

IM SYLLABUS (2012)

INFORMATION TECHNOLOGY

IM 19

SYLLABUS

Information Technology IM 19	(Available in September)
Syllabus coursework	1 paper (3 hours) +

Introduction

The aim of this subject is to prepare students for understanding the practical aspects of computing and become aware of the organisational environment in which it has to operate.

In particular it aims to prepare students to:

- Acquire a basic knowledge of computer hardware and software;
- Become familiar with the functions of Information Systems;
- Understand how computers are integrated into an organisation;
- Learn how information is managed within organisation;
- Develop basic communication and business skills required in computing.

Course Structure

Prerequisites: None.

Duration: A 2-year period of study is assumed with a total of approximately 140 contact hours which include both lectures and lab work.

Content

The syllabus consists of three major modules:

1: Computing Principles

Aim: To show how ICT is affecting various spheres of modern society and to give a broad foundation of basic computing/data processing knowledge and skills. Students are expected to become familiar with the various types of software categories and their capabilities.

2: Human communication and Business Organisation

Aim: Human Communication to provide students with the necessary written and verbal communication skills to enable them to relate to others on computing and non-computing matters.
Business Organisation to give the student an understanding of the information needs of organisations, the various types of organisation and the principal functional areas within organisations.

3: Exercises

Aim: To give students the opportunity to put into practice concepts learnt during the course.

Assessment Procedure

Modules 1 and 2 are assessed on the basis of ONE WRITTEN EXAMINATION PAPER AT THE END OF THE 2-YEAR COURSE.

Module 3 is assessed on the basis of a set of *three* school based exercises carried out by the candidate during the course of study, monitored and assessed by the tutor and moderated by the markers' panel. All marks are to be submitted to MATSEC not later than the date stipulated by the Matsec board.

Note on Private candidates: Private candidates are to submit all exercises for assessment to MATSEC Support Unit by the date stipulated by the unit. Candidates may be called for an interview about their work.

Weightings for final Grade

		Module	% Weighting
Examination Paper (3 hours)	Section A	Computing Principles	55
	Section B	Human Communication & Business Organisation	25
Set Exercises			20

Three exercises will be set during the course. The percentage values illustrate the weighting of each assignment mark as a percentage of the overall final grade.

- (i) Database and spreadsheet assignment 8%
- (ii) Web Design assignment 7%
- (iii) Human Communication and Business Organisation Assignment 5%

Paper Structure

Duration three hours.

Maximum mark 80.

This paper will comprise two sections.

Section A on Computing Principles (maximum mark 55)

Questions are set on the syllabus content of Module 1.

Seven questions are set as follows:

One compulsory question, consisting of a case study and carrying 15 marks;

Six questions, to choose four, each carrying 10 marks.

Section B on Human Communication and Business Organisation (maximum mark 25)

Questions are set on part of the syllabus content of Module 2.

Three questions are set as follows:

One compulsory question, consisting of short questions and carrying 15 marks;

Two questions, to choose one, each carrying 10 marks.

Grading

The final grade will be based on an overall aggregate score in written paper and exercises. Students must obtain a minimum mark in the paper to be established by the Markers' Panel.

Re-sit

Candidates who fail to meet the criteria for a pass will have to re-sit the examination. Project marks may be carried forward for subsequent sessions based on this syllabus.

1: COMPUTING PRINCIPLES

1.1 INFORMATION SYSTEMS

1.1.1 THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) TODAY

By the end of this section the student should be able to:

- Distinguish clearly between data and information, and appreciate the relevance of information in modern organisations;
- Understand clearly computer-related crime and the counter-measures employed to combat such crime;
- Appreciate the need for data protection legislation;
- Have a basic understanding of how ICT is affecting various spheres of modern society.

Data and Information	<p>Definition of each.</p> <p>The idea that from information one is able to extract knowledge (i.e. learning from interpretation of information).</p> <p>The input-process-output cycle – information obtained by processing of ‘raw’ data.</p> <p>Direct and indirect sources of data. The importance of quality of data /information (i.e. up-to-date, accurate and complete).</p> <p>The significance of data and information to modern organisations – ability to take effective decisions for the benefit of organisations (such as entering a new market and doing research into a promising area).</p> <p>External and internal forms of data with respect to organisations.</p> <p>Modern organisations/individuals are subjected to overexposure to data and information. The need to find only what is required, when it is required.</p> <p>The notion of the Information Society – a society based on information and knowledge.</p> <p>The use of ICT to facilitate data organisation. Benefits and limitations of ICT systems.</p>
Computer-related crime	<p>A society based on information is threatened by itself. Data/information has become vital to most organisations/individuals that they may seek illegal ways to obtain it.</p> <p>A new type of crime – computer based crime. Defining computer crime/computer misuse. Authorities were initially unprepared.</p> <p>Categories of illegal practices – hacking, theft (money, data, etc), computer based fraud, malicious code – viruses. The Internet as a means to perpetuate these crimes beyond physical borders.</p> <p>Modern legislation has been introduced to combat computer/digital crime (Malta/UK) computer misuse/ acts.</p> <p>Software copyright laws – main issues (illegal to make, use and transmit unauthorised copies to other users).</p>
Data protection legislation	<p>The need to protect a person’s personal privacy in lieu of the fact that a person’s personal details are relatively more easy to access online than with previously used systems.</p> <p>Principles of data protection and the data protection act (Malta/UK).</p> <p>Exemptions (e.g. due to national security reasons).</p> <p>Defining a data subject (i.e. persons whose details are stored in some database). Their rights.</p> <p>The role of the Data Protection Registrar</p>
ICT in the modern society	<p>An awareness of the limited role of computing in the past and its much wider role today.</p>

	<p>Typical examples of ICT in use today would be: Teleworking and the changing nature of work and employment resulting from ICT The use of ICT in business and commerce – smaller organisations can compete via ICT, the advent of e-commerce (buying and selling over the Internet), use of ICT in banking. E-government – people able to pay bills, fill up forms for government related services (e.g. income tax) over the Internet. ICT in manufacturing – overview of CAD in conjunction with CAM. ICT in Science and Engineering- design tools-CAD, simulation-traffic, piloting (air, sea), data tracking systems, telemetry, GIS, weather forecasting, statistical packages (SPSS), expert systems (engineering, medical, legal). Computer aided learning/e-learning in schools and over the Internet. ICT in the caring society – overview of expert systems, use of ICT by persons with special needs/requirements ICT and leisure – ICT related entertainment, ‘chatting’, booking of holidays, flights etc via use of ICT.</p>
Health and Safety	<p>Computers and health – people are using ICT more than ever before hence exposed to hazards that were not common in the past. Stress, Repetitive Strain Injury (RSI), Eyestrain, Extremely Low Frequency (ELF) radiation. Computers, health and the law. The ergonomic environment – recommendations regarding the design of ICT work environment</p>

1.1.2 INFORMATION: THE TOOLS REQUIRED TO HANDLE IT

By the end of this section the student should be able to:

- Define the basic components of a computer system;
- Understand the basic characteristics of a typical microprocessor;
- Be aware of the principal input devices currently in use;
- Be aware of the main storage devices currently in use;
- Be aware of the main output devices currently in use;
- Define the main issues relevant to network environments in modern organisations;
- Distinguish between the main modes of processing used;
- Understand the importance of user interfaces for IS and the main types of user interfaces found today;
- Appreciate the fact that all data in computers is stored in binary format and that the most frequently used number bases are binary and hexadecimal;
- Demonstrate an understanding of the different data representations;
- Appreciate that various verification and validation techniques exist to minimize the number of errors in data storage/transmission.

Computer system	<p>Outline of a computer system as being made of various components. (I/O, processor, main memory, auxiliary storage). Type of components may vary and depend on requirements. Main categories of computers currently in existence and their use.</p>
Microprocessor	<p>Overview of a typical processor (ALU, CU, registers, buses as channels through which the various components are linked). Main types of RAM and ROM currently in use. The ASCII code as a means to represent characters. (EBCDIC, UNICODE)</p>
Input devices	<p>Brief overview of main input devices (no need to go in their detailed function). Important to indicate the advantages and disadvantages of each and hence the environment where they should be used.</p>

Storage devices	Notion of primary and secondary storage. Main types of magnetic-based storage devices, and main types of optical-based storage devices. Advantages/disadvantages.
Output devices	Brief overview of main output devices (no technical details required). Advantages and disadvantages of each and areas of application of each.
Networks in organisations	Types of networks commonly used: LAN and WAN. Advantages and disadvantages of networks. Common LAN setups (Star, Ring, Bus). Server-based vs peer-to-peer networks. Wide Area Networks. Overview of Internet structure – mesh of interlinked networks Overview of communications links and common media used. ISDN lines. The use of bridges and gateways to link different networks together. Overview of Synchronous and Asynchronous transmission. Factors affecting the rate of data transmission. Protocols as standards required to link different network types together.
Processing modes	Understand the principles of batch processing and interactive processing Concept of master files and transaction files. Real-time and pseudo real-time processing. Criteria for the choice of processing mode.
User interface in IS	The importance of a good interface Main interface styles – Command Line Interface (CLI) and Graphical User Interface (GUI). Advantages and disadvantages of each. New ways – script recognition, speech input/output.
Management Information System	Decision making is the process of selecting the most desirable or optimum alternative to solve a problem or achieve an objective. The quality and soundness of managerial decisions is largely contingent upon the information available to the decision-maker. Decision making is classified on three levels : <ul style="list-style-type: none"> • <i>Strategic</i> decisions are future-oriented because of uncertainty. They are part of the planning activity. • <i>Tactical</i> decision making combines planning activities with controlling. It is for short-term activities and associated allocation of resources to them to achieve the objectives. • <i>Technical</i> decision making is a process of ensuring efficient and effective implementation of specific tasks.
Data representations	Binary numbers as made up of bits. Meaning of byte. Data representation in binary to code text, numbers and control signals. Different file formats and common file extensions: Binary (.bin or .exe), graphic (bit-mapped, JPEG and GIF), sound (WAV, MP3), video (AVI), text (.txt), database records (.DBF) and hypertext (.HTML)
Validation and verification techniques	Validation checks: range and check digit Verification checks on files. Error correction techniques: parity and CRC.

1.2 SOFTWARE AND SYSTEM DEVELOPMENT

1.2.1 CATEGORIES OF SOFTWARE

At the end of this module, students will be able to:

- Distinguish between the major categories of software;
- Describe the functions of the basic components found in an operating system;
- Understand the notions of software capabilities with reference to upgradeability, ease of use and reliability.

Software categories	Main two categories are System Software and Application Software. Definitions of each.
System Software	Types of: Operating system, Utility programs such as antivirus, compressors and defragmentation. Translators (compilers, interpreters and assemblers). Monitoring software for both hardware and software. Communication software. Students should know that some Operating systems contain most of the system software above. Candidates are expected of be familiar with the properties and capabilities of the various types of system software.
Application software	Types of: specific, general purpose (generic), and application generators. Integrated and software suites. Advantages and disadvantages of each type. The scenarios in which each type of software may be applied.
Operating System (OS)	Purpose of OS. Candidates should know that the OS is software that controls all operations. Components of OS. Kernel (supervisor or control program), memory manager, input/output manager, backing store manager, resource allocation and scheduler, accounting, error handling and security, interface between hardware and user. Types of operating systems. Single program OS, multitasking, multiprogramming and networked. Command line interface and GUI interface. Candidates are expected to be aware of different types of operating systems.
Software Capabilities.	Portability between programs. Portability between files. Upgrades compatibility. Object Linking and Embedding (OLE). Differences between linked and embedded objects. Reliability tests.

1.2.2 GENERIC SOFTWARE

In this module, students will:

- Become conversant with the nature and capabilities of the most common generic software;
- Improve their development skills by using generic packages namely word-processing, spreadsheet and database.

Word processing	Page layout, formatting, spell and grammar checkers, index and table of contents creation, importation of files, mail merge and template creation.
Spreadsheet	Cell formatting, manipulation of cells, rows and columns, use of functions (sum, average, maximum, minimum) plus standard mathematical operators, sorting and querying simple database sheets, multiple linked worksheets, cell absolute and reference, creation of charts and graphs. Pivot tables. Goal seek solver. Use of macros. What if analysis.
Database	Creation of tables, queries, forms and reports. Creation of well organised and linked relational tables. Field data types: numeric, string, boolean and date. Enforcement of referential integrity. Use of macros. Creation of customised menus. Execution of multi-table queries.

Manual operational skills of how to use particular generic software will not be assessed. However, examination questions will assume a reasonable level of knowledge and understanding of the capabilities of database, spreadsheet and word-processing.

1.2.3 DATABASE SYSTEMS

At the end of this module, students will be able to:

- Describe the nature and purpose of database systems and how they work;
- Describe the functions of the tools readily available in database packages;
- Appreciate the advantages of relational database systems over traditional file systems.

Introduction to Database systems	Notion of a file. Program files and data files. Database systems and flat-file systems. Their definitions. Relative advantages and disadvantages of each. Database management system (DBMS). Role of DBMS as the interface between user and database in a database system. Database as a collection of data organised in tabular form – base table.
Relational Tables	Table organisation Definition of entity, field (attribute), key field (primary key), secondary key, record (tuple). Links between tables. Definition of foreign key. Representation of relational tables by the use of the notation in which the name of each table is followed by a list of all the fields in brackets. Key fields are underlined and foreign keys are in italic, or have a line over them. (Entity name in block capitals whereas field names are in lower case.) Field types in relational tables – text, numeric, date, boolean and memo.
Tools in database packages	Tables: creation of relational (base) tables. Operations on tables such as search, deletion, amend and sort. Referential integrity taken care of by database package. Forms: types of. Advantages of forms with special reference to validations in entry forms. Queries: definition of. Done via Graphics User Interface or by Structured Query Language (SQL). Answer table. Reports: definition of.

1.2.4 INTERNET-RELATED SOFTWARE

At the end of this module, candidates will be able to:

- Describe internet related terms;
- Describe the capabilities of internet-related utility software;
- Try most of the internet utilities listed below;
- Appreciate that all internet applications and utilities run on top of standard protocols;
- Appreciate existence of software to improve security.

Introduction to the Internet	How the Internet was developed. Internet structure. Internet registries. Domain names. DNS and TLD. Intranets and Extranets.
Internet utility software	All Internet software is based on client-server technology. Internet is not just the WWW. Other utilities are: e-mail, ftp, telnet, usenet groups, chat lines and videoconferencing. Students are expected to describe the purpose, features, advantages and disadvantages of each software utility. Awareness of mobility. Connecting to the Internet via mobile phone. Advantages/disadvantages.
e-commerce	The trade cycle The Value chain <ul style="list-style-type: none"> • EDI • Emarkets • Internet commerce Competitive benefits
e-government	Life events Portals-one stop shop Admin to Admin Admin to Business Admin to Citizen Procuring systems-inhouse/outsource, ASP Informing Transaction-applications, payments, licences. E-mail request tracking
WWW	Internet service provider. Web site. Web page construction. Web server. Web browser (URL, HTML, bookmark, history, downloading, hyperlinks).
Internet protocols	SMTP. POP and IMAP. FTP. HTTP. TCP/IP. Candidates need only know the purpose of each protocol.
Security problems	Internet based fraud. Password hacking. Viruses. Some solutions to these problems: Encryption and decryption keys. Firewalls. Anti-virus software. Digital signatures and certificates.

1.2.5 SYSTEM DEVELOPMENT

Students will learn how to:

- Plan the time schedule to complete system objectives;
- Investigate the client’s requirements and set objectives during the design phase;
- Use structured techniques involved in system design;
- Produce the final documentation of the system being developed.

Planning	Before a system starts taking shape it must go through a number of development stages each of which must be well planned. Candidate learns how to plan the time schedule keeping in mind that all objectives are to be realistically chosen and achieved in the time frame available. Any standard system life cycle may be followed.
Analysis Problem Identification and Investigation	Problem must be completely understood before solving it systematically. Candidates are expected to practise methods for collecting information, such as interviews, questionnaires, observations and inspection of documents.
Feasibility Study	Candidates are expected to practise writing feasibility study reports based on the outcomes of the investigation. Technical, financial and social aspects should be considered.
System and information requirements	Input and output formats. System type such as single/multi user, on-line, batch or real-time. Storage requirements. User interface needs. Representation of data flow within the present system. Processing requirements. Proposal of alternative methods of solution
Design	One method of solution is chosen. Reasons of choice are to be documented. Criteria considered could be costs, needs for development, knowledge and time frame available. Selection of existing software tools. Structured techniques. Top-down and bottom-up approaches. Choice of data types. Human Communication Interface. Input and output formats. Data capture and validation methods.
Implementation and testing	Mapping of modules’ design into an application generation tool. Testing is carried out according to chosen testing strategy. System testing (acceptance testing, alpha and beta testing). System implementation method (parallel, direct, pilot or phased). Staff training. Conversion of data files. User’s guide and technical documentations.
Maintenance	Issues that make a system easy to maintain.
System evaluation	System evaluation based on usability, effectiveness and maintainability.

2: HUMAN COMMUNICATION AND BUSINESS ORGANISATION

2.1 HUMAN COMMUNICATION

At the end of the module candidates will be able to:

- Describe the nature of communication;
- Understand different means of communication;
- Appreciate related technologies, their basic functions and relative advantages;
- Appreciate the power of the Internet as a means of human communication;
- Understand the information structures used for dissemination of information internally and also externally;
- Describe what e-business has to offer.

Introduction to Communication	<p>What is communication? The communication model. Different types of communication: verbal, written and visual. How electronic communication is affecting business: Tele-working, Internet. (in brief as it will be covered later), Video Conferencing, E-Government (information about government services, payment and actual delivery of services)</p>
Verbal communication	<p>The advantages and disadvantages of verbal communication.</p> <p>Speech: Preparation, Delivery, The subject, Public speaking, Assessment technique. Non Verbal Communication.</p>
Written communication	<p>The advantages and disadvantages of written communication. The concept of written media: content, structure, style, layout. The curriculum vitae.</p> <p>Examples: Letter, memos, reports, minutes.</p> <p>Related technologies – main features and advantages</p> <ul style="list-style-type: none"> – word-processing, – e-mail – document systems (like groupware and workflow systems)
Visual communication	<p>The effects of visual communication with respect to ICT.</p> <p>Related technologies – main features and advantages.</p> <ul style="list-style-type: none"> – desktop publishing – digital Image Processing – presentations etc..
The Internet as a Human Communication Media	<p>What is the Internet?</p> <p>Internet utilities that can be used as human communication tools : Email, Chatting, Newsgroups and Discussion Groups, Web Conferencing. (The student should know how one could use the above services in a business both in internal and external communications.)</p> <p>Advantages and disadvantages of the internet as a communication tool.</p>
Internal communication in an organisation	<p>Structures for dissemination of information</p> <p>Upward Communication: Purpose and Content of reports, Suggestion scheme systems, Interviews, Employees groups, Staff development and appraisal.</p>

	<p>Downward Communication: Purpose, Policies of communication, The different ways that a company can take in order to communicate with the employees (magazines, induction manual, annual reports, letter, notice board, pay envelope inserts).</p> <p>The Grapevine lateral Communication.</p>
External communication in an organization	<p>Why does a company have to spread information to the outside world:</p> <ul style="list-style-type: none"> - Suppliers (what info should they know), - Customers (present and future), - Public relations. <p>Different ways and means of how to spread information:</p> <ul style="list-style-type: none"> - Newspaper, letters to customers and other media.
Use of Communication Technologies in a business organisation	<p>Telephone, PABX systems, Voice Mail, Facsimile, TV and Radio. Internet as a general communication tool.</p>
E-business	<p>The emergence of e-business such as buying, selling, ordering of stock and settling bills. E-commerce as a tool for buying and selling.</p> <p>Doing business on the web:</p> <ul style="list-style-type: none"> - Advantages to business and to customers - Disadvantages to business and to customer - Distinction between business to business (B2B) and business to consumer (B2C)

2.2 BUSINESS ORGANISATION

2.2.1 ORGANISATIONS

Upon successful completion of this module the students will be able to:

- Describe the information and different types of organisation in the public and private sectors;
- Describe the fundamental characteristics of an organisation;
- Construct an organisational chart showing the various working relationships;
- Outline the various functional areas within organisations;
- Understand the activities that take place in various departments;
- Identify the types of documentation used in offices;
- Understand how change can be managed.

Formation of organisations	<p>What is an organisation? Behavioural science; from Barter Trade to Modern Organisations; specialisation; profit/non-profit-making organisations.</p>
Types of organisations	<p>Economics systems - Mixed Economies. Organisations in the Private and Public Sectors: Sole Trader; Partnership; Private and Public Ltd. Companies; Co-ops; Public Corporations.</p>
Characteristics of organisations	<p>Essential components of organisations; open vs closed systems; formal vs informal organisations; authority, responsibility and delegation; centralised and decentralised;</p>

	decision-making management functions.
Organisational Structure	Departmentalisation: By Function, by Product; by Location; by Project/Contract. The Organisational Chart: Vertical, Horizontal and Circular Working Relationships: Line, Lateral, Staff and Function.
Introduction to Functional Areas	Outline the various functional areas; develop an organisational chart; explain the work carried out in each function; the duties and responsibilities of the personnel at various levels within each functional area.
Documentation	Identify and describe the various types of documentation used in organisations:- Sales and Purchases documentation, Production documentation, Personnel documentation, Finance documentation, Administration documentation.
Managing Change	Reasons leading to change; Classical example is the introduction or development of an information system: this will result in change that must be managed. Factors could include re-skilling, attitude, organisational structure, employment pattern and conditions, internal procedures. Overcoming resistance to change. Effects of and coping with Stress.

3: EXERCISES

3.1 GUIDELINES ON EXERCISES

Problems chosen by students should be realistic and reasonable in the sense that the objectives planned may be implemented in the time-frame available. Candidates should be encouraged to use different sources of information – books, Internet, newspapers and journals.

In marking the assignments, credit will be given to the inclusion of the appropriated features as described in the following sections.

3.2 WEB DESIGN ASSIGNMENT

Features in Web Design assignment

Candidates are to design a web page for a business or organization. Candidates may use FrontPage, Publisher, or any other software or programming language that they wish. At a very minimum the candidates' web design should include: an introductory page with links to pages describing the company's products/services, personnel, etc... Candidates may also wish to include response or comment pages, as well as other pages providing information about the company, industry, or other information relevant to the target market.

3.3 DATABASE AND SPREADSHEET ASSIGNMENT

Features in Database and Spreadsheet assignment

Features in Spreadsheet

- More than one worksheet
- Linked worksheets
- Use of labels, numbers and formulae
- Absolute and reference cells
- Entry of data by user
- Validation of data entered
- Pivot tables
- Goal seek and solver
- Locking sheets
- Macros to control input/output and processing
- Customisation of menus and toolbars
- Built-in presentation tools such as charts

Features in Database

- Entity-Relationship Diagrams
- Well organised tables
- Field types well chosen and explained. Inclusion of any default values and validations
- Demonstration of referential integrity
- Creation and use of forms for data entry
- Queries on multiple tables
- Creation and display of reports
- Use of macros
- Creation of switchboard

3.4 HUMAN COMMUNICATION AND BUSINESS ORGANISATION ASSIGNMENT

Features in the human communication and business organisation assignment

Coursework involves skills in information gathering, collation, design and presentation. The final form of coursework should be a slideshow presentation.

Candidates are expected to show how much they can exploit the characteristics of a particular medium to transmit the selected content.

Attention is to be given to the selection of content (image and text), composition, emphasis and use of colour.

Assignment criteria include:

- 1) Presentation length will be **between 8 and 10 minutes**.
- 2) Candidates will utilize a **minimum of 4 Power Point slides** (topic slide not included) and a **maximum of 20 slides**.
- 3) Candidates should submit an outline for this presentation and a **bibliography/references/works consulted page**.
- 4) Candidates will **select their own presentation topic**. This topic may be an issue discussed in class. The topic **must be relevant to the business environment**.
- 5) Candidates are expected to give a verbal in-class presentation.

Books

The following books may be used as textbooks and/or as reference books.

‘A’ Level ICT (2nd ed), by P.M. Heathcote (2000), Payne-Gallway Publishers Ltd
ISBN 0-9532490-8-5

‘AS’ Level ICT (1st ed), by P.M. Heathcote, (2000), Payne-Gallway Publishers Ltd
ISBN 0-9532490-9-3

Business Systems Development, by Tudor Dorothy and Tudor Ian (1997), NCC Education Services Limited
ISBN 1-90234-305-0

Human Communication and Information Systems, by Stuart Harris (1988), NCC Education Services Limited, 1998
ISBN 1-90234-300-X

The Complete A-Z ICT & Computing Handbook, by Bob Penrose and Bill Pollard, Hodder & Stoughton Ltd
ISBN 0-340-80277-4

Using Information Technology. A Practical Introduction to Computers and Communications. (3rd ed)
by Williams, Sawyer & Hutchinson (1999), Irwin/McGraw-Hill Companies
ISBN 0-07-115867-7
