DB개론 Project6 (DeadLine 5월 25일 낮12시, 50점 만점) 조번호(   )

1번 5점

- Construct an ER diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient a log of the various test and examinations conducted. Make each entity to have at least 3 attributes.

Answer

Figure 6.1   E-R diagram for a hospital.

2번 5점

- Design an ER diagram for keeping track of the exploits of your favorite sports team. You should store matches played, the scores in each match, the players in each match, and individual player statistics for each match. Summary statistics should be modeled as derived attributes.

Answer

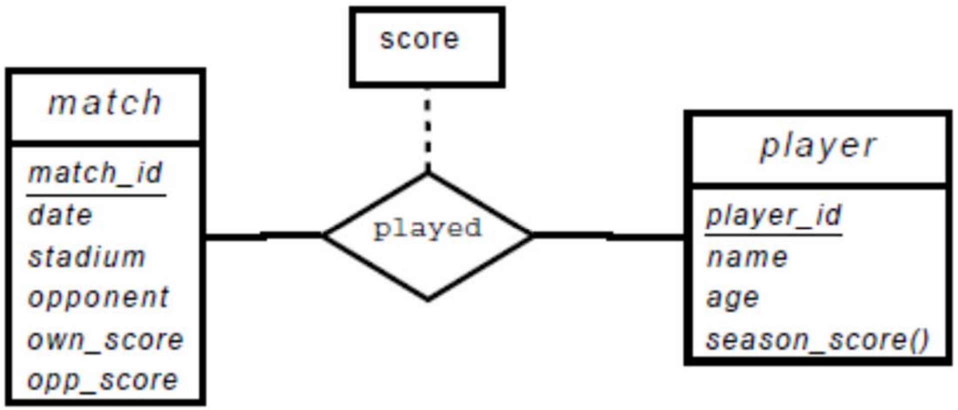

Figure 7.4 E-R diagram for favourite team statistics.

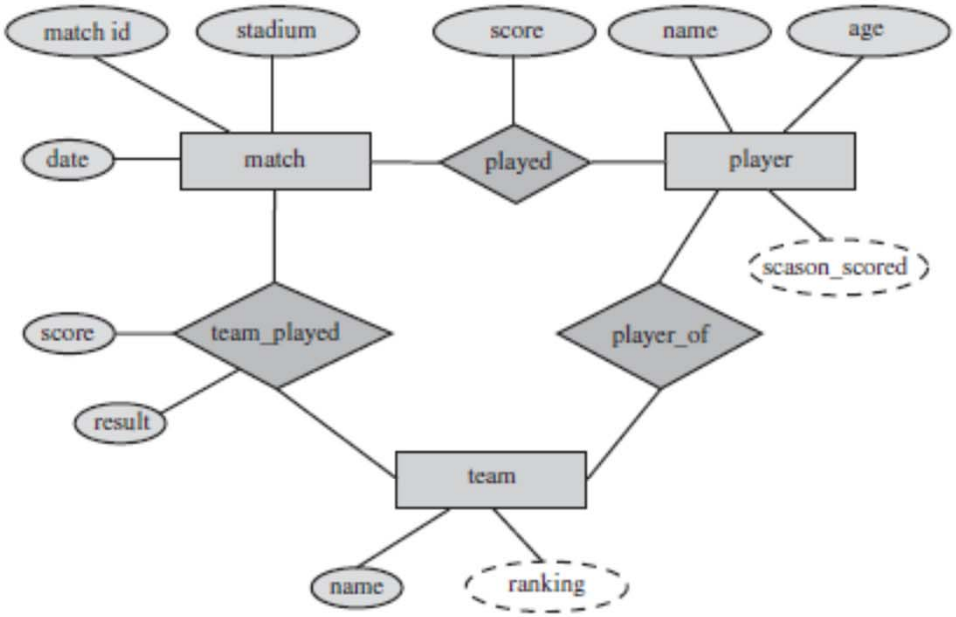

Figure 6.2 E-R diagram for all teams statistics.

3번 5점

Use Armstrong's axioms to prove the soundness of the union rule. (*Hint*: Use the augmentation rule to show that, if $\alpha \rightarrow \beta$, then $\alpha \rightarrow \alpha\beta$. Apply the augmentation rule again, using $\alpha \rightarrow \gamma$, and then apply the transitivity rule.)

Answer: To prove that:

$$\text{if } \alpha \rightarrow \beta \text{ and } \alpha \rightarrow \gamma \text{ then } \alpha \rightarrow \beta\gamma$$

Following the hint, we derive:

$\alpha \rightarrow \beta$	given
$\alpha\alpha \rightarrow \alpha\beta$	augmentation rule
$\alpha \rightarrow \alpha\beta$	union of identical sets
$\alpha \rightarrow \gamma$	given
$\alpha\beta \rightarrow \gamma\,\beta$	augmentation rule
$\alpha \rightarrow \beta\gamma$	transitivity rule and set union commutativity

4번 5점

Suppose that we decompose the schema $R = (A, B, C, D, E)$ into

$$(A, B, C)$$
$$(A, D, E).$$

Show that this decomposition is a lossless-join decomposition if the following set F of functional dependencies holds:

$$A \rightarrow BC$$
$$CD \rightarrow E$$
$$B \rightarrow D$$
$$E \rightarrow A$$

Answer: A decomposition $\{R_1, R_2\}$ is a lossless-join decomposition if $R_1 \cap R_2 \rightarrow R_1$ or $R_1 \cap R_2 \rightarrow R_2$. Let $R_1 = (A, B, C)$, $R_2 = (A, D, E)$, and $R_1 \cap R_2 = A$. Since A is a candidate key (see Practice Exercise 8.6), Therefore $R_1 \cap R_2 \rightarrow R_1$.

5번 10점

- 아래 상황을 고려해서 lossless join property와 dependency preservation property 를 가지는 3NF로 design하시요
- Relation schema: *cust_banker_branch* = (*customer_id, employee_id, branch_name, type*)
- The FDs are:
  1. *customer_id, employee_id* → *branch_name, type*
  2. *employee_id* → *branch_name*
  3. *customer_id, branch_name* → *employee_id*

Answer

- We first compute a canonical cover
  - *branch_name* is extraneous in the r.h.s. of the 1st dependency
  - No other attribute is extraneous,

    so we get F_C = *customer_id, employee_id* → *type, employee_id* → *branch_name, customer_id, branch_name* → *employee_id*
- The **for** loop generates following 3NF schema:

  (*customer_id, employee_id, type*), (*employee_id, branch_name*), (*customer_id, branch_name, employee_id)*
  - Observe that (*customer_id, employee_id, type*) contains a candidate key of the original schema, so no further relation schema needs be added
- At end of for loop, detect and delete schemas, such as (*employee_id, branch_name*), which are subsets of other schemas
  - result will not depend on the order in which FDs are considered
- The resultant simplified 3NF schema is: (*customer_id, employee_id, type*) , (*customer_id, branch_name, employee_id)*

7번 5점

- *Let* $R = (A, B, C, G, H, I)$ *and* $F = \{A \rightarrow B, \quad A \rightarrow C, \quad CG \rightarrow H, \quad CG \rightarrow I, \quad B \rightarrow H\}$
- (1) Find $(AG)^+$
- (2) Is AG a candidate key?

(1) Find $(AG)^+$

- Answer
    1. $result = AG$
    2. $result = ABCG$ $\quad (A \rightarrow C$ and $A \rightarrow B)$
    3. $result = ABCGH$ $\quad (CG \rightarrow H$ and $CG \subseteq AGBC)$
    4. $result = ABCGHI$ $\quad (CG \rightarrow I$ and $CG \subseteq AGBCH)$

(2) Is AG a candidate key?

- Answer
    1. Is AG a superkey?
        1. Does $AG \rightarrow R?$ == Is $(AG)^+ \supseteq R$
    2. Is any subset of AG a superkey?
        1. Does $A \rightarrow R?$ == Is $(A)^+ \supseteq R$
        2. Does $G \rightarrow R?$ == Is $(G)^+ \supseteq R$

8번 5점

- *Let* $R = (A, B, C)$ *and* $F = \{A \rightarrow BC, \; B \rightarrow C, \; A \rightarrow B, \; AB \rightarrow C\}$
- Find the canonical cover of F?

- Answer
- Combine $A \rightarrow BC$ and $A \rightarrow B$ into $A \rightarrow BC$
  - Set is now $\{A \rightarrow BC, \; B \rightarrow C, \; AB \rightarrow C\}$
- A is extraneous in $AB \rightarrow C$
  - Check if the result of deleting A from $AB \rightarrow C$ is implied by the other dependencies
    - Yes: in fact, $B \rightarrow C$ is already present!
  - Set is now $\{A \rightarrow BC, \; B \rightarrow C\}$
- C is extraneous in $A \rightarrow BC$
  - Check if $A \rightarrow C$ is logically implied by $A \rightarrow B$ and the other dependencies
    - Yes*:* using transitivity on $A \rightarrow B$ *and* $B \rightarrow$ C.
      - Can use attribute closure of A in more complex cases
- The canonical cover is: $A \rightarrow B, \quad B \rightarrow C$