

# Baze podataka 2

## Projektovanje šeme baze podataka metodom sinteze

---

*Primeri*

# Primer 1

---

$U = \{A, B, C, D, E, F\}$

$F = \{AB \rightarrow C, AB \rightarrow D, DE \rightarrow A, DE \rightarrow B, AC \rightarrow F, BF \rightarrow E, E \rightarrow C\}$

Metodom sinteze izgenerisati skup šema relacija u 3NF.

# Primer 1

---

- $F = \{AB \rightarrow C, AB \rightarrow D, DE \rightarrow A, DE \rightarrow B, AC \rightarrow F, BF \rightarrow E, E \rightarrow C\}$
- dekompozicija
  - *svaka fz sa desne strane sadrži samo jedno obeležje*
- redukcija levih strana
  - $AB \rightarrow C: (A)^+_F = A; (B)^+_F = B$
  - $AB \rightarrow D: (A)^+_F = A; (B)^+_F = B$
  - $DE \rightarrow A: (D)^+_F = D; (E)^+_F = EC$
  - $DE \rightarrow B: (D)^+_F = D; (E)^+_F = EC$
  - $AC \rightarrow F: (A)^+_F = A; (C)^+_F = C$
  - $BF \rightarrow E: (B)^+_F = B; (F)^+_F = F$
  - *nijedna fz ne može se levo redukovati*

# Primer 1

---

- $U = \{A, B, C, D, E, F\}$
- $F = \{AB \rightarrow C, AB \rightarrow D, DE \rightarrow A, DE \rightarrow B, AC \rightarrow F, BF \rightarrow E, E \rightarrow C\}$
- eliminacija redundantnih fz
  - $AB \rightarrow C: C \notin (AB)^+_{F \setminus \{AB \rightarrow C\}} = ABD$
  - $AB \rightarrow D: D \notin (AB)^+_{F \setminus \{AB \rightarrow D\}} = ABCFE$
  - $DE \rightarrow A: A \notin (DE)^+_{F \setminus \{DE \rightarrow A\}} = DEBC$
  - $DE \rightarrow B: B \notin (DE)^+_{F \setminus \{DE \rightarrow B\}} = DEACF$
  - $AC \rightarrow F: F \notin (AC)^+_{F \setminus \{AC \rightarrow F\}} = AC$
  - $BF \rightarrow E: E \notin (BF)^+_{F \setminus \{BF \rightarrow E\}} = BF$
  - $E \rightarrow C: C \notin (E)^+_{F \setminus \{E \rightarrow C\}} = E$
  - *ne postoje redundantne fz*

# Primer 1

---

- $kp(F) = F = \{AB \rightarrow C, AB \rightarrow D, DE \rightarrow A, DE \rightarrow B, AC \rightarrow F, BF \rightarrow E, E \rightarrow C\}$
- particije kanoničkog pokrivača
  - $G(AB) = \{AB \rightarrow C, AB \rightarrow D\}$
  - $G(DE) = \{DE \rightarrow A, DE \rightarrow B\}$
  - $G(AC) = \{AC \rightarrow F\}$
  - $G(BF) = \{BF \rightarrow E\}$
  - $G(E) = \{E \rightarrow C\}$
  - $\mathbf{G} = \{G(AB), G(DE), G(AC), G(BF), G(E)\}$

# Primer 1

---

- $\mathbf{G} = \{G(AB), G(DE), G(AC), G(BF), G(E)\}$
- traženje podskupova  $G(X_i), G(X_j) \in \mathbf{G}$  s ekvivalentnim levim stranama
  - $(AB)^+_F = ABCDFE$
  - $(DE)^+_F = DEABCF$
  - $(AC)^+_F = ACF$
  - $(BF)^+_F = BFEC$
  - $(E)^+_F = EC$
- $(AB)^+_F = (DE)^+_F$ 
  - $G(AB, DE) = G(AB) \cup G(DE) = \{AB \rightarrow C, AB \rightarrow D, DE \rightarrow A, DE \rightarrow B\}$
  - $\mathbf{G} = \{G(AB, DE), G(AC), G(BF), G(E)\}$

# Primer 1

---

– uklanjanje tranzitivnih fz - formiranje skupa fz ekvivalentnih levih strana **J**

- $(AB)^+_F = (DE)^+_F$
- $J = \{AB \rightarrow DE, DE \rightarrow AB\} = \{AB \rightarrow D, AB \rightarrow E, DE \rightarrow A, DE \rightarrow B\}$
- $G(AB, DE) \leftarrow G(AB, DE) \setminus J$
- $G(AB, DE) = \{AB \rightarrow C\}$

# Primer 1

---

– uklanjanje tranzitivnih fz - traženje suvišnih fz iz skupa  $G_U$

- $G_U = \cup_{G_X \in \mathbf{G}} (G_X) = \{AB \rightarrow C, AC \rightarrow F, BF \rightarrow E, E \rightarrow C\}$
- $M = G_U \cup J = \{AB \rightarrow C, AC \rightarrow F, BF \rightarrow E, E \rightarrow C, AB \rightarrow D, AB \rightarrow E, DE \rightarrow A, DE \rightarrow B\}$
- $AB \rightarrow C: C \in (AB)^+_{M \setminus \{AB \rightarrow C\}} = ABDECF \Rightarrow$  suvišna
- $AC \rightarrow F: F \notin (AC)^+_{M \setminus \{AC \rightarrow F\}} = AC$
- $BF \rightarrow E: E \notin (BF)^+_{M \setminus \{BF \rightarrow E\}} = BF$
- $E \rightarrow C: C \notin (E)^+_{M \setminus \{E \rightarrow C\}} = E$
  
- $AB \rightarrow C$  suvišna  $\Rightarrow G(AB, DE) = \{\}$
- u polaznom skupu  $F$   $AB \rightarrow C$  nije bila suvišna, ali u  $M$  je postala suvišna jer važi  $AB \rightarrow E, E \rightarrow C$

# Primer 1

---

– rekonstrukcija particija

- $G = \{G(AB, DE), G(AC), G(BF), G(E)\}$
- $J = \{AB \rightarrow DE, DE \rightarrow AB\} = \{AB \rightarrow D, AB \rightarrow E, DE \rightarrow A, DE \rightarrow B\}$
- $G(X_{i_1}, \dots, X_{i_n}) \leftarrow G(X_{i_1}, \dots, X_{i_n}) \cup \{X_i \rightarrow X_j \in J \mid X_i \in \{X_{i_1}, \dots, X_{i_n}\}\}$
- $G(AB, DE) = \{AB \rightarrow D, AB \rightarrow E, DE \rightarrow A, DE \rightarrow B\}$
- $G(AC) = \{AC \rightarrow F\}$
- $G(BF) = \{BF \rightarrow E\}$
- $G(E) = \{E \rightarrow C\}$

– formiranje skupa šema relacija

- $S = \{N1(\{A, B, D, E\}, \{AB, DE\}), N2(\{A, C, F\}, \{AC\}), N3(\{B, F, E\}, \{BF\}), N4(\{E, C\}, \{E\})\}$

–  $S$  je u 3NF

# Primer 1

---

- Napomena: da nije izvršena eliminacija tranzitivnih zavisnosti dobili bismo sledeće:
  - $S' = \{N1(\{A, B, C, D, E\}, \{AB, DE\}), N2(\{A, C, F\}, \{AC\}), N3(\{B, F, E\}, \{BF\}), N4(\{E, C\}, \{E\})\}$
  - $N1(\{A, B, C, D, E\}, \{AB, DE\}) : AB \rightarrow C, AB \rightarrow D, AB \rightarrow E, E \rightarrow C, DE \rightarrow A, DE \rightarrow B, DE \rightarrow C : AB \rightarrow C$  je tranzitivna,  $S'$  nije u 2NF
- formiranje ograničenja stranog ključa
  - $N_1[E] \subseteq N_4[E]$
  - $N_3[E] \subseteq N_4[E]$
- spojivost bez gubitaka
  - ključevi univerzalne šeme relacije su  $K = \{AB, DE\}$
  - u skupu  $S$  postoji šema relacije sa ključem univerzalne šeme relacije, pa je spojivost bez gubitaka očuvana

# Primer 2

---

$U = \{A, B, C, D, E, F, G\}$

$F = \{ABC \rightarrow D, AB \rightarrow C, C \rightarrow A, C \rightarrow B, D \rightarrow E, AB \rightarrow E, EF \rightarrow G, G \rightarrow F, DG \rightarrow F\}$

Metodom sinteze izgenerisati skup šema relacija u 3NF.

# Primer 2

---

- $F = \{ABC \rightarrow D, AB \rightarrow C, C \rightarrow A, C \rightarrow B, D \rightarrow E, AB \rightarrow E, EF \rightarrow G, G \rightarrow F, DG \rightarrow F\}$
- dekompozicija
  - *svaka fz sa desne strane sadrži samo jedno obeležje*
- redukcija levih strana
  - *Da li  $ABC \rightarrow D$  može da se redukuje? Tražimo minimalni pravi podskup od  $ABC$ , takav da određuje  $D$ . Možemo posmatrati redom zatvarače nad  $A, B, C, AB, AC, BC$ .*
  - $ABC \rightarrow D : (A)^+_F = A; (B)^+_F = B; (C)^+_F = CABDE \Rightarrow ABC \rightarrow D$   
*se redukuje na  $C \rightarrow D$*
  - $AB \rightarrow C : (A)^+_F = A; (B)^+_F = B$
  - $AB \rightarrow E : (A)^+_F = A; (B)^+_F = B$
  - $EF \rightarrow G : (E)^+_F = E; (F)^+_F = F$
  - $DG \rightarrow F : (D)^+_F = DE; (G)^+_F = GF \Rightarrow$  *redukuje se na  $G \rightarrow F$*
  - $H = \{C \rightarrow D, AB \rightarrow C, C \rightarrow A, C \rightarrow B, D \rightarrow E, AB \rightarrow E, EF \rightarrow G, G \rightarrow F\}$

# Primer 2

---

- $H = \{C \rightarrow D, AB \rightarrow C, C \rightarrow A, C \rightarrow B, D \rightarrow E, AB \rightarrow E, EF \rightarrow G, G \rightarrow F\}$
- eliminacija redundantnih fz
  - $C \rightarrow D : D \notin (C)^+_{H \setminus \{C \rightarrow D\}} = C A B E$
  - $AB \rightarrow C : C \notin (AB)^+_{H \setminus \{AB \rightarrow C\}} = A B E$
  - $C \rightarrow A : A \notin (C)^+_{H \setminus \{C \rightarrow A\}} = C B D$
  - $C \rightarrow B : B \notin (C)^+_{H \setminus \{C \rightarrow B\}} = C A D$
  - $D \rightarrow E : E \notin (D)^+_{H \setminus \{D \rightarrow E\}} = D$
  - $AB \rightarrow E : E \in (AB)^+_{H \setminus \{AB \rightarrow E\}} = A B C D E \Rightarrow AB \rightarrow E$  suvišna (redundantna), pa će biti eliminisana iz skupa  $H$
  - $EF \rightarrow G : G \notin (EF)^+_{H \setminus \{EF \rightarrow G\}} = E F$
  - $G \rightarrow F : F \notin (G)^+_{H \setminus \{G \rightarrow F\}} = G$
  - $H = kp(F) = \{C \rightarrow D, AB \rightarrow C, C \rightarrow A, C \rightarrow B, D \rightarrow E, EF \rightarrow G, G \rightarrow F\}$

# Primer 2

---

- $H = kp(F) = \{C \rightarrow D, AB \rightarrow C, C \rightarrow A, C \rightarrow B, D \rightarrow E, EF \rightarrow G, G \rightarrow F\}$
- particije kanoničkog pokrivača
  - $G(C) = \{C \rightarrow D, C \rightarrow A, C \rightarrow B\}$
  - $G(AB) = \{AB \rightarrow C\}$
  - $G(D) = \{D \rightarrow E\}$
  - $G(EF) = \{EF \rightarrow G\}$
  - $G(G) = \{G \rightarrow F\}$

# Primer 2

---

- $\mathbf{G} = \{G(C), G(AB), G(D), G(EF), G(G)\}$
- traženje podskupova  $G(X_i), G(X_j) \in \mathbf{G}$  s ekvivalentnim levim stranama
  - $(C)^+_F = CDABE$
  - $(AB)^+_F = ABCDE$
  - $(D)^+_F = DE$
  - $(EF)^+_F = EFG$
  - $(G)^+_F = GF$
- $(C)^+_F = (AB)^+_F$ 
  - $G(C, AB) = G(C) \cup G(AB) = \{C \rightarrow D, C \rightarrow A, C \rightarrow B, AB \rightarrow C\}$
  - $\mathbf{G} = \{G(C, AB), G(D), G(EF), G(G)\}$

# Primer 2

---

– uklanjanje tranzitivnih fz - formiranje skupa fz ekvivalentnih levih strana  $J$

- $(C)^+_F = (AB)^+_F$
- $J = \{AB \rightarrow C, C \rightarrow AB\} = \{AB \rightarrow C, C \rightarrow A, C \rightarrow B\}$
- $G(C, AB) \leftarrow G(C, AB) \setminus J$
- $G(C, AB) = \{C \rightarrow D\}$

# Primer 2

---

– uklanjanje tranzitivnih fz - traženje suvišnih fz iz skupa  $G_U$

- $G_U = \cup_{G_X \in G} (G_X) = \{C \rightarrow D, D \rightarrow E, EF \rightarrow G, G \rightarrow F\}$
- $M = \cup_{G_X \in G} (G_X) \cup J = \{C \rightarrow D, D \rightarrow E, EF \rightarrow G, G \rightarrow F, AB \rightarrow C, C \rightarrow A, C \rightarrow B\}$
- $C \rightarrow D : D \notin (C)^+_{M \setminus \{C \rightarrow D\}} = CAB$
- $D \rightarrow E : E \notin (D)^+_{M \setminus \{D \rightarrow E\}} = D$
- $EF \rightarrow G : G \notin (EF)^+_{M \setminus \{EF \rightarrow G\}} = EF$
- $G \rightarrow F : F \notin (G)^+_{M \setminus \{G \rightarrow F\}} = G$
- *nema suvišnih fz*

# Primer 2

---

– rekonstrukcija particija

- $G = \{G(C, AB), G(D), G(EF), G(G)\}$
- $J = \{AB \rightarrow C, C \rightarrow A, C \rightarrow B\}$
- $G(X_{i_1}, \dots, X_{i_n}) \leftarrow G(X_{i_1}, \dots, X_{i_n}) \cup \{X_i \rightarrow X_j \in J \mid X_i \in \{X_{i_1}, \dots, X_{i_n}\}\}$
- $G(C, AB) = \{C \rightarrow D, C \rightarrow A, C \rightarrow B, AB \rightarrow C\}$
- $G(D) = \{D \rightarrow E\}$
- $G(EF) = \{EF \rightarrow G\}$
- $G(G) = \{G \rightarrow F\}$

– formiranje skupa šema relacija

- $S = \{N1(\{A, B, C, D\}, \{C, AB\}), N2(\{D, E\}, \{D\}), N3(\{E, F, G\}, \{EF\}), N4(\{G, F\}, \{G\})\}$

–  $S$  je u 3NF

# Primer 2

---

- formiranje ograničenja stranog ključa
  - $N_1[D] \subseteq N_2[D]$
  - $N_3[G] \subseteq N_4[G]$
- spojivost bez gubitaka
  - *ključevi univerzalne šeme relacije su  $K=\{ABF, ABG, CF, CG\}$*
  - *u skupu  $S$  ne postoji šema relacije sa ključem univerzalne šeme relacije, pa spojivost bez gubitaka nije očuvana*
  - *npr možemo dodati šemu  $(\{C, G\}, \{CG\})$*
  - $S= \{N1(\{A, B, C, D\}, \{C, AB\}), N2(\{D, E\}, \{D\}), N3(\{E, F, G\}, \{EF\}), N4(\{G, F\}, \{G\}), N5(\{C, G\}, \{CG\})\}$
  - *Dodatna ograničenja stranog ključa nakon dodavanja nove šeme:  $N_5[G] \subseteq N_4[G], N_5[C] \subseteq N_1[C]$*

# Primer 3

---

$U = \{A, B, C, D, E, F, G, H, I\}$

$F = \{CD \rightarrow E, E \rightarrow BCD, BC \rightarrow D, CDE \rightarrow A, A \rightarrow B, E \rightarrow G, EH \rightarrow I, C \rightarrow H, F \rightarrow H, E \rightarrow H, A \rightarrow D\}$

Metodom sinteze izgenerisati skup šema relacija u 3NF.

# Primer 3

---

- $F = \{CD \rightarrow E, E \rightarrow BCD, BC \rightarrow D, CDE \rightarrow A, A \rightarrow B, E \rightarrow G, EH \rightarrow I, C \rightarrow H, F \rightarrow H, E \rightarrow H, A \rightarrow D\}$
- dekompozicija
  - $H = \{CD \rightarrow E, E \rightarrow B, E \rightarrow C, E \rightarrow D, BC \rightarrow D, CDE \rightarrow A, A \rightarrow B, E \rightarrow G, EH \rightarrow I, C \rightarrow H, F \rightarrow H, E \rightarrow H, A \rightarrow D\}$
- redukcija levih strana
  - $CD \rightarrow E : (C)^+_F = CH; (D)^+_F = D$
  - $BC \rightarrow D : (B)^+_F = B; (C)^+_F = CH$
  - $CDE \rightarrow A : (C)^+_F = CH; (D)^+_F = D; (E)^+_F = EBCDAGHI \Rightarrow$   
*redukuje se na  $E \rightarrow A$*
  - $EH \rightarrow I : (E)^+_F = EBCDAGHI \Rightarrow$   
*redukuje se na  $E \rightarrow I$*
  - $H = \{CD \rightarrow E, E \rightarrow B, E \rightarrow C, E \rightarrow D, BC \rightarrow D, E \rightarrow A, A \rightarrow B, E \rightarrow G, E \rightarrow I, C \rightarrow H, F \rightarrow H, E \rightarrow H, A \rightarrow D\}$

# Primer 3

---

- $H = \{CD \rightarrow E, E \rightarrow B, E \rightarrow C, E \rightarrow D, BC \rightarrow D, E \rightarrow A, A \rightarrow B, E \rightarrow G, E \rightarrow I, C \rightarrow H, F \rightarrow H, E \rightarrow H, A \rightarrow D\}$
- eliminacija redundantnih fz
  - $CD \rightarrow E : E \notin (CD)^+_{H \setminus \{CD \rightarrow E\}} = CDH$
  - $E \rightarrow B : B \in (E)^+_{H \setminus \{E \rightarrow B\}} = ECDABGIH \Rightarrow E \rightarrow B$  suvišna
  - $E \rightarrow C : C \notin (E)^+_{H \setminus \{E \rightarrow C\}} = EDABGIH$
  - $E \rightarrow D : D \in (E)^+_{H \setminus \{E \rightarrow D\}} = ECABGIHD \Rightarrow E \rightarrow D$  suvišna
  - $BC \rightarrow D : D \notin (BC)^+_{H \setminus \{BC \rightarrow D\}} = BCH$
  - $E \rightarrow A : A \notin (E)^+_{H \setminus \{E \rightarrow A\}} = EGIHC$
  - $A \rightarrow B : B \notin (A)^+_{H \setminus \{A \rightarrow B\}} = AD$
  - $E \rightarrow G : G \notin (E)^+_{H \setminus \{E \rightarrow G\}} = ECIHABD$
  - $E \rightarrow I : I \notin (E)^+_{H \setminus \{E \rightarrow I\}} = ECABGHD$
  - $C \rightarrow H : H \notin (C)^+_{H \setminus \{C \rightarrow H\}} = C$

# Primer 3

---

– eliminacija redundantnih fz

- $F \rightarrow H : H \notin (F)^+_{H \setminus \{F \rightarrow H\}} = F$
- $E \rightarrow H : H \in (E)^+_{H \setminus \{E \rightarrow H\}} = ECH \Rightarrow E \rightarrow H$  suvišna
- $A \rightarrow D : D \notin (A)^+_{H \setminus \{A \rightarrow D\}} = AB$

–  $H = kp(F) = \{CD \rightarrow E, E \rightarrow C, BC \rightarrow D, E \rightarrow A, A \rightarrow B, E \rightarrow G, E \rightarrow I, C \rightarrow H, F \rightarrow H, A \rightarrow D\}$

– particije kanoničkog pokrivača

- $G(CD) = \{CD \rightarrow E\}$
- $G(E) = \{E \rightarrow C, E \rightarrow A, E \rightarrow G, E \rightarrow I\}$
- $G(BC) = \{BC \rightarrow D\}$
- $G(A) = \{A \rightarrow B, A \rightarrow D\}$
- $G(C) = \{C \rightarrow H\}$
- $G(F) = \{F \rightarrow H\}$

# Primer 3

---

- $\mathbf{G} = \{G(CD), G(E), G(BC), G(A), G(C), G(F)\}$
- traženje podskupova  $G(X_i), G(X_j) \in \mathbf{G}$  s ekvivalentnim levim stranama
  - $(CD)^+_F = CDEAGIBH$
  - $(E)^+_F = ECAGIBDH$
  - $(BC)^+_F = BCDEAGIH$
  - $(A)^+_F = ABD$
  - $(C)^+_F = CH$
  - $(F)^+_F = FH$
- $(CD)^+_F = (E)^+_F = (BC)^+_F$ 
  - $G(CD, E, BC) = G(CD) \cup G(E) \cup G(BC) = \{CD \rightarrow E, E \rightarrow C, E \rightarrow A, E \rightarrow G, E \rightarrow I, BC \rightarrow D\}$
  - $\mathbf{G} = \{G(CD, E, BC), G(A), G(C), G(F)\}$

# Primer 3

---

– uklanjanje tranzitivnih fz - formiranje skupa fz ekvivalentnih levih strana  $J$

- $(CD)^+_F = (E)^+_F = (BC)^+_F$
- $J = \{CD \rightarrow E, E \rightarrow CD, CD \rightarrow BC, BC \rightarrow CD, E \rightarrow BC, BC \rightarrow E\} = \{CD \rightarrow E, E \rightarrow C, E \rightarrow D, CD \rightarrow B, CD \rightarrow C, BC \rightarrow C, BC \rightarrow D, E \rightarrow B, E \rightarrow C, BC \rightarrow E\} = \{CD \rightarrow E, CD \rightarrow B, E \rightarrow C, E \rightarrow D, E \rightarrow B, BC \rightarrow D, BC \rightarrow E\}$
- $G(CD, E, BC) = \{E \rightarrow A, E \rightarrow G, E \rightarrow I\}$

# Primer 3

---

– uklanjanje tranzitivnih fz - traženje suvišnih fz iz skupa  $G_U$

- $G_U = \cup_{G_X \in \mathbf{G}}(G_X) = \{E \rightarrow A, E \rightarrow G, E \rightarrow I, A \rightarrow B, A \rightarrow D, C \rightarrow H, F \rightarrow H\}$
- $M = \cup_{G_X \in \mathbf{G}}(G_X) \cup J = \{E \rightarrow A, E \rightarrow G, E \rightarrow I, A \rightarrow B, A \rightarrow D, C \rightarrow H, F \rightarrow H, CD \rightarrow E, CD \rightarrow B, E \rightarrow C, E \rightarrow D, E \rightarrow B, BC \rightarrow D, BC \rightarrow E\}$
- $E \rightarrow A : A \notin (E)^+_{M \setminus \{E \rightarrow A\}} = EBCDGIH$
- $E \rightarrow G : G \notin (E)^+_{M \setminus \{E \rightarrow G\}} = EAIBCDH$
- $E \rightarrow I : I \notin (E)^+_{M \setminus \{E \rightarrow I\}} = EAGBDCH$
- $A \rightarrow B : B \notin (A)^+_{M \setminus \{A \rightarrow B\}} = AD$
- $A \rightarrow D : D \notin (A)^+_{M \setminus \{A \rightarrow D\}} = AB$
- $C \rightarrow H : H \notin (C)^+_{M \setminus \{C \rightarrow H\}} = C$
- $F \rightarrow H : H \notin (F)^+_{M \setminus \{F \rightarrow H\}} = F$

# Primer 3

---

## – rekonstrukcija particija

- $G = \{G(CD, E, BC), G(A), G(C), G(F)\}$
- $J = \{CD \rightarrow E, CD \rightarrow B, E \rightarrow C, E \rightarrow D, E \rightarrow B, BC \rightarrow D, BC \rightarrow E\}$
- $G(X_{i_1}, \dots, X_{i_n}) \leftarrow G(X_{i_1}, \dots, X_{i_n}) \cup \{X_i \rightarrow X_j \in J \mid X_i \in \{X_{i_1}, \dots, X_{i_n}\}\}$
- $G(CD, E, BC) = \{E \rightarrow A, E \rightarrow G, E \rightarrow I, CD \rightarrow E, CD \rightarrow B, E \rightarrow C, E \rightarrow D, E \rightarrow B, BC \rightarrow D, BC \rightarrow E\}$
- $G(A) = \{A \rightarrow B, A \rightarrow D\}$
- $G(C) = \{C \rightarrow H\}$
- $G(F) = \{F \rightarrow H\}$

## – formiranje skupa šema relacija

- $S = \{N1(\{A, B, C, D, E, G, I\}, \{CD, E, BC\}), N2(\{A, B, D\}, \{A\}), N3(\{C, H\}, \{C\}), N4(\{F, H\}, \{F\})\}$

# Primer 3

---

- $S = \{N1(\{A, B, C, D, E, G, I\}, \{CD, E, BC\}), N2(\{A, B, D\}, \{A\}), N3(\{C, H\}, \{C\}), N4(\{F, H\}, \{F\})\}$
- $S$  je u 3NF
- Napomena:  $S$  nije u BCNF, jer u okviru početne univerzalne šeme važe fz  $A \rightarrow B$  i  $A \rightarrow D$ . Ove fz su putem ključa ugrađene u šemu  $N2$ , ali važe i nad šemom  $N1$ , pa samim tim šema  $N1$  ne zadovoljava BCNF.

# Primer 3

---

- formiranje ograničenja stranog ključa
  - $N_1[A] \subseteq N_2[A]$
  - $N_1[C] \subseteq N_3[C]$
- spojivost bez gubitaka
  - *ključevi univerzalne šeme relacije su  $K=\{ACF, DCF, EF, BCF\}$*
  - *u skupu  $S$  ne postoji šema relacije sa ključem univerzalne šeme relacije, pa spojivost bez gubitaka nije očuvana*
  - npr možemo dodati šemu  $(\{E, F\}, \{EF\})$
  - $S = \{N1(\{A, B, C, D, E, G, I\}, \{CD, E, BC\}), N2(\{A, B, D\}, \{A\}), N3(\{C, H\}, \{C\}), N4(\{F, H\}, \{F\}), N5(\{E, F\}, \{EF\})\}$

# Primer 4

---

$U = \{A, B, C, D, E, F, G, H, I\}$

$F = \{ABC \rightarrow DE, DE \rightarrow BF, A \rightarrow F, F \rightarrow A, F \rightarrow I, I \rightarrow G, FG \rightarrow C, DI \rightarrow H\}$

Metodom sinteze izgenerisati skup šema relacija u 3NF.

# Primer 4

---

- $F = \{ABC \rightarrow DE, DE \rightarrow BF, A \rightarrow F, F \rightarrow A, F \rightarrow I, I \rightarrow G, FG \rightarrow C, DI \rightarrow H\}$
- pokazati da se dobije  $H = kp(F) = \{AB \rightarrow D, AB \rightarrow E, DE \rightarrow B, DE \rightarrow F, A \rightarrow F, F \rightarrow A, F \rightarrow I, I \rightarrow G, F \rightarrow C, DI \rightarrow H\}$
- particije kanoničkog pokrivača
  - $G(AB) = \{AB \rightarrow D, AB \rightarrow E\}$
  - $G(DE) = \{DE \rightarrow B, DE \rightarrow F\}$
  - $G(A) = \{A \rightarrow F\}$
  - $G(F) = \{F \rightarrow A, F \rightarrow I, F \rightarrow C\}$
  - $G(I) = \{I \rightarrow G\}$
  - $G(DI) = \{DI \rightarrow H\}$

# Primer 4

---

- $\mathbf{G} = \{G(AB), G(DE), G(A), G(F), G(I), G(DI)\}$
- traženje podskupova  $G(X_i), G(X_j) \in \mathbf{G}$  s ekvivalentnim levim stranama
  - $(AB)^+_F = ABDEFICGH$
  - $(DE)^+_F = DEBFAICGH$
  - $(A)^+_F = AFICG$
  - $(F)^+_F = FAICG$
  - $(I)^+_F = IG$
  - $(DI)^+_F = DIHG$
- $(AB)^+_F = (DE)^+_F; (A)^+_F = (F)^+_F$ 
  - $G(AB, DE) = G(AB) \cup G(DE) = \{AB \rightarrow D, AB \rightarrow E, DE \rightarrow B, DE \rightarrow F\}$
  - $G(A, F) = G(A) \cup G(F) = \{A \rightarrow F, F \rightarrow A, F \rightarrow I, F \rightarrow C\}$
  - $\mathbf{G} = \{G(AB, DE), G(A, F), G(I), G(DI)\}$

# Primer 4

---

– uklanjanje tranzitivnih fz - formiranje skupa fz ekvivalentnih levih strana **J**

- $(AB)^+_F = (DE)^+_F; (A)^+_F = (F)^+_F$
- $\mathbf{J} = \{AB \rightarrow DE, DE \rightarrow AB, A \rightarrow F, F \rightarrow A\} = \{AB \rightarrow D, AB \rightarrow E, DE \rightarrow A, DE \rightarrow B, A \rightarrow F, F \rightarrow A\}$
- $G(AB, DE) = \{DE \rightarrow F\}$
- $G(A, F) = \{F \rightarrow I, F \rightarrow C\}$

# Primer 4

---

- ... Pokazati da se na kraju postupka sinteze dobije rešenje  $\mathbf{S} = \{N1(\{A, B, D, E\}, \{AB, DE\}), N2(\{A, F, I, C\}, \{A, F\}), N3(\{I, G\}, \{I\}), N4(\{D, I, H\}, \{DI\})\}$
- Ukoliko zavisnost spoja nije zadovoljena, doraditi rešenje tako da zavisnost spoja bude zadovoljena.
- Definirati ograničenja stranog ključa.

# Primer 5

---

$U = \{A, B, C, D, E, F, G, H, I, J\}$

$F = \{AB \rightarrow E, E \rightarrow A, E \rightarrow B, E \rightarrow C, BC \rightarrow A, ABE \rightarrow D, E \rightarrow G, EH \rightarrow I, B \rightarrow H, F \rightarrow H, H \rightarrow J, ABC \rightarrow J\}$

Metodom sinteze izgenerisati skup šema relacija u 3NF.

# Primer 5

---

- Pokazati da se sintezom dobije rešenje  $\mathbf{S} = \{N1(\{A, B, C, D, E, G\}, \{E, AB, BC\}), N2(\{B, H\}, \{B\}), N3(\{F, H\}, \{F\}), N4(\{H, J\}, \{H\})\}$
- Ukoliko zavisnost spoja nije zadovoljena, doraditi rešenje tako da zavisnost spoja bude zadovoljena.
- Definisati ograničenja stranog ključa.