Analysis for Gerund Entity Anomalies in Data Modeling

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Analysis for Gerund Entity Anomalies in Data Modeling

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Abstract: Data is the most important component of an information system development. Collected data that will be used in future needs should be kept well to make it easy to inquire. The data stored in a database consists of several groups of data relations. These relations should be connected through fields which are unique to the relations linked. In designing database itself, it is very important to note how data is organized and stored to minimize data redundancy. The tools used in depiction of the relationship between tables or entities are Entity Relationship Diagram (ERD) that can have one to one, one to many and many to many relationships. Gerund entity will be formed if the relationship between the entities is many to many. However, the new entity is still a possible anomaly. The reanalysis is needed to be free of anomalies. Gerund entity that still has an anomaly will form a new entity again, which in this case referred to as a sub gerund entity which is a derivative of a gerund entity. The result of a good database design or free of anomalies will increase the optimization of memory usage, consistency and integrity of data.

1 INTRODUCTION

Database is the most important component in the development of Information Systems because it is a place to accommodate and organize all data in the system, so that it can be explored to compile information in various forms (Sutedjo and Oetomo, 2002). The data will be organized in such a way that there is no unnecessary duplication, so that it can be processed or explored quickly and easily to produce the information needed. From several existing database modeling, relational database modeling is still the most used model by various Database Management System (DBMS) software. This is because it is easy to manage data (Barioni et al., 2011; Stonebraker and Moore, 1995).

Entity Relationship Diagram (ERD) is a model diagram that is used as a representation of database structure in which table information includes and the existence of relationships between tables and the form of the relation itself based on existing standard notations (Date, 1977). ERD is used to express the relationship between an entity or object in the form of a table with another entity. In database design, logically is done by transforming an ER diagram developed during conceptual design into a relational database scheme (Ramakrishnan and Gehrke, 2000; Gehrke and Ramakrishnan, 2003).

Relationships that occur between entities have a type of relationship: one-to-one (1: 1), one-to-many (1: N) and many-to-many (M: N). Based on the many-to-many relationship, it will form a new entity called Gerund Entity or Associative Entity. But in this case, the gerund entity still allows for irregularities (anomalies) in storing data, namely the occurrence of duplication or waste of data. No writer has found a study that examines the anomalies in the gerund entity yet, so that further analysis needs to be done so that the database created is really in accordance with the objectives of the database itself including avoiding or minimizing data redundancy, because the waste of data will result in waste of memory usage and can cause problems in the process of accessing data such as data inconsistency, longer access times and problems in data integrity (Gehrke and Ramakrishnan, 2003; Silberschatz et al., 1997).

2 DATA MODELLING

In describing ER diagrams, it takes the existence of entities, attributes and relationships between entities. Entity is a set of objects in the real world whose existence does not depend on others and has the same

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property. Examples of objects in an entity that can be uniquely identified are called entity occurrence. Entities can be something real, such as: Members, Films, Office Branch or abstract (concepts), such as: Rental, Registration, Role. (Kadir, 2000)

Transforming or mapping ER diagrams into relations is a mechanical process, in the sense that the process has certain regularities. To transform from the ER diagram to the relational scheme there are 3 (three) entities that need to be understood, namely (Kroenke and Dolan, 1983; Silberschatz et al., 1997): The document margins must be the following:

- Ordinary entities (regular entities) are entities that are independent of their existence and generally describe real objects in the real world. Ordinary entities are often also called strong entities depicted with four single-striped rectangles.
- Weak entities (week entity) are entities whose existence depends on other entities (usually strong entities). Weak entities are represented by four double-striped rectangles.
- Associative entities (associative entities) or gerund entities are generally formed from many to many relationships between other entities. Associative entities are generally represented by rectangles with parallelograms in them.

Types of relations can be classified as follows:

- one-to-one (1: 1)
- one-to-many (1: M)
- many-to-many (M: N)

Gerund Entity or Associative Entity is formed from many to many relationships. Example: Student entity with the subject matter, Customer entity with the Goods entity and so on.
In logical database design, it can be done by:

- Applying Normalization to a known table structure.
- Directly create the Entity-Relationship (ER model) model.

Logical data model is a source of physical design information. This model provides designers with a vehicle for consideration in designing an efficient database.

Physical database design is the process of producing a description of database implementation on secondary storage, describing storage structures and accessing methods to improve access effectiveness. At this stage, physical design is intended for a particular DBMS. Physical level database design has been associated with database management systems and platforms where the database is implemented (Connolly and Begg, 2005).

Well-organized data can produce good information Organizing data to prevent unnecessary duplication. Data that is organized and correlated each other called as a database, whereas to manage and organize databases that are built in a system, a database management is called a database management system (DBMS). DBMS is software that will determine how data is organized, stored, modified, retrieved, regulated data security mechanisms, and mechanisms for sharing data together (Date, 1983).

2.1 Role of Normalization in Database Design

Normalization is a formal technique that can be used in database design. The main purpose of normalization is to identify the suitability of relationships that support data to meet the needs of a particular company or institution. The role of normalization in this case is in the use of bottom-up approaches and validation techniques. The validation technique is used to check whether the relation structure produced by the ER model is good or not. For more details, it can be shown in figure 1.

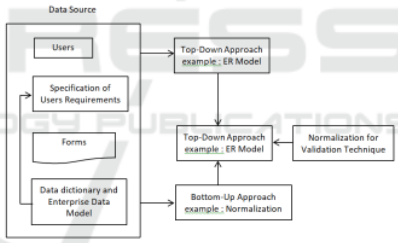

Figure 1: Role of normalization in database design.

In Figure 1 it can be seen that the data source consists of users, specifications of various user requirements, various forms or reports, data dictionary and enterprise data models. Then there is the top-down and bottom-up approach where the approach will result in the design of relations, then the role of normalization on bottom up and validation techniques (Indrajani, 2011).

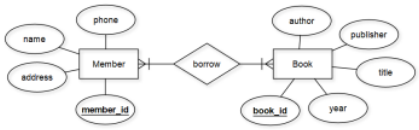

Figure 2: The relationship of many to many between member entity and book entity.

3 RESULT AND DISCUSSION

3.1 Entity Relationship Model

In relational data modelling using the ER diagram can be described in figure 2.

If the entities relationship described as many to many, then it will make a new entity called Gerund Entity or Associative Entity. The field key which connected each entities should be there in the new entity. Then, it continues by more relevant attributes added. It can be seen in figure 3.

Figure 3: Gerund entity from the relationship of book entity to the member entity.

The diagram in figure 3 can be described more detail in figure 4.

Figure 4: New entity formed (gerund entity).

Based on diagram in figure 4, can be transformed into tables/relations by sample data shown in table 1 to table 3.

The Member relation in the table 1 can be save member data with member_id as primary key. The relation doest not have redudancy data.

The member relation has the form:

Table 1: Member Relation

member_id	name	address	phone
1001	John	Sudirman 10	654534
1002	Dannis	Dt. Setia 15	742345
1003	Betty	M.Yamin 12	653421

Table 2: Book Relation

book_id	title	Author	Publisher	year
C-001	Concepts of Database Management	Philip J.Pratt, Joseph J Adamski	Course Technology	2012
C-002	Principles of Distributed Systems	M. Tamer Ozsu, Patrick Valduriez	Springer	2015
A-002	Fundamental Accounting Principles	John J. Wild, Ken W.Shaw	Mc Grow Hill	2015

Member (member_id, name, address, phone)

The Book relation in the table 1 can be save book data with book_id as primary key. The relation also does not have redudancy data.

The book relation has the form:

Book (book_id, title, author, publisher, year)

Table 3: Borrowing Relation

borrowing_id	member_id	borrow_date	book_id	due_date	return_date
19001	1001	05/02/2019	C-001	05/09/2019	05/08/2019
19001	1001	05/02/2019	C-002	05/10/2019	06/12/2019
19004	1003	06/10/2019	C-002	06/15/2019	06/10/2019

Cardinality relation between member and book relation is many to many so it creates the new table as gerund entity. In this case is called borrowing relation (shown in the table 3). Borrowing relation has borrowing_id as primary key while member_id and book_id is a foreign key.

The borrowing relation has the form:

Borrowing (borrowing_id, member_id, book_id, due_date, return_date)

3.2 Analysis Anomalies of Gerund Entity

Analysis of anomalies in the Borrowing relation by using normalization technique.

Table 4: Borrowing Relation

borrowing_id	member_id	borrow_date	book_id	due_date	return_date
19001	1001	05/02/2019	C-001	05/09/2019	05/08/2019
19001	1001	05/02/2019	C-002	05/10/2019	06/12/2019
19004	1003	06/10/2019	C-002	06/15/2019	06/10/2019

In the Borrowing table as gerund entity. This table has some anomalies. It can be seen a member borrows 2 books at 05/02/2019. In here contain data redundancy in member_id and borrow_date.

- To insert the book of borrowing_id 19004, we must enter member_id and borrow_date repeatedly.
- If we want to change the value of member_id or borrow_date for borrowing_id '19001', we must update the rows of the borrowing_id. If this modification is not carried out on all the appropriate rows of the Borrowing relations, the database will become inconsistent. So that, the borrowing relation should be separated as a new table that called is Borrowing_Detail relation.

The resulting normalization relation have the form:

Borrowing (borrowing_id, member_id, borrow_date)

Borrowing_Detail (borrowing_date, book_id, due_date, return date)

The Borrowing and Borrowing_Detail relations are shown in Table 5 and Table 6. The result of Gerund Entity analysis from Borrowing relation can be shown ER model in Figure 5.

Table 5: Borrowing Relation

borrowing_id	member_id	borrow_date
19001	1001	05/02/2019
19004	1003	06/10/2019

Table 6: Borrowing_Detail Relation

borrowing_id	book_id	due_date	return_date
19001	C-001	05/09/2019	05/08/2019
19001	C-002	05/10/2019	06/12/2019
19004	C-002	06/15/2019	06/10/2019

The establishment of a new entity from the gerund entity above will minimize or eliminate data redundant that can improve optimization of memory usage, consistency and data integrity.

Figure 5: ERD from analysis of Gerund Entity.

4 CONCLUSIONS

Based on the results of the analysis that has been carried out it can be concluded as follows:
In the gerund entity is still possible for an anomaly to occur, so that it will create a new entity again as a derivative of the gerund entity which in this case the author called the sub gerund entity. In the gerund entity, it is necessary to provide a connecting field to the unique sub gerund entity. The establishment of a new entity from the gerund entity will minimize or not even redundant the data so that it can improve optimization of memory usage, consistency and data integrity. For complex databases, anomalous analysis of sub gerund entities can still be continued to ensure that the resulting relations are free from anomalies.

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