Introduction to Database Systems

- Database
  - A shared collection of logically related data, and a description of this data, designed to meet the information needs of an organization.
    - Note the uses of the phrases:-
      - Shared collection
      - Logically related
      - Description of data

- Database System
  - It is a system which has the following components
    - Database,
    - Database Management System,
      - DBMS is a software that enables users to define, create, maintain, and control access to the database
    - Hardware.
    - People having roles to play in the database environment, and
    - Some application programs

Database System: Overview

- Assuming AAUSC uses a Database System to handle student records how do
  - Instructors enter grades?
  - Students register for courses?
  - Students get information on their academic performance?
  - Queries are processed?

- Database and Database Systems have become an essential component of everyday life in modern society
- It is fair to say that databases play a critical role in almost all areas where computers are used

- Some examples
  - Depositing or withdrawing money from a bank
  - Making airline reservation
  - Accessing a computerized library catalog to search for books
  - Purchasing an item from a supermarket
  - Booking a holiday at the travel agent
  - Purchasing using your credit card
  - Using the Internet
- All these may involve accessing databases

- Database Applications:
  - Banking: all transactions
  - Airlines: reservations, schedules
  - Universities: registration, grades
  - Sales: customers, products, purchases
  - Manufacturing: production, inventory, orders, supply chain
  - Human resources: employee records, salaries, tax deductions
- Databases touch all aspects of our lives

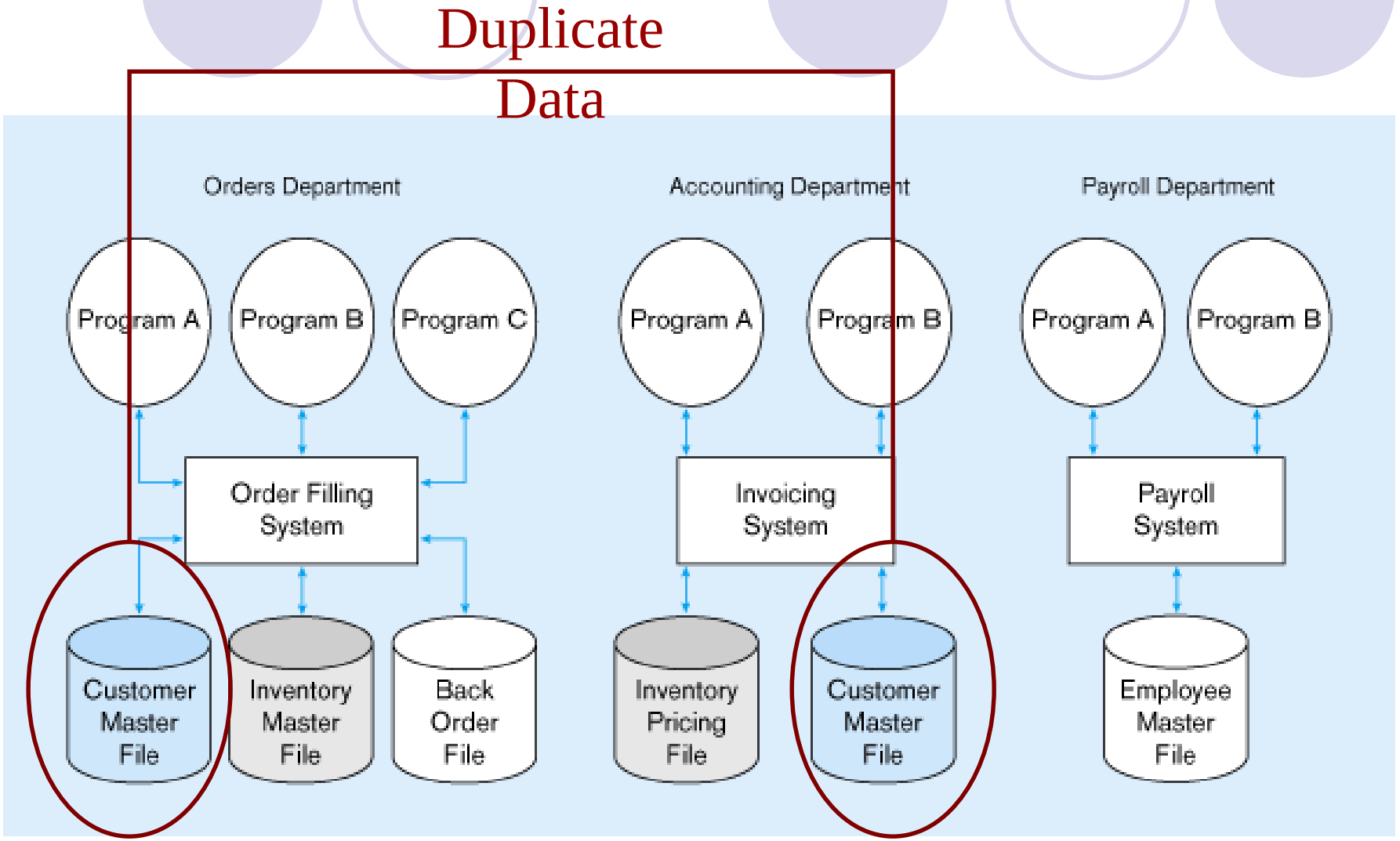
- Data has no meaning and hence not helpful, information is useful to make decisions and control and coordinate activities
- Data is input to Information System and information is output from the system.

- Example:
  - The numbers 18, 20, 23, 20, 25, 25, 28 can be considered as data. But if you are told that these are the highest temperature recordings during the first week of the month of June, 2007, at Addis Ababa, Ethiopia; it becomes information.

File - Based Systems

- File based systems were an early attempt to computerize manual systems.
- This approach is a decentralized computerized data handling method - it develops a program or a number of programs for each different application.
- Since every application defines and manages its own data, the system is subjected to serious data duplication problem

Example: Three file processing systems at Company A



Limitations of File-Based systems

- Data Redundancy (Duplication of data)
  - **Same data is held by different programs**
    - Wasted space **(Uncontrolled duplication of data)**
- Separation and isolation of data
  - **Each program maintains its own set of data. Users of one program may be unaware of potentially useful data held by other programs.**
  - **Limited data sharing**

Limitations of File-Based systems (Cont.)

- **Data Inconsistency and confusion**

  There are potentially different values and/or different formats for the same item

- **Program - Data dependence**

  File structure is defined in the program code and is dependent on the application programming language.

  Each application program must have its own processing routines for reading, inserting, updating and deleting data

Limitations of File Based Systems (Cont.)

- **Incompatible file formats (Lack of Data Sharing and Availability)**
  - Programs are written in different languages, and so cannot easily access each others files.
    - E.g. personnel writes in C++

      finance writes in COBOL

- **Poor Security and administration**

Limitations of File-Based systems (Cont.)

Update Anomalies

- Modification Anomalies: A problem experienced when one or more data value is modified on one application program but not on others containing the same data set.
- Deletion Anomalies: A problem encountered where one record set is deleted from one application but remain untouched in other application programs
- Insertion Anomalies: A problem experienced whenever there is a new data item to be recorded, and the recording is not made in all the applications

File based approaches