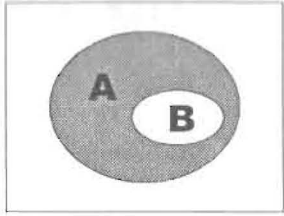



$A' - B' = \varnothing$

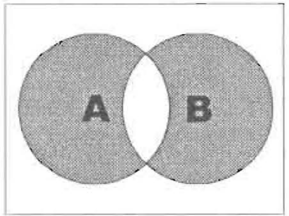



$A' - B'$

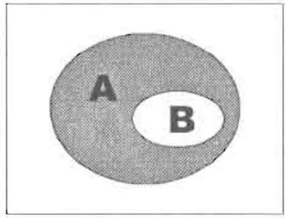
Lisa 2. Elementaartehetega seotud olulisemad võrdused, omadused ja Venn'i diagrammid



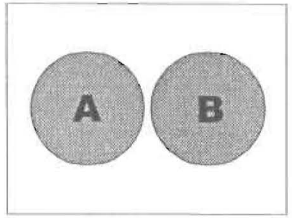

$A' - B'$



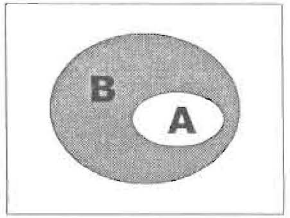

$A' \Delta B'$




$A' \Delta B'$




$A' \Delta B'$

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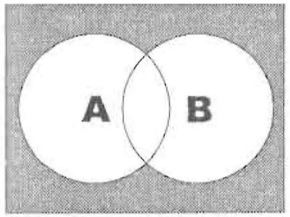
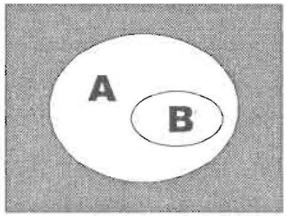
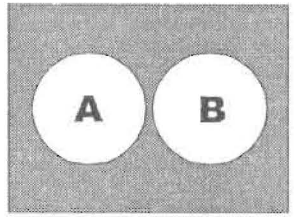


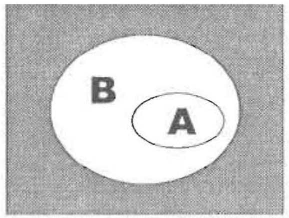

$(A \cup B)'$



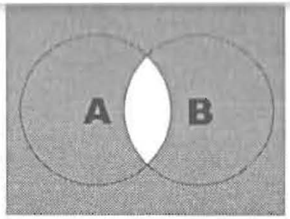

$(A \cup B)'$



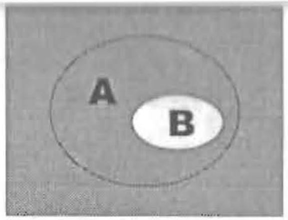

$(A \cup B)'$




$(A \cup B)'$



(A ∩ B)′



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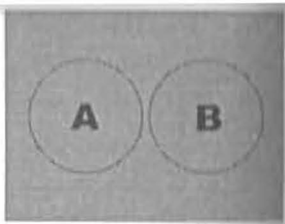
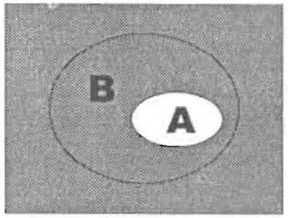
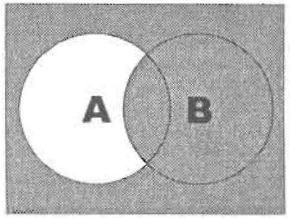


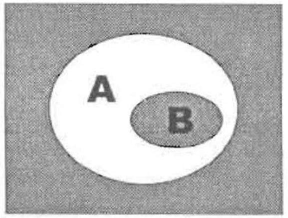
(A ∩ B)′



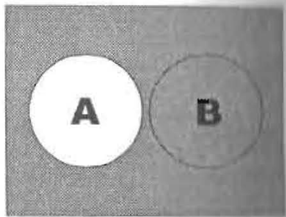
(A ∩ B)′



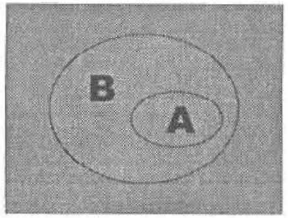
(A–B)′



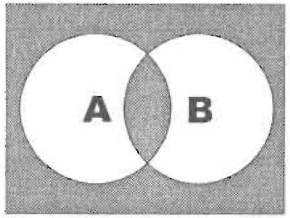
(A–B)′



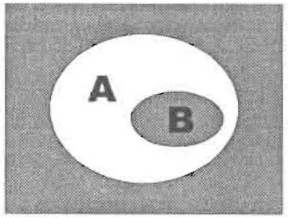
(A–B)′



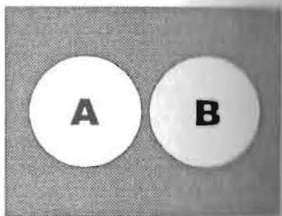
(A–B)′



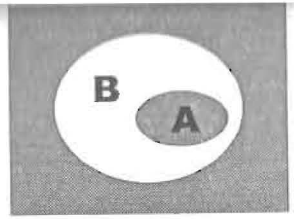
(A Δ B)′



(A Δ B)′



(A Δ B)′



(A Δ B)′