11149CH07

Chapter 7

Database Concepts

"Inconsistency of your mind... Can damage your memory... Remove the inconsistent data... And keep the original one !!!"

— Nisarga Jain

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7.1 Introduction

After learning about importance of data in the previous chapter, we need to explore the methods to store and manage data electronically. Let us take an example of a school that maintains data about its students, along with their attendance record and guardian details.

The class teacher marks daily attendance of the students in the attendance register. The teacher records 'P' for present or 'A' for absent against each student's roll number on each working day. If class strength is 50 and total working days in

a month are 26, the teacher needs to record 50 × 26 records manually in the register every month. As the volume of data increases, manual data entry becomes tedious. Following are some of the limitations of manual record keeping in this example:

1) Entry of student details (Roll number and name) in the new attendance register when the student is promoted to the next class.
2) Writing student details on each month's attendance page where inconsistency may happen due to incorrectly written names, skipped student records, etc.
3) Loss of data in case attendance register is lost or damaged.
4) Erroneous calculation while consolidating attendance record manually.

The office staff also manually maintain Student details viz. Roll Number, Name and Date of Birth with respective guardian details viz. Guardian name, Contact Number and Address. This is required for correspondence with guardian regarding student attendance and result.

Finding information from a huge volume of papers or deleting/modifying an entry is a difficult task in pen and paper based approach. To overcome the hassles faced in manual record keeping, it is desirable to store attendance record and student details on separate data files on a computerized system, so that office staff and teachers can:

1) Simply copy the student details to the new attendance file from the old attendance file when students are promoted to next class.
2) Find any data about student or guardian.
3) Add more details to existing data whenever a new student joins the school.
4) Modify stored data like details of student or guardian whenever required.
5) Remove/delete data whenever a student leaves the school.

Activity 7.1

Visit a few shops where records are maintained manually and identify a few limitations of manual record keeping faced by them.

7.2 FILE SYSTEM

A file can be understood as a container to store data in a computer. Files can be stored on the storage device of a computer system. Contents of a file can be texts, computer program code, comma separated values

(CSV), etc. Likewise, pictures, audios/videos, web pages are also files.

Files stored on a computer can be accessed directly and searched for desired data. But to access data of a file through software, for example, to display monthly attendance report on school website, one has to write computer programs to access data from files.

Continuing the example of attendance at school, we need to store data about students and attendance in two separate files. Table 7.1 shows the contents of STUDENT file which has six columns, as detailed below:

RollNumber – Roll number of the student

SName – Name of the student

SDateofBirth – Date of birth of the student

GName – Name of the guardian

GPhone – Phone number of the student guardian

GAddress – Address of the guardian of the student

Table 7.1 STUDENT file maintained by office staff

Roll Number	SName	SDateof Birth	GName	GPhone	GAddress
1	Atharv Ahuja	2003-05-15	Amit Ahuja	5711492685	G-35, Ashok Vihar, Delhi
2	Daizy Bhutia	2002-02-28	Baichung Bhutia	3612967082	Flat no. 5, Darjeeling Appt., Shimla
3	Taleem Shah	2002-02-28	Himanshu Shah	4726309212	26/77, West Patel Nagar, Ahmedabad
4	John Dsouza	2003-08-18	Danny Dsouza		S -13, Ashok Village, Daman
5	Ali Shah	2003-07-05	Himanshu Shah	4726309212	26/77, West Patel Nagar, Ahmedabad
6	Manika P.	2002-03-10	Sujata P.	3801923168	HNO-13, B- block, Preet Vihar, Madurai

Table 7.2 shows another file called ATTENDANCE which has four columns, as detailed below:

AttendanceDate – Date for which attendance was marked

RollNumber – Roll number of the student

SName – Name of the student

AttendanceStatus – Marked as P (present) or A (absent)

Table 7.2 ATTENDANCE file maintained by class teacher

AttendanceDate	RollNumber	SName	AttendanceStatus
2018-09-01	1	Atharv Ahuja	P
2018-09-01	2	Daizy Bhutia	P
2018-09-01	3	Taleem Shah	A
2018-09-01	4	John Dsouza	P
2018-09-01	5	Ali Shah	A
2018-09-01	6	Manika P.	P
2018-09-02	1	Atharv Ahuja	P
2018-09-02	2	Daizy Bhutia	P
2018-09-02	3	Taleem Shah	A
2018-09-02	4	John Dsouza	A
2018-09-02	5	Ali Shah	P
2018-09-02	6	Manika P.	P

7.2.1 Limitations of a File System

File system becomes difficult to handle when number of files increases and volume of data also grows. Following are some of the limitations of file system:

(A) Difficulty in Access

Files themselves do not provide any mechanism to retrieve data. Data maintained in a file system are accessed through application programs. While writing such programs, the developer may not anticipate all the possible ways in which data may be accessed. So, sometimes it is difficult to access data in the required format and one has to write application program to access data.

(B) Data Redundancy

Redundancy means same data are duplicated in different places (files). In our example, student names are maintained in both the files. Besides, in Table 7.1, students with roll numbers 3 and 5 have same guardian name and therefore same guardian name is maintained twice. Both these are examples of redundancy which is difficult to avoid in a file system. Redundancy leads to excess storage use and may cause data inconsistency also.

(C) Data Inconsistency

Data inconsistency occurs when same data maintained in different places do not match. If a student wants to get changed the spelling of her name, it needs to be

changed in SName column in both the files. Likewise, if a student leaves school, the details need to be deleted from both the files. As the files are being maintained by different people, the changes may not happen in one of the files. In that case, the student name will be different (inconsistent) in both the files.

(D) Data Isolation

Both the files presented at Table 7.1 (STUDENT) and at Table 7.2 (ATTENDANCE) are related to students. But there is no link or mapping between them. The school will have to write separate programs to access these two files. This is because data mapping is not supported in file system. In a more complex system where data files are generated by different person at different times, files being created in isolation may be of different formats. In such case, it is difficult to write new application programs to retrieve data from different files maintained at multiple places, as one has to understand the underlying structure of each file as well.

(E) Data Dependence

Data are stored in a specific format or structure in a file. If the structure or format itself is changed, all the existing application programs accessing that file also need to be change. Otherwise, the programs may not work correctly. This is data dependency. Hence, updating the structure of a data file requires modification in all the application programs accessing that file.

(F) Controlled Data Sharing

There can be different category of users like teacher, office staff and parents. Ideally, not every user should be able to access all the data. As an example, guardians and office staff can only see the student attendance data but should not be able to modify/delete it. It means these users should be given limited access (read only) to the ATTENDANCE file. Only the teacher should be able to update the attendance data. It is very difficult to enforce this kind of access control in a file system while accessing files through application programs.

7.3 Database Management System

Limitations faced in file system can be overcome by storing the data in a database where data are logically related. We can organise related data in a database so that it can be managed in an efficient and easy way.