

**Eastern  
Economy  
Edition**

**Third Edition**

# **ANALYSIS AND DESIGN OF INFORMATION SYSTEMS**



**V. RAJARAMAN**

# ANALYSIS AND DESIGN OF INFORMATION SYSTEMS

THIRD EDITION

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**ANALYSIS AND DESIGN OF INFORMATION SYSTEMS, Third Edition**  
V. Rajaraman

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*In memory of*  
**Dr. M.S. Muthana**  
*Director*  
Indian Institute of Technology Kanpur

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# Preface

One of the most important uses of computers is to provide up-to-date information to managers to efficiently run their organizations. Of the total number of computers installed in the world today, over eighty percent are used in organizations for management information systems. It is thus very important for all students of Computer Science to know how to design computer-based information systems to aid management. This introductory text gives a lucid, self-contained presentation to students on how to analyze and design information systems for use by managers.

The subject, Information Systems Analysis and Design, also known as Systems Analysis and Design, is a compulsory subject for MCA, BCA, B.Com and BE students of Computer Science and Information Technology. This book covers the syllabi of these courses and the syllabus of the DOEACC (Level A) conducted by the DOEACC Society.

I developed and taught a course on Information Systems Design to Computer Science students for twenty years, first at the Indian Institute of Technology Kanpur, and later at the Indian Institute of Science, Bangalore. This book has evolved from the class notes used in this course and has been thoroughly classroom tested. Real examples are very important to explain ideas used in designing information systems and this text uses many examples taken from the Indian context. The book also includes a large number of exercises.

I used this book to prepare learning material consisting of PPTs, solutions to all the exercises and over 500 multiple choice questions with answers. This material was prepared for a course titled "Systems Analysis and Design" and was funded by the National Programme for Technology Enhanced Learning (NPTEL) of the Ministry of Human Resource Development, Government of India. I also gave 40 lectures based on this book for the NPTEL project phase 1. Both these materials are available on the NPTEL website. The lectures are also available on YouTube.

Chapter 1 shows the distinction between data and information and classifies information as strategic, tactical and operational. It also shows how to divide management functionally and hierarchically and what type of information is required by each of these functions and levels of management. The chapter concludes by pointing out the desirable attributes of information. Chapter 2 describes various functions of organizations, their computer infrastructure needs and the variety of information systems they require. Chapter 3 describes what is meant by systems life cycle and the significance

of the life cycle, and brings out the importance of user participation in arriving at requirements specification. It also analyzes the tasks of a systems analyst, the desirable attributes of an analyst, and the tools of the trade. Chapter 4 demonstrates how to gather information, the need for interviewing, and the method of consensus for formulating information requirements of an organization.

Chapter 5 discusses the use of document and data flow diagram in specifying and documenting users' information requirements. How users' requirements can be divided into operational, tactical and strategic needs is also described. Chapter 6 shows how the users' specifications are quantified and analyzes the feasibility of each alternate solution—the need for cost-benefit analysis and how it is carried out are clearly explained. Finally, the chapter shows how to document a feasibility report.

Starting from Chapter 7 the various tools used in designing information systems are dealt with. This chapter describes how data flow diagrams are developed using good style conventions. It also discusses the idea of levelling of data flow diagrams. The methods used to specify processing of information using structured English and decision tables are introduced in Chapter 8. Chapter 9 gives a detailed presentation on decision tables. I feel strongly that the use of decision tables is an excellent specification technique as it is non-procedural. Further, precise methods of detecting incompleteness, ambiguity, contradictions and redundancies in decision tables exist, which are described in this chapter.

I have introduced in this third edition of the book a new chapter (Chapter 10) on **Use Case Method**. This method is very useful in specifying users' requirements and has gained popularity in industry. Use Case method is also part of object modeling.

Chapters 11 and 12 deal with data and their organization. Chapter 11 presents the entity-relationship modelling technique to develop a conceptual model of data. It also describes the use of relations and their normalization to develop relational database for applications. Chapter 12 brings out the need for an integrated database in organizations. It also brings out the need for database management systems, their objectives and organization.

Chapter 13 discusses Object-Oriented System Modelling, as object orientation has become very important. In this chapter both the method to identify objects and the way they are used to model information systems are described. The objective here is not to discuss at length object-oriented analysis and design but to give a broad overview of this topic and compare it with structured analysis and design.

Chapter 14 shows how to input data. The topics include the design of forms and screens for data entry, data encoding, error detection and input data controls to ensure correct data entry.

Chapter 15 describes how to present processed data as information to the users of a system and presents the design of output reports, screens and graphics. It is very important to ensure that the results obtained from an information system are correct and reliable. To ensure this, systematic control and audit procedures are required. Chapter 16 discusses how to introduce controls in an information system, how to audit the system, how to test the system, and how to ensure security of the system.

Chapter 17 is on electronic commerce (or e-Commerce) which is becoming extremely important. This chapter gives a broad overview of e-Commerce so that the student can design information systems keeping this development in view.

Various tools and techniques learnt by the students are used to design a small information system in the last chapter (Chapter 18). At the end of this chapter I have given ten realistic cases which are described in reasonable detail so that a student can use the data to design a system for each of these cases.

A book of this type naturally gained a lot of ideas from the books written by many authors. I thank all of them. Mr. S. Thirumalai assisted me in teaching a course on information systems design. He read all the chapters critically and gave numerous suggestions which considerably improved the book. He also evolved the case study problems given at the end of Chapter 18. I am extremely thankful to him for his assistance. Chapters 11, 12 and 13 were reviewed by Prof. Jayant Haritsa and he gave me several valuable suggestions which helped me to update these chapters. I thank NPTEL project and its coordinator at IISc, Bangalore, Prof. N.J. Rao, for funding the preparation of the web material and video graphing the lectures based on this book. I thank Prof. R. Govindarajan, Chairman, Supercomputer Education and Research Centre, and Prof. P. Balaram, Director Indian Institute of Science, Bangalore, for the facilities provided which enabled me to write this edition of the book. The manuscript of this edition was entered on a word processor by Ms. T. Mallika. I thank her for an excellent job.

Finally, I thank my wife Dharma for proofreading the manuscript and giving numerous suggestions. Without her cheerful cooperation and assistance this book would not have been written.

Bangalore  
January, 2011

**V. RAJARAMAN**

# Information and Management

## LEARNING GOALS

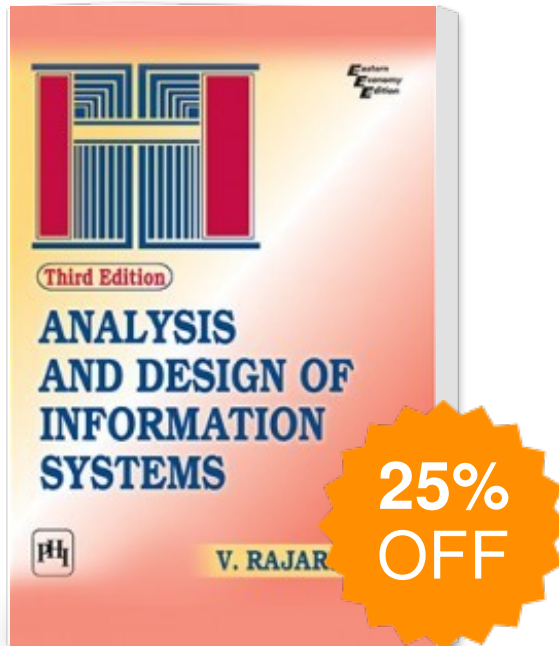
After reading this chapter a student should be able to:

1. Distinguish between data and information.
2. Identify information needs of an organization and distinguish between operational, tactical and strategic information.
3. Divide an organization based on its functions and determine information needs of each of the functional areas.
4. Identify the desirable attributes of information.

Everyone in his or her day-to-day work gathers and processes data. For example, when a housewife buys milk every morning, she writes in a notebook the number of litres she bought. At the end of the month she adds the data (litres of milk bought per day) in the notebook and multiplies it by the price per litre. The result is the information she uses to pay the milkman. The data on milk purchased each day may be processed in other ways too to obtain different information. For example, if the total milk bought in a month is divided by the number of members in the family, it gives information on average milk consumption per head. If the total monthly expense on milk is divided by the monthly income of the family, it gives information on proportion of income spent on milk. The main point is that *data and information are not the same*. *Data* is the raw material with which we start. *Information* is processed data which is used to trigger certain actions or gain better understanding of what the data implies. In this example the knowledge of percentage of family income spent on milk may be used by the family to manage their family budget in a more efficient manner.

As is seen above, data is the raw material with which we begin. Information is the finished product. Collecting data costs money. For example, if we want to survey the preferences of consumers regarding some products, then someone has to go out, interview prospective customers and collect data. As the number of people interviewed increases, the cost of data collected increases. This data by itself is useless unless it is processed to obtain information which can be used to arrive at marketing decisions. This

# Analysis And Design Of Information System



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