CSC343 Worksheet 12 Solution

June 30, 2020

1. • Keys
     – {id of molecule}
     – {x position, y position, z position}
   • Functional Dependencies
     1. id of molecule → x position, y position, z position, x velocity, y velocity, z velocity
     2. x position, y position, z position → id of molecule, x velocity, y velocity, z velocity

Notes:

- Function Dependencies
  - *Functional Dependency* is a relationship between two attributes typically between the key and other non-key attributes within a table.

    Example:

    SIN → Name, Address, Birthdate

    Example 2:

    ISBN → Title
- Key of Relations
  - One or more attributes $\{A_1, A_2, ..., A_n\}$ is a key for a relation R if
    1. Those attributes functionally determine all other attributes of the relation
    2. No proper subset of $\{A_1, A_2, ...A_n\}$ functionally determines all other attributes of R

    Example:

    Given relation

    $R =$ Movies1(title, year, length, genre, studioName, starName)

    i. {title, year, starName } form a key for the relation **Movies1**

ii. { year, starName } is not a key. Same star can be in multiple movies per year

- Superkeys
  * Means a a set of attributes that contains a key
  * Don't need to be minimal

  Example:
  Given relation

  $R =$ Movies1(title, year, length, genre, studioName, starName)
  · { title, year, starName } is a key and superkey
  · { title, year, starName, title, year, length} is a superkey

References:

1) OpenTextBC, Chapter 11 Functional Dependencies, link

2. a) **Notes:**

- The Splitting / Combining Rule
  - Combining Rule
    * $A_1, A_2, \cdots, A_n \rightarrow B_i$ for $i = 1, 2, ..., m$
      to
      $A_1, A_2, \cdots A_n \rightarrow B_1, B_2, \cdots B_m$

    Example:

    Given

    title year → length
    title year → genre
    title year → studioName

    it's combined form is

    title year → length genre studioName

  - Splitting Rule
    *
    * $A_1, A_2, \cdots A_n \rightarrow B_1, B_2, \cdots B_m$
      to
      $A_1, A_2, \cdots, A_n \rightarrow B_i$ for $i = 1, 2, ..., m$

Example:

Given

title year → length

It's splitted form is

title → length
year → length

- Trivial Functional Dependencies
  - A functional dependency $FD : X \to Y$ is **trivial** if Y is a subset of X

    Exmaple:

    title year → title

    Example 2:

    title → title

- Non-trivial Functional Dependencies
  - is a case where some but not all of the attributes on the R.H.S of an FD are also on L.H.S

    Example:

    title year → title movieLength

  - Can be simplified using **tirivial-dependency rule**
    - The FD $A_1A_2 \cdots A_n \to B_1B_2 \cdots B_m$ is equivalent to $A_1A_2 \cdots A_n \to C_1C_2 \cdots C_k$

      where C's are all those B's that are not in A's.

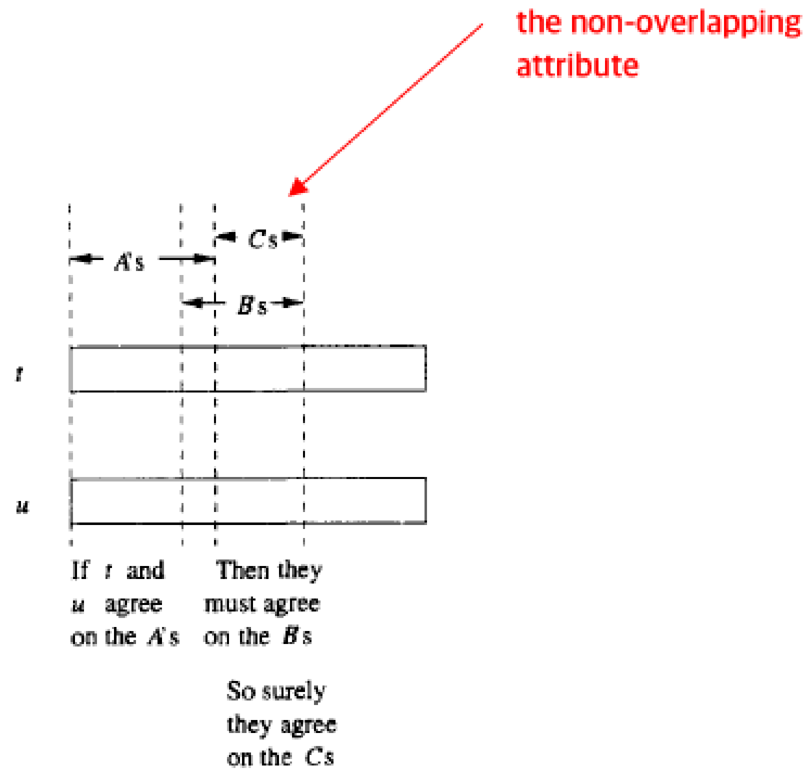

Figure 3.3: The trivial-dependency rule

- Computing the Clousre of Attributes
  - Closure of attribute set $\{X\}$ is denoted as $\{X\}^+$.
- Why the Closure Algorithm Works
- Transitive Rule
  - Definition

    If $A_1A_2 \cdots A_n \rightarrow B_1B_2 \cdots B_m$ and $B_1B_2 \cdots B_m \rightarrow C_1C_2 \cdots C_k$ hold in relation R, $A_1A_2 \cdots A_n \rightarrow C_1C_2 \cdots C_k$ also holds in R.

    Example:

    Given

    title year $\rightarrow$ studioName
    studioName $\rightarrow$ studioAddr

    Transitive rule says the above is equal to the following

    title year $\rightarrow$ studioAddr
- Inference Rules
  - Is allso called **Armstrong's Axioms**
  - Has 3 axioms

1. *Reflexivity*
   * If $\{B_1, B_2, ..., B_n\} \subseteq \{A_1, A_2, ..., A_n\}$ then $A_1A_2 \cdots A_n \rightarrow B_1B_2 \cdots B_m$
   * also called **trivial FDs**
2. *Augmentation*
   * If $A_1A_2 \cdots A_n \rightarrow B_1B_2 \cdots B_m$ then $A_1A_2 \cdots A_nC_1C_2 \cdots C_k \rightarrow B_1B_2 \cdots B_mC_1C_2 \cdots C_k$
   * $C_1C_2 \cdots C_k$ are any set of attributes
3. *Transitivity*
   * If $A_1A_2 \cdots A_n \rightarrow B_1B_2 \cdots B_m$ and $B_1B_2 \cdots B_m \rightarrow C_1C_2 \cdots C_k$ then $A_1A - 2 \cdots A_n \rightarrow C_1C_2 \cdots C_k$

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