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Database Designing for the Online Examination Application Using SAP-ABAP

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Abstract: The Online Examination Application [1] is an application which utilizes SAP as a platform and is developed using ABAP language. The Database of this application is thus responsible for holding the various data right from the time of registration of the candidates to the final module of displaying the results all is performed using the database tables. This paper thus deals with the different tables as utilized by the application and hence helps in bringing out the effectiveness of the database in any similar application.

Keywords: SAP, ERP, OEA, DATA TYPES, DATABASE TABLES.

I. Introduction

A database is essentially an electronic filing system that houses a collection of information organized in such a way that allows a computer program to quickly find desired pieces of data [2].

In the simplest form, a database is composed of tables, columns (called fields), and rows (called records or data). A classic example of a database is a telephone book, which is organized alphabetically so as to make it possible to quickly find a desired piece of data. The telephone book can be considered a table, a storage container for information. Within this table is typically found three columns (or fields)—name, address, and telephone number. Within each of these fields exists rows (or records), the simplest form of data in the database. The basic structure of a database is quite similar to a Microsoft Excel spreadsheet wherein columns (fields) store row after row of records (data). The biggest difference between a database and a spreadsheet is simply that databases can contain multiple tables that are connected to one another through relationships. Thus, a database can be thought of as a much more complex, and ultimately much more useful, spreadsheet.

The database plays a key role in each SAP system, as it houses all the data that are used by that particular SAP component or product. SAP can use a variety of different brand name database releases ranging from very expensive and imminently flexible to very inexpensive and yet quite capable.

II. The various data types as used in ABAP

Like every other programming language ABAP also has some predefined data types with defined ranges which are used with the different variables that come across while composing a program. The data types in ABAP can be broadly categorized in the following way [4]:

A. Elementary types:

Elementary types are part of the dual-level domain concept for fields in the ABAP Dictionary. The elementary type has semantic attributes, such as texts, value tables, and documentation, and has a data type. There are two different ways to specify a data type:

By directly assigning an ABAP Dictionary type: We can assign a predefined ABAP Dictionary type and a number of characters to an elementary type. The ABAP Dictionary has considerably more predefined types than the ABAP programming language. The number of characters here is not the field length in bytes, but the number of valid characters excluding formatting characters. The data types are different because the predefined data types in the ABAP Dictionary have to be compatible with the external data types of the database tables supported by the SAP Web AS ABAP. When we refer to data types from the ABAP Dictionary in an ABAP program, the predefined Dictionary types are converted to ABAP types as follows:

Figure 1 Predefined dictionary data type in ABAP

Dictionary type	Meaning	Maximum length n	ABAP type
DEC	Calculation/amount field	1-31, 1-17 in tables	P((n+1)/2)
INT1	Single-byte integer	3	Internal only
INT2	Two-byte integer	5	Internal only
INT4	Four-byte integer	10	I
CURR	Currency field	1-17	P((n+1)/2)
CUKY	Currency key	5	C(5)
QUAN	Quantity	1-17	P((n+1)/2)
UNIT	Unit	2-3	C(n)
PREC	Accuracy	16	Internal only
FLTP	Floating point number	16	F(8)
NUMC	Numeric text	1-255	N(n)
CHAR	Character	1-255	C(n)

LCHR	Long character	256-max	C(n)
STRING	String of variable length	1-max	STRING
RAWSTRING	Byte sequence of variable length	1-max	XSTRING
DATS	Date	8	D
ACCP	Accounting period YYYYMM	6	N(6)
TIMS	Time HHMMSS	6	T
RAW	Byte sequence	1-255	X(n)
LRAW	Long byte sequence	256-max	X(n)
CLNT	Client	3	C(3)
LANG	Language	internal 1, external 2	C(1)

Assigning a domain: The technical attributes are inherited from a domain. Domains are standalone Repository objects in the ABAP Dictionary. They can specify the technical attributes of a data element. One domain can be used by any number of data elements. When you create a domain, you must specify a Dictionary data type (see above table) and the number of characters.

B. Reference types:

Reference types describe single fields that can contain references to **global** classes and interfaces from the ABAP class library. In an ABAP program, we can use the **TYPE** addition to refer directly to a data element. The predefined Dictionary data types of the domain are then converted into the corresponding ABAP types.

If we define a local data type in a program by referring to a data element as follows:

TYPES dtype TYPE data_element then the semantic attributes of the data element are inherited and will be used, for example, when we display a data object with type **dtype** on the screen. Since all data types in the ABAP Dictionary are based on data elements, they all contain the corresponding semantic attributes.

C. Structures:

A structure is a sequence of any other data types from the ABAP Dictionary, that is, data elements, structures, table types, or database tables. When we create a structure in the ABAP Dictionary, each component must have a name and a data type.

In an ABAP program, we can use the **TYPE** addition to refer directly to a structure.

If you define a local data type in a program by referring to a structure as follows:

TYPES dtype TYPE structure.

III. Types of database tables

The Database in this application is implemented is implemented by means of tables. These tables can be grouped into different types based on their usage and requirement. Hence, the different tables are as following [2]:

A. Transparent tables:

A transparent table is a table that stores data directly. Transparent table is a one to one relation table i.e. when a transparent table is created then exactly same table will be created in data base and it is basically used to store transaction data. The transparent table contains a single table. For each transparent table there is one associated table in the database. The database table has the same name, same number of fields and the fields have the same names. A single table can have one or more primary keys as well as secondary indexes can also be created. They can be accessed using open and native SQL. These tables are used to hold master data.

B. Pool tables:

Pooled tables are logical tables that must be assigned to a table pool when they are defined. Pooled tables are used to store control data. Several pooled tables can be combined in a table pool. The data of these pooled tables are then sorted in a common table in the database. They are used to hold a large number of very small tables (stores customizing data or system data).It has a many-to-one relationship with a table in the database. It is stored with other pooled tables in a single table called table pool in the database. The database table has different name, different number of fields and fields have different names. Table pools contain more tables than table clusters. Primary key of each table does not begin with same fields or fields. However, secondary indexes cannot be created. They can be accessed using open SQL only. They reduce the amount of database resources needed when many small tables have to be opened at the same time.

C. Cluster tables:

Cluster tables are logical tables that must be assigned to a table cluster when they are defined. Cluster tables can be used to store control data. They can also be used to store temporary data or texts, such as documentation. They are used to hold data from a few large tables. It has a many-to-one relationship with table in the database. Many cluster tables are stored in a single table in the database called a table cluster. The database table has different name, different number of fields and fields have different names. These tables contain lesser tables than table pools. Primary key of each table begins with same fields or fields but the secondary indexes cannot be created. These tables can be accessed using open SQL only. They would be used when the tables have primary key in common and data in these tables are all accesses simultaneously.

IV. Database tables in online examination application

The database of the Online Examination Application is basically composed of three main tables apart from the ones that are automatically created by the system. These tables are required to hold the information of the registration details of the candidates, show the various questions that can be uploaded along with the possible options and finally the third table is of the results which holds the correct options as well as computes the total of the candidates. The different tables thus are as following:

A. The registration table:

The Registration Table is the first table named as ZOES_REGTABLE is responsible for holding the various entries which are to be made by the candidate through the registration page in order to register him to take up the test. The candidate is required to make the entries like the email id, his name, address and the contact number. It is mandatory on the part of the candidate that all the entries are made i.e. the candidate cannot skip any of the entries otherwise the registration is cancelled. The Registration Table of the Online Examination Application can be seen as following:

Figure 1: The Registration Table

Field	Key	Incl.	Data element	Data T...	Length	Decl...	Short Description
EMAIL_ADDRESS	☒	☒	ZEMAIL	CHAR	30		0:0ES REGISTRATION TABLE EMF
FIRST_NAME	☒	☒	ZFIRSTNAME	CHAR	15		0:0ES REGISTRATION TABLE FRC
LAST_NAME	☒	☒	ZLASTNAME	CHAR	15		0:0ES REGISTRATION TABLE LAS
DATE_OF_BIRTH	☒	☒	ZDOB	DATE	8		0:0ES REGISTRATION TABLE DAT
ADDRESS1	☒	☒	ZADDRESS1	CHAR	40		0:0ES REGISTRATION TABLE ZAC
ADDRESS2	☒	☒	ZADDRESS2	CHAR	40		0:0ES REGISTRATION TABLE ZAC
PINCODE	☒	☒	ZPINCODE	NUMBER	6		0:0ES REGISTRATION TABLE P29
CONTACT_NO	☒	☒	ZCONTACTNO	NUMBER	10		0:0ES REGISTRATION TABLE COR

Data types of the registration table:

In the database tables it is required that the entries have to be specified with a particularly specified data type. Here also the data types of all the entries have been mentioned. The email, names and address fields have been mentioned of the type character. The date of birth has been mentioned of type DATS. The pincode and the contact number have been mentioned of type number. It is interesting to note that there are also various type of validation checks in the different fields. The email field prevents the use of the different special characters, spaces and the use of the capital letters. The names field also prevents the use of the special characters and the numerals. The fields that have been declared of type number have a validation of inserting only numerals and all other data types have been restricted.

Primary key for the registration table

Primary key is the key which is required to be unique and should always be not null. In the registration table the email id of the candidate has been declared as the primary key. This is because the email id of each candidate is always a unique entity which is the foremost requirement for any entry to be declared as the primary key.

The contents of the Registration Table can be seen as following where the different entries are shown:

Figure 2: Entries held in registration table.

EMAIL_ADDRESS	FIRST_NAME	LAST_NAME	DATE_OF_BIRTH	ADDRESS1	ADDRESS2
KAPIL@GMAIL.COM	KAPIL	WADKAR	16.05.1988	SHARADARA	DELHI

B. The question upload table:

The Question Upload Table is named as the ZOESEXAM. This table is responsible for holding the various questions along with the four possible options. The last option shows the correct answer for that question. The ZOESEXAM table can be seen as below with the various table entries:

Figure 3: The Question Upload Table

Field	Key	Data Element	Data Type	Length	Short Description
QSTN_NO	✓	ZQSTNNO	NUMC	2	QUESTION NUMBER
QUESTION		ZQUESTION	STRING	1000	QUESTIONS QUESTION
RESP_A		ZRESPONSE	CHAR	255	RESPONSES
RESP_B		ZRESPONSE	CHAR	255	RESPONSES
RESP_C		ZRESPONSE	CHAR	255	RESPONSES
RESP_D		ZRESPONSE	CHAR	255	RESPONSES
ANSWER		ZANSWER	CHAR	5	ANSWER

Data types of the question upload table:

This table consists of the question number which is defined of type number. The next field entry is the question number which is of type string. Followed by the question are the four options for each question which are again of type character. Lastly there is option which happens to be the correct answer for that particular question which of type character.

Primary key for the question upload table:

The primary key for this table is the question number which is unique entity for each table. Hence, as it serves the uniqueness feature of the primary key therefore, it is chosen as the same. The figure below displays the contents of the question upload (ZOESEXAM):

Figure 4: Entries held in Question Upload Table

QSTN NO	QUESTION	RESP A	RESP B	RESP C	RESP D	ANSWER
2	What is the basic object of data Dictionary?	Domain	Communication	Data Model	Sympo	A

C. The result table:

This table is the final of the three tables created for the Online Examination Application. This table is responsible for holding the answers to the questions as have been answered by the various candidates. This table is especially important as it helps in computation of the result of each candidate by comparing his answers with the correct ones. If the answer happens to be correct than the marks are allotted for the same. However, if the answer is incorrect than as per the marking scheme the negative marks are deducted from the total and likewise the result is generated. This table is mentioned as ZOES_RESULT. The table with its various entries is shown in the figure 5.

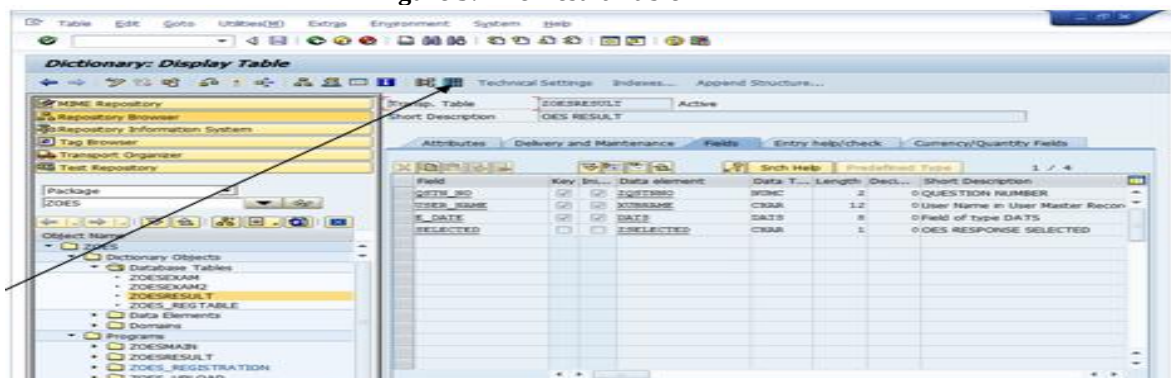
Data types of the result table:

The result table consists of four data entry fields. The first entry i.e. the question number is of type number. The next table entry is the user_name which is the name of the candidate and is defined of type character. The next field is k_date which signifies the date on which the exam was taken by the candidate of type DATS. The last table entry is the Response field which holds the option that has been selected by the candidate as his reply to the question.

Primary key for the result table:

The primary key for the ZOES_RESULT table is actually a combination of the three fields i.e. the question number, user name (user_name) and the date (k_date) on which the exam was taken. These here are combined by the use of a join operation and then taken as a single primary key for the entire table.

Figure 5: The Result Table



This was done as taking any of the keys singly would not help to maintain the uniqueness criteria for the primary key. The question number field is not chosen since the same question as will be answered by the different candidates will tend to over write the previous question by the next one. Secondly, the user_name field could not be taken as the primary key as there can possibly be two or more than two candidates by the same name. Finally, the third field i.e. The exam date (k_date) is not chosen as the primary key as, if the test is again intended to be taken at some future date then it will over write all the previous test details and hence the primary requirement of data consistency does not stand accomplished. Hence, owing to these reasons the above mentioned keys have not been mentioned as the primary key instead all the three have been combined together to form a single and unique primary key.

The table ZOEES_RESULT with the contents can be seen as in the figure below. The figure shows the different questions along with their correct answers and the ones that have been answered by the candidates. Upon matching the answers with their correct options the marks of the individual candidate are also computed which can then be sent to the candidate via email.

Figure 6: Entries held in The Result Table

QUESTION	ORIGINAL ANSWER	ANSWER ATTEMPTED
1	B	B
2	A	B
3	B	D
4	B	A
5	A	A
6	B	E
7	C	D
8	D	A
9	A	B
10	C	C
11	C	C
12	C	C
13	D	C
14	C	C
15	B	C
16	A	C
17	A	A
18	B	B

V. Conclusion

Hence, it can be concluded that using the different database tables not only adds to the usability of the system but also makes it much more convenient to handle. Here also we see that the different tables that have been created serve the purpose of handling the data effectively and thus they reduce the ambiguity of the data.

VI. References

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