

Algorithm for the storage of questionnaire data in OODBMS

Dr. Ranjana Ingolikar¹, Rasika Khandal², Dr. Rahul Mohare³

¹HOD, Dept. of Comp. Sci., SFS College, RTM Nagpur University, Nagpur

²Faculty, MCA Dept., SRPCE, RTM Nagpur University, Nagpur

³Asst. Professor, DMIMS, RTM Nagpur University, Nagpur

Abstract: This is an exploratory approach of designing the generalized algorithm for only storing the responses where the researcher had used db4o and .NET framework for some illustrative construction of a simple prototype. The purpose of this paper is to propose a method of storage for transforming response of a structured questionnaire from MS-Excel to OODBMS model. To propose a generalized algorithm that will illustrate the said purpose of storing responses in OODBMS model. To explore the transforming of response storage from MS-Excel to object oriented data model, a questionnaire designed by a business management researcher is used for illustration. By using given steps of algorithm the simple excel response sheet can be transformed into OODBMS model. It has been found that the proposed algorithm can be used for storing responses of questionnaire into the OODBMS database.

Keywords: Questionnaire, Object Oriented database management System (OODBMS), Object, Public Class, Class Properties

I. INTRODUCTION

A. Questionnaire

A questionnaire is one type of data collection method, which contains formalized set of structured type of questions and to obtain responses from respondents. Respondents were asked to mark their responses. Usually novices store their responses in the structured excel sheet. Here an attempt is made to associate relational data model with the storage of questionnaire responses. Business Management researcher whose case study was considered for research had used excel response sheet for storing responses. It is transformed by using generalized algorithm into the object oriented database model.

B. Object Oriented Database System

An object oriented database management system is the result of combining object oriented programming principles with database management principles. Object oriented programming concepts such as encapsulation, polymorphism and inheritance as well as database management concept such as ACID properties (Atomicity, Consistency, Isolation and Durability) are enforced which lead to system integrity. It supports an ad hoc query language and secondary storage management system which allows managing of very large amount of data. It supports the following features as mandatory for a system it can be called as OODBMS;

Complex Object, Object identity, Encapsulation, Types and Classes, Class or Type Hierarchies, Overriding, overloading and late binding, Computational Completeness, Extensibility, Persistence, Secondary storage management, Concurrency, Recovery and an ad hoc query facility.

In the object oriented database model, any real world entity is represented by only modeling concept – the object. An object has a state and behavior associated with it. The state of an object is defined by the value of its properties (attributes). Properties can be primitive values (like strings and integers) and non-primitive objects. The behavior of an object is specified by methods that operate on the state of the object. Each object is uniquely identified by a system-defined identifier (OID). Objects with the same properties and behavior are grouped into classes. An object can be an instance of only one class or an instance of several classes.

Data definition and data manipulation language (DDML) allows persistent data to be created, updated, deleted or retrieved. DDML allows defining a database, maintaining and querying a database including updating, inserting, modifying, and querying data by using class methods [4].

C. OODBMS Transaction

The job of the database is to provide for persistent data storage. It's usually expected that the database will do this job in a robust manner: making sure that the data that is stored is the correct data, that it hasn't been corrupted either by failures or by different users trying to change the same data at the same time.

Transaction will start with the call **OpenFile** and database is closed with the call **Close**. You can also explicitly commit the updates during a transaction explicitly with a call to **Commit**. Rollback the transaction with a call to **RollBack**[2].

D. Class Definition

A class is a construct that enables you to create your own custom types by grouping together variables of other types, properties, methods and events. A class is like a blueprint. It defines the data and behavior of a type[c].

E. Object Definition

A class definition is like a blueprint that specifies what the type can do. An object is basically a block of memory that has been allocated and configured according to the blue print[c].

F. Access Specifiers

Access specifiers support the concept of information hiding and encapsulation. Access specifiers control access to class members. Some access specifiers may also control how classes inherit such constraints. Their primary purpose is to separate the interface of a class from its implementation[d]. The following is a common set of access specifiers:

- **private**(or *class-private*) restricts the access to the class itself. Only methods that are part of the same class can access private members.
- **protected** (or *class-protected*) allows the class itself and all its subclasses to access the member.
- **public** means that any code can access the member by its name.

G. Class Properties

A property is a member of class that provides a flexible mechanism to read, write, or compute the value of a private field. Properties can be used as if they are public data members, but they are actually special methods called assessors. This enables data to be accessed easily and still helps promote the safety and flexibility of methods[c].

II. BENEFITS OF OODBMS DATA MODEL

When questionnaire data stored in OODBMS, it gives better performance than MS-Excel datasheet. Some of the benefits are given below:

1. Records can be stored in the form of object.
2. OODBMS holds all object oriented characteristics because it is compatible with the programming language like .NET or JAVA.
3. In OODBMS data can be viewed in the form of class hierarchy.
4. It supports object oriented programming concepts so that the exact and accurate information is fetched by the user.
5. It supports all data types with their default values and field width.
6. OODBMS supports complex object type like graphics, audio/video or geographic information.
7. Validation rules and validation text can be applied on given member variable of class.
8. OODBMS support object oriented programming concepts such as encapsulation, inheritance, polymorphism, dynamic binding etc.
9. Query processing is not necessary, still DDL and DML used to querying data from database by using powerful query engine.

III. LIMITATIONS OF OODBMS DATA MODEL

1. OODBMS is language dependent because it tied to a specific language.
2. Complexity: OODBMS is more complex than MS-Excel. It is more expensive and difficult to use.
3. Data cannot easily export from OODBMS to MS-Excel.

Here it is proposed that the algorithm can be used to partition the questionnaire into different classes where lossless categorized object based decomposition will be form object based lossless decomposition supports the object oriented programming concepts like

- Designing of classes.
- Every class has a unique Object ID (OID).
- Classes are liked or bind by using parent child relationship.
- Response/Data entry form can be designed in term of decomposed classes.
- Conditional validate data entry can be performed.
- Data can be retrieved at any instance through query builder.

To illustrate the concept of partitioning, the following case study has been considered.

IV. CASE STUDY

The management researcher Mrs. Soma Sharma, Research scholar of RTM Nagpur University, in her Ph.D. thesis “A Study of Micro Finance as a tool for alleviating urban poverty with reference to Nagpur City” has done her work in MS-Excel response sheet for storing responses.

In this paper the best way of transforming given responses into the object oriented data model by following the steps of generalized algorithm is proposed. The questionnaire contains 35 structured questions which are multiple choice questions filled from respondents and whose responses were stored in MS-Excel which are to be partitioned into classes and insert it into OODBMS.

Multiple-Choice Questions: In which the management researcher provides a choice of answers and respondents are asked to select only one alternative from the given choices.

A. Problems/ Limitations of MS-Excel sheet

The researcher used MS-Excel sheet for storing responses. With reference to the case study considered for research, storing responses in the MS-Excel datasheet is not an efficient way. It has the following major limitations:

1. Data types and default values of data types are not supported in excel.
2. Field width or size of field is not supported in excel.
3. Validation rules and validation text cannot be applied.
4. Text formatting is not supported.
5. MS-Excel does not give the facility of data query processing.
6. Data present in an MS-Excel does not support referential integrity rules for establishing relationship between data.
7. There are limitations in data storage size. e.g. In the new version of MS-Excel 2007, the limitations are 1,048,576 rows by 16,384 columns. [a][b].

Looking at the above limitations or problems of MS-Excel datasheet. The proposed generalized algorithm is used only for storing responses of questionnaire into the OODBMS database.

V. STEPS OF GENERALIZED ALGORITHM

STEP-1: To decompose the interdependent and interrelated questions of structured questionnaire in terms of public class.

STEP-2: Identify the variables of respective questions to be defined in class definition.

STEP-3: Perform variable data type mapping, if built in data type is present then go to **STEP-4** else go to **STEP-5**

STEP-4: Define variable data type for the identified variables of respective class and go to **STEP-6**.

STEP-5: Define respective complex object data type for the identified variables of respective class.

STEP-6: Define the class constructor as well as properties for the variables.

STEP-7: If need to link the classes then go to **STEP-8** else go to **STEP-9**.

STEP-8: Define the type of inheritance as per the requirement of the class specification.

STEP-9: Select the appropriate and compatible front end application software like .NET or JAVA which is compatible to the back end like db4o [2].

STEP-10: If required embed the requisite namespace of the underlying OODBMS in the discussion for to performing common database transactions.

STEP-11: Design the data entry form for entering the data.

STEP-12: Execute the front end application to start data entry.

STEP-13: Apply **STEP-12** repeatedly until the data entry is finished.

A. Partition of Questionnaire

The given MS-Excel datasheet contains the responses of questionnaires and it looks as below:

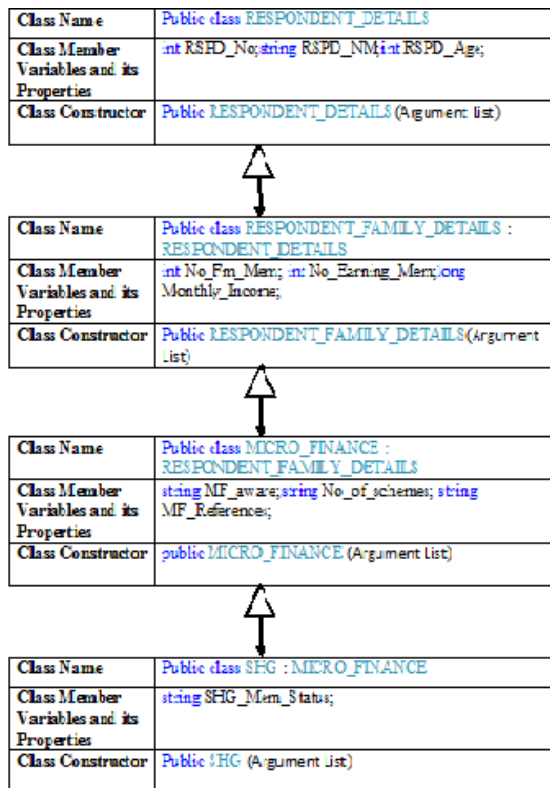
Response	1	2	3	4	5	6	7	8	9	10	11	
1	31-35	SSC Pass	Married	Maid servant	1-2 members	1	less than 1000	Own house	No	saving schemes	Friend	
2	31-35	SSC Pass	Married	Maid servant	1-2 members	2	less than 1000	Own house	Yes	Micro insurance	Nearght	
3	26-30	SSC Pass	Married	Maid servant	1-2 members	1	less than 1000	Own house	Yes	saving schemes	Friend	
4	31-35	SSC Pass	Married	Maid servant	1-2 members	1	less than 1000	Own house	Yes	Micro Credit	Nearght	
5	41-50	SSC Pass	Married	Petty Business	3-5 members	2	2001-3000	Own house	Yes	Micro insurance	Repress	
6	50 and above	Illiterate	Widow	Maid servant	more than 5 members	3	2001-3000	rented house	Yes	saving schemes	Nearght	
7	36-40	Illiterate	Married	Maid servant	3-5 members	2	2001-3000	Own house	Yes	saving schemes	Nearght	
8	50 and above	Illiterate	Married	Maid servant	3-5 members	2	2001-3000	rented house	Yes	employment scheme	Nearght	
9	7	50 and above	Illiterate	Widow	Maid servant	3-5 members	1	2001-3000	rented house	Yes	saving schemes	Nearght
10	31-35	SSC Pass	Married	Maid servant	1-2 members	1	less than 1000	Own house	Yes	saving schemes	Friend	
11	41-50	Illiterate	Married	Petty Business	3-5 members	2	2001-3000	Own house	Yes	Micro insurance	Repress	
12	50 and above	Illiterate	Widow	Maid servant	3-5 members	2	2001-3000	rented house	Yes	saving schemes	Nearght	
13	41-50	Illiterate	Married	Maid servant	3-5 members	2	2001-3000	Own house	Yes	saving schemes	Nearght	
14	50 and above	Illiterate	Married	Maid servant	3-5 members	2	2001-3000	rented house	Yes	employment scheme	Nearght	
15	36-40	Illiterate	Married	Maid servant	3-5 members	2	2001-3000	rented house	Yes	saving schemes	Nearght	
16	31-35	SSC Pass	Married	Maid servant	1-2 members	1	less than 1000	Own house	No	saving schemes	Friend	
17	31-35	SSC Pass	Married	Maid servant	1-2 members	1	less than 1000	Own house	Yes	Micro insurance	Nearght	
18	31-35	SSC Pass	Married	Maid servant	1-2 members	1	less than 1000	Own house	Yes	saving schemes	Friend	
19	26-30	Illiterate	Married	Maid servant	1-2 members	1	less than 1000	Own house	Yes	saving schemes	Friend	
20	31-35	SSC Pass	Married	Maid servant	1-2 members	1	less than 1000	Own house	Yes	Micro Credit	Nearght	
21	41-50	SSC Pass	Married	Petty Business	3-5 members	2	2001-3000	Own house	Yes	Micro insurance	Repress	
22	41-50	SSC Pass	Married	Maid servant	1-2 members	1	less than 1000	Own house	Yes	saving schemes	Friend	
23	50 and above	Illiterate	Widow	Maid servant	more than 5 members	1	2001-3000	rented house	Yes	saving schemes	Nearght	

Object oriented approach views a problem in terms of objects rather than procedure. Object is an identifiable entity with some characteristics and behavior. Object is an instance of a class. For identifying object class and their associate member variables of class the above generalized algorithm is used by user for storing responses of questionnaires[1][3]. By following the given steps of algorithm the following classes are derived:

- I. RESPONDENT_DETAILS
- II. RESPONDENT_FAMILY_DETAILS
- III. MICRO_FINANCE
- IV. SHG
- V. SHG_LOAN

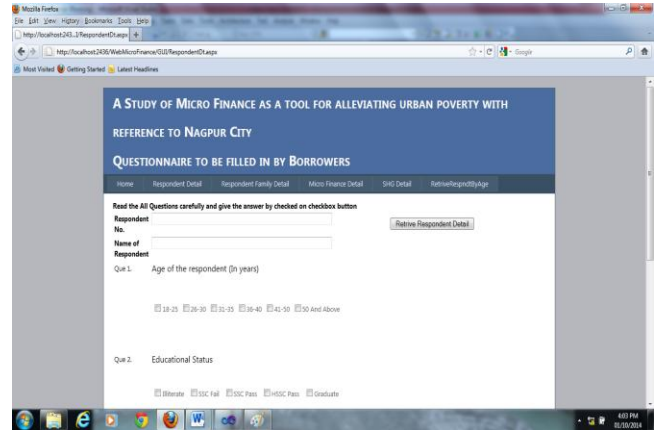
To illustrate this concept by creating an application in object oriented programming language C#.net which is supported by OODBMS and to store the responses of questionnaires in terms of objects into the OODBMS.

To represent relationship between classes in C#.net with their data member is given below:



By following the steps 2 to 6 of the algorithm the above classes is formed with their data members and supporting compatible data types. According to step 8 of algorithm the class hierarchy is generated by using the appropriate type of inheritance.

Generating of respondent data entry form in .NET as follows:



After designing the respondent data entry form, by following the STEP-10 of algorithm, embed the requisite namespace of the underlying OODBMS which gives the functionality over the database operations like insert new object data into the object database, updating an existing data and to delete an existing data. After giving responses from respondent to create a class objects for the entered record and insert it into the OODBMS by using predefined function of underlying OODBMS.

VI. LIMITATIONS OF GENERALIZED ALGORITHM

1. **Class limitation:** Class should be public, private class specification is inaccessible due to its protection level.
2. **Properties definition:** One definition for each variable of the class.
3. **Requirement of inheritance:** If need to require link the classes then used anyone type of inheritance which is supported by .NET and JAVA. The following table (A) represents the type of inheritance and their used in programming language.
4. **System Requirement:** The following table (B) represents the hardware/software requirement for the application.

Sr. No.	Types of Inheritance	How to Perform
1	Single inheritance	A derived class is created from a single base class
2	Multi-level inheritance	A derived class is created from another derived class
3	Hierarchical inheritance	More than one derived classes are created from a single base class

Table (A): Types of Inheritance

Sr. No.	System Requirement		
1	Software	Operating System	Supported in Window XP/7 and highest version
		Backend	Any compatible object database
		Frontend	.NET or JAVA
		Development kit	Microsoft visual studio 2010

REFERENCE SITES

- [1] <http://spreadsheetpage.com>
- [2] [http://wiki.answers.com/Q/Total number of row and column of ms.excel](http://wiki.answers.com/Q/Total_number_of_row_and_column_of_ms_excel)
- [3] <http://msdn.microsoft.com/en-us/library/x9fsa0sw.aspx>
- [4] [http://en.wikipedia.org/wiki/Class \(computer programming\)](http://en.wikipedia.org/wiki/Class_(computer_programming))

Table (B): System Requirement

VII CONCLUSION

We conclude from the given algorithm the following output is generated are:

- 1. In terms of Data Retrieval:**
 - a. Modified and secured way of storing the data.
 - b. Data is stored in encrypted form unlike MS-Excel.
 - c. Conditional and validate data retrieval is possible.
- 2. In terms of Memory:**
 - a. MS-Excel has very less capacity as compared to OODBMS. It extends up to 254 GB.
 - b. Fixed length memory require as the object is assigned to the each record.
- 3. In terms of Operations Performed:**
 - a. All basic operations supported by OODBMS.
 - b. All logical and mathematical statistical operation can be performed over given data value.
 - c. By the virtue of object reference the data can be migrated within OODBMS.

REFERENCES

- [1] D. Maier, J. Stein, A. Otis, A. Purdy, "Development of an object-oriented DBMS" Report CS/E- 86-005, Oregon Graduate Center, April 86.
- [2] Jim Paterson, Stefan Edlich, Henrik Höming, and Reidar Höming "The Definitive Guide to db4o".
- [3] Malcolm Atkinson, François Bancilhon, David DeWitt, Klaus Dittrich, David Maier, Stanley Zdonik (1989), "The Object-Oriented Database System Manifesto".
- [4] T. Atwood, "An object-oriented DBMS for design support applications", Ontologic Inc. Report.