[FD] HOANG LONG VU - 20204897

Question 1

① $R(\overset{A}{\text{patientNum}}, \overset{B}{\text{name}}, \overset{C}{\text{address}}, (\overset{D}{\text{date}}, \overset{E}{\text{time}}, \overset{F}{\text{drNum}}, \underset{G}{\text{drName}}, \underset{H}{\text{visitCode}}, \underset{I}{\text{description}}))$

$F = \{$ patientNum $\to$ name, patientNum $\to$ address,
(patientNum, date, time) $\to$ drNum,
(patientNum, date, time) $\to$ visitCode,
(patientNum, date, time) $\to$ description,
drNum $\to$ drName $\}$

$F = \{ A \to B,\ A \to C,\ ADE \to F,\ ADE \to H,\ ADE \to I,\ F \to G \}$

Minimal cover: $G = \{ A \to B,\ A \to C,\ ADE \to FHI,\ F \to G \}$

Minimal key: $K = ADE$

We have the decomposition: $R_1(ABC)$, $R_2(ADEFHI)$, $R_3(FG)$

$K \subset R_2 \Rightarrow$ Decomposition: $D = \{R_1, R_2, R_3\}$

R_1(patientNum, name, address)

R_2(patientNum, date, time, drNum, visitCode, description)

R_3(drNum, drName)

Question 2

② $R(A, B, C, D, E)$

$F = \{ A \to B,\ BC \to E,\ ED \to A \}$

a) $(ACD)^+ = ABCED$
$A^+ = AB$
$C^+ = C$
$D^+ = D$
thus ACD is minimal
ACD is a candidate key

b) Minimal cover: $G = \{ A \to B,\ BC \to E,\ ED \to A \}$

Minimal key: $K = ACD$

$\Rightarrow$ 3NF: $R_1(AB)$, $R_2(BCE)$, $R_3(EDA)$, $R_4(ACD)$

Question 3

(3) $R(A, B, C, D)$

I) $C \to D$, $C \to A$, $B \to C$

a) K^0 : ABCD
K^1 : BCD, $(BCD)^+ = BCDA = R \to K^1 = BCD$
K^2 : ACD, $(ACD)^+ = ACD \neq R \to K^2 = BCD$
K^3 : ABD, $(ABD)^+ = ABCD = R \to K^3 = BD$
K^4 : ABC, $(ABC)^+ = ABCD = R \to K^4 = B$

→ Minimal key: $\underline{\underline{B}}$

b) Candidate key: B $\quad (B^+ = BCDA)$

c) Minimal cover $G = \{C \to D, C \to A, B \to C\}$

Decomposition: $R_1(CDA)$, $R_2(BC)$

II) $ABC \to D$, $D \to A$

a) K^0 : ABCD
K^1 : BCD, $(BCD)^+ = BCDA = R \to K^1 = BCD$
K^2 : ACD, $(ACD)^+ = ACD \neq R \to K^2 = K^1$
K^3 : ABD, $(ABD)^+ = ABD \neq R \to K^3 = K^2$
K^4 : ABC, $(ABC)^+ = ABCD = R \to K^4 = BC$

→ Minimal key: $\underline{\underline{BC}}$

b) Candidate key: ABC

c) Minimal cover: $G = \{ABC \to D, D \to A\}$

Decomposition: $R_1(ABCD)$, $R_2(DA)$

III) $A \to B$, $BC \to D$, $A \to C$

a) $K^0 = ABCD$
$K^1 = BCD$, $(BCD)^+ = BCD \neq R \to K^1 = K^0$
$K^2 = ACD$, $(ACD)^+ = ABCD = R \to K^2 = ACD$
$K^3 = ABD$, $(ABD)^+ = ABCD = R \to K^3 = AD$
$K^4 = ABC$, $(ABC)^+ = ABCD = R \to K^4 = A$

Minimal key: $\underline{\underline{A}}$

b) Candidate key: A

c) Minimal cover $G = \{A \to BC, BC \to D\}$

$\Rightarrow R_1(ABC)$, $R_2(BCD)$

IV) $AB \to C$, $AB \to D$, $C \to A$, $D \to B$

a) $K^0 = ABCD$

$K^1 = BCD$, $(BCD)^+ = BCAD = R \to K^1 = BCD$

$K^2 = ACD$, $(ACD)^+ = ACDB = R \to K^2 = CD$

$K^3 = ABD$, $(ABD)^+ = ABCD = R \to K^3 = D$

$K^4 = ABC$, $(ABC)^+ = ABCD = R \to K^4 = \phi$

$\Rightarrow$ No minimal key

b) Candidate key: CD, $(CD)^+ = CABD$

c) Minimal cover: $G = \{ AB \to CD, C \to A, D \to B \}$

$\Rightarrow R_1(ABCD)$, $R_2(CA)$, $R_3(DB)$