TO: Dean Steve “The Bear” Wiltkerbad

FROM: Roger Baumbach II

RE: Residence Hall Complaint System: The Database Schema

DATE: November 15, 2013

This Memo is a detailed description of a Database Schema, its purposes and place in the Systems Development Life-Cycle (SDLC), and more importantly, and its’ importance to the development of the Residence Hall Complaint System. A database schema is a conceptual level model of the database that is derived from the Entity Relationship Diagram and the Functional Requirements. The schema contains information such as the details regarding the physical data store, i.e. descriptions, locations, and indexes to the data. More importantly, the schema is built from the Entity relationship diagram specifically; which is used to design the structure of the table, or “relation,” that the data will be held within. Each column in the table/relation must be a unique value that is either natural or invented, and each record should only have one value for each column. The values of data should also be condensed into more detailed or specific values to cut down on the bulk of the data on the data stores. For example, in a database pertaining to people and their personal information, there may be a field for a zip code, city, and state. This data can all be condensed into two fields in the first table: address and zip code. The rest can be made into a separate table that holds all the zip codes, their cities, and the states that each zip code pertains to. This will help to cut down on the duplication of writing the same state and cities over and over again.

Shown below in Chart 1, is the first version of the database schema. It is derived directly from the Entity Relationship Diagram. Each row, in the Chart is a type entity that will interact with the system and each will have a separate table within the database, where all data, of that type of entity, will be recoded. Each value that follows the initial name of the entity is a field or attribute that needs to be collected from each entity that interacts with the system. For example, each student will have to have their name and age recorded within the system. Within each entity, there are two types of special identifying traits that had been previously mentioned in the ERD Memo. They are the Primary keys and the Foreign Keys. The Primary key is a specific key that only one record in each table will have. Each of the three entities will only have one primary key; Students have their Student ID, which is a specific number that is unique to each student. Staff members have their Staff ID, which is also unique to them. Grievance has their Grievance ID that each grievance is assigned. Unlike Primary keys, anyone of these entities could have multiple or no foreign keys. The purpose of a foreign key is to link one table/relation to another. For example, in the University’s Residence Hall Complaint System Grievances is the only table to have any foreign keys and they have two of them: Student and Staff IDs. The reason the table uses Student ID and Staff ID is to designate “Who” (in both charts) is responsible for or related to each grievance.

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| Table | Primary Key | Attributes | | | | | | | | |
| Student | Student ID | Name | Address | City | State | Zip Code | E-mail Address | Phone Number | Gender | Age |
| Grievance | Grievance ID | **\*Student ID\*** | **\*Staff ID\*** | Name of Student | Date | Time | Place | Person filing | Nature/Type | Explanation |
| Staff | Staff ID | Name | Address | City | State | Zip Code | E-mail Address | Phone Number |  |  |
| \*Bold Faced and Asterisked Attributes are Foreign Keys\* | | | | |  |  |  |  |  |  |

Note that the Database Schema is not done at this point. The schema now must transform and be put into a Normal Form. This is a set of rules and guidelines for organizing data within a system to better utilize the constraints of data stores and formalize the data structure. There are three types of Normal Form that are used to organize the data. The first normal form asks for five things: tables are relations, tables must have simple cells, entities must be in columns from the same set of values, rows must be unique, the sequence of columns in a table can be interchanged without changing the meaning, and the rows can be interchanged or stored in any sequence. When these constraints have been met, the table is in 1st normal form (1NF). For a table then to be in 2NF, each primary key must be different in each record and each record must be about a unique subject. Lastly, for a table to be in 3NF, a table must not have a zip code problem. This is where the table has city, state, and a zip code for each subject. The problem with this is that when a subject has a zip code, state, and city, there is wasted space to go and reiterate the fact that city X is located in Zip Code Y, and that Zip Code Y is in State Z. It can be simplified by making zip code into a foreign key for any table that has it and by making a Zip code table which has each zip code, city, and state combination once. For the chart below, Student is in 2NF because the student has simple cells and meets the five criteria for first normal form. It does not meet the requirements for 3NF because it has a zip code problem. To fix this, a separate table has been created with Zip Codes, State and City has been removed from Student, and Zip Code has been changed to a foreign key. Student is now in 3NF. Staff has the same problem as Student. It starts in 2NF because each attribute is about a simple subject. To move Staff to 3NF, the previously created Zip Code Table is used by Staff, as well as Student, and State and City are removed from Staff. Lastly, Grievances is in 3NF to begin with and does not need to be changed. The attributes are all simple, the table only has data on single subjects, and there is no zip code problem.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table | Primary Key | Attributes | | | | | | | | |
| Student | Student ID | **\*Zip Code\*** | Name | Address | E-mail Address | Phone Number | Gender | Age |  |  |
| Grievance | Grievance ID | **\*Student ID\*** | **\*Staff ID\*** | Name of Student | Date | Time | Place | Person filing | Nature/Type | Explanation |
| Staff | Staff ID | **\*Zip Code\*** | Name | Address | E-mail Address | Phone Number |  |  |  |  |
| Zip Code | Zip Code | City | State |  |  |  |  |  |  |  |
| \*Bold Faced and Asterisked Attributes are Foreign Keys\* | | | | |  |  |  |  |  |  |