INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

IST-S1

Domaine Scientifique de la DOUA - Bât. A. de Saint-Exupéry
27, avenue Jean Capelle - 69621 VILLEURBANNE

ANNEE : 1ère année / 1st year - ECTS

- EC : Data Mining - 3.00 ECTS
- EC : Assembly Programming - 3.00 ECTS
- EC : Image Processing - 3.00 ECTS
- EC : Operating Systems - 3.00 ECTS
- EC : Middleware Architectures for Ambient to Cloud Computing - 3.00 ECTS
- EC : Transmission Lines and RF Systems - 3.00 ECTS
- EC : Signal Processing - 3.00 ECTS
- EC : Java Programming - 3.00 ECTS
- EC : Wireless Communications Basics - 3.00 ECTS
- EC : Computer Networks: LAN & IP Networks - 3.00 ECTS
- EC : Computer Networks: Routing in the Internet - 3.0 ECTS
- EC : Data Bases - 3 ECTS
- EC : Research Project - 10.00 ECTS

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Information Science & Technology Semester (IST)

Domaine Scientifique de la DOUA
20, Avenue Albert Einstein - 69100 Villeurbanne

Data Mining

IDENTIFICATION

CODE : IST-0-S1-EC-DBM2
ECTS : 3.00

HOURS

Cours :	0h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	0h
Total :	20h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

English

CONTACT

M. Tommasini Riccardo :
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M. Famà Mauro :
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AIMS

This course introduces data mining as an extension of standard database querying approaches. We motivate the need for new querying mechanisms to support data analysis and Knowledge Discovery from Databases (KDD) by means of data mining techniques. The classical data mining algorithms (clustering, classification, association rule mining) are introduced. We explain why it is interesting to study and implement such algorithms within the recent setting of constraint-based data mining. Finally, the design of data mining query languages is considered. To be concrete, the students will have to perform some practical data analysis tasks by means of the open source KNIME data mining tool. Beside the introduction of the most popular techniques, we will do our best to sketch research challenges in the area, including a discussion on the research results collected in Lyon during the last decade.

CONTENT

From data to knowledge: A database perspective to KDD Introducing the most important data mining methods Exploratory Data Analysis Clustering Pattern discovery Supervized classification Designing data mining query languages

BIBLIOGRAPHY

[1] David Hand, Heikki Mannila, Padhraic Smyth. Principles of Data Mining. MIT Press, 2001, 546 pages. Chinese translation, China Machine Press, ISBN 7-111-11577-5, 2003. [2]Pang-Ning Tan, Michael Steinbach, Vipin Kumar. Introduction to Data Mining. Addison- Wesley, 2006, 710 pages. [3]Mohammed J. Zaki, Wagner Meira Jr., Fundamentals of Data Mining Algorithms, Cambridge Press. In Press (2011). PRE-REQUISITE Basic database notions, SQL

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Information Science & Technology Semester (IST)

Domaine Scientifique de la DOUA
20, Avenue Albert Einstein - 69100 Villeurbanne

Assembly Programming

IDENTIFICATION

CODE : IST-0-S1-EC-ASM
ECTS : 3.00

HOURS

Cours :	0h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	0h
Total :	20h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

English

CONTACT

M. Morel Lionel :
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M. Salagnac Guillaume :
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AIMS

The aim of this course is to acquire a concrete understanding of what it means to "execute" a "program" on a "computer". What is an "instruction" ? What is "a variable" ? What does "the processor" do ? What does "assembly programming" mean ? This course is neither a "computer architecture" course (we will *not* discuss implementation details of the hardware) nor an "operating systems" course (we will not talk about advanced topics such as virtual memory or process context switching).

CONTENT

Information coding: binary numbers, hexadecimal, ascii - Binary Arithmetics: addition, subtraction, multiplication, two's complement encoding - The von Neumann Architecture: CPU+Memory, machine language vs assembly, immediates - Control Flow: control structures (loops, alternatives), mandatory vs conditional jumps, breakpoints - Addressing modes and memory instructions: direct vs indirect, indexed addressing - Memory-mapped input/output: peripheral interface through load/store - Subroutines: call protocol, return address, parameter passing, calling conventions - The Execution Stack: push/pop instructions, stack pointer, register spilling - Recursion: Application Binary Interface, fixed/caller-saved/callee-saved/scratch registers

BIBLIOGRAPHY

- Patterson and Hennessy, Computer Organization and Design: The Hardware/Software Interface

PRE-REQUISITES

High school maths: integer arithmetics, boolean logic - A laptop with Python installed (python 3.6+)

Image Processing

IDENTIFICATION

CODE : IST-0-S1-EC-SIP2
ECTS : 3.00

HOURS

Cours :	0h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	0h
Total :	20h

ASSESMENT METHOD

Grading is done according to the following :
- The image processing lab report.
- A presentation of work on the Kaggle challenge.

TEACHING AIDS

All course material is published on Moodle.

TEACHING LANGUAGE

English

CONTACT

M. KECHICHIAN Razmig :
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AIMS

This course comprises 2 modules :
- A theoretical and practical introduction to image processing.
- A Deep Learning workshop.

CONTENT

- Digital image representation (spatial and frequency domains), notions of neighborhood, sampling, quantization etc.
- Image processing : histogram operations, linear operations (denoising, edge detection etc.),
non-linear operations and mathematical morphology.
- Image segmentation : histogram, contour and region based approaches.
- Image processing lab applied to previous points.
- Introduction to deep learning via convolutional neural networks tutorial lab.
- Application of deep learning to a Kaggle challenge.

BIBLIOGRAPHY

- Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 3rd edition, Pearson,
2007
- Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016, https://
www.deeplearningbook.org/

PRE-REQUISITES

Good background in applied math and digital signal processing is necessary, e.g. the SIP1 module, in addition basic Python programming skills.

Operating Systems

IDENTIFICATION

CODE : IST-0-S1-EC-OPS
ECTS : 3.00

HOURS

Cours :	0h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	0h
Total :	20h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

English

CONTACT

M. Salagnac Guillaume :
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AIMS

The aim of the course is to present the fundamental concepts and issues in the topic of operating Systems. We will first take a short historical tour of computer systems and discuss why operating systems were introduced. We will then describe the major components and abstractions of a general-purpose OS. Finally, we will address the programming interfaces of many operating systems based on processes, various interprocess communication techniques and scheduling of processes.

CONTENT

- using the unix command line: terminal, shell, commands, files vs directories, ls, cd,mkdir, cp, mv, rm - compiling and debugging a C program: gcc=cpp+cc+as+ld, objdump, gdb, breakpoints, single-stepping, examining memory. - introduction to the C language: syntax, variables, types, control structures (if, for, while), functions, formatted output with printf - arrays and pointers: pointers and addresses, arrays, strings, passing command-line arguments to your programs - processes, kernel and system calls, userland, processes - file input/output: file descriptors, open/close/read/write syscalls, stdio streams, fopen/fgets/ etc, buffering - memory allocation: static vs dynamic, globals / stack / heap, malloc, structured data types, linked lists

BIBLIOGRAPHY

[1] Operating System Concepts Essentials, A. Silberschatz P. Galvin and G. Gagne, Wiley. [2] The C Language. Brian W. Kernighan, Dennis M. Ritchie. [3] Computer Organization and Design. David Patterson, John L. Hennessy. PRE-REQUISITE - Computer architecture: registers vs ALU, CPU vs bus vs memory, the Von Neumann cycle, address space vs memory size, hexadecimal notation and powers of two. - Computer programming: control flow and variables, functions, loops, simple data structures such as arrays and linked lists. - C language: write, run and debug simple programs on linux. design data structures including pointer fields, strings.

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Information Science & Technology Semester (IST)

Domaine Scientifique de la DOUA
20, Avenue Albert Einstein - 69100 Villeurbanne

Middleware Architectures for Ambient to Cloud Computing

IDENTIFICATION

CODE : IST-0-S1-EC-MID
ECTS : 3.00

HOURS

Cours :	0h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	0h
Total :	20h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

English

CONTACT

M. Le Mouël Frédéric :
frederic.le-mouel@insa-lyon.fr

AIMS

This course focuses on the design and implementation of common middleware families as found in real-world distributed application architectures. We tackle the challenges addressed by middleware design through both the prism of classical distributed systems problems as well as the techniques used to simplify programming models. Students will acquire useful knowledge in the age of cloud computing as a target of choice for building innovative products. Indeed, they will understand key elements in the design of popular frameworks, and they will learn about the common pitfalls of distributed systems.

CONTENT

* Introduction * Concurrent programming * Lock-free concurrent programming * Aspect-oriented programming * Component container design and usage * Comparing distributed events with logical and vector clocks * Consensus algorithms

BIBLIOGRAPHY

[1] Andrew S Tanenbaum, "Distributed Operating Systems", Prentice-Hall [2] Sape Mullender, "Distributed Systems", Addison-Wesley [3] Clemens Szyperski with Dominik Gruntz and Stephan Murer, "Component-Software Beyond Object-Oriented Programming" [4] Richard Monson-Haefel, "Enterprise JavaBeans", O'Reilly [5] Gregor Hophe, Bobby Woolf, "Enterprise Integration Patterns: Designing, Building, and Deploying Messaging Solutions", Addison-Wesley PRE-REQUISITE Java, networks, operating systems

PRE-REQUISITES

Transmission Lines and RF Systems

IDENTIFICATION

CODE : IST-0-S1-EC-TLRS
ECTS : 3.00

HOURS

Cours :	0h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	0h
Total :	20h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

English

CONTACT

M. Hutu Florin :
florin-doru.hutu@insa-lyon.fr

AIMS

Knowledge about high frequency systems. Choice of right transmission line considering applications. Matching circuit design. RF simulation tools. Basic principles of transmission lines. Comprehensive study of high frequency propagation and standing waves. Knowledge about matching circuits and applications. Different kinds of transmission lines. Link with the wireless propagation domain.

CONTENT

Telegraphist Equations - Reflection Coefficient - Standing Waves - Impedance Matching - Smith Chart - S parameters

BIBLIOGRAPHY

[1] Brian C. Wadell, Transmission Line Design Handbook (Artech House), 1991 [2] Philip C. Magnusson, Andreas Weisshaar, Vijai K. Tripathi, Gerald C. Alexander, Transmission Lines and Wave Propagation, Fourth Edition, CRC Press, 2000 PRE-REQUISITE Good basis in mathematics

PRE-REQUISITES

Signal Processing

IDENTIFICATION

CODE : IST-0-S1-EC-SIP1
ECTS : 3.00

HOURS

Cours :	0h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	0h
Total :	20h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

English

CONTACT

M. Merveille Odyssée :
odyssee.merveille@insa-lyon.fr

AIMS

The course introduces the fundamentals of signal processing. Signals and systems are studied both in time and frequency domains. Linear and Time Invariant Systems are analyzed through their impulse and frequency responses and their transfer function. Skills: To model, analyze and characterize in time and frequency.

CONTENT

- General signal and system properties - Linear Time Invariant Systems and convolution - Fourier Series, Fourier Transform: in continuous time and in discrete time - Time and frequency characterization of signals and systems - Sampling - Several labs will allow to get familiar with Matlab, to process various signals and to analyze them in time and frequency.

BIBLIOGRAPHY

[1] Alan V. Oppenheim, Ronald T. Schafer, Ronald W. Schafer, Wayne T. Padgett , Discrete-Time Signal Processing, Prentice Hall, ISBN 0131988425, 1108 p., 2009. [2] Bernard Mulgrew, Peter M. Grant, John Thompson, John Thompson,Digital Signal Processing: concepts and applications, Palgrave Macmillan, ISBN 0333963563, 380 page, 2003.

PRE-REQUISITES

B.Sc. standard level in mathematics, esp. Function analysis, Series, Differential and integral calculus Basic programming skills

Java Programming

IDENTIFICATION

CODE : IST-0-S1-EC-JAV
ECTS : 3.00

HOURS

Cours :	0h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	0h
Total :	20h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

English

CONTACT

M. Le Mouël Frédéric :
frederic.le-mouel@insa-lyon.fr

AIMS

The aim of the course is to learn java programming. After a brief 2h general introduction, the work is done directly on computers. The course is structured in lectures that span the Java programming language and the virtual machine. The course is illustrated by practical sessions. Skills - Programming skills - Understanding Object philosophy as a design tool - Rapid integration of on-line documentation - Debugging skills

CONTENT

- General presentation of Java and object oriented language - Object and Classes - Virtual Machine and running java applications - Methods and class structure - Exceptions and Classpath - Inheritance and Interfaces - Data Structures with java - Input/Ouput - Multi-threaded applications - Graphical User-Interfaces - Applets

BIBLIOGRAPHY

[1] Exploring Java 2nd edition, P. Niemeyer et J. Peck, Addison Wesley, 1997 [2] Effective Java, Guy L., Jr. Steele, Joshua Bloch, et Josh Bloch, Addison-Wesley, 2003
PRE-REQUISITE Algorithmic principles : assignations, loops, conditions, recursion. Programming basics in another language.

PRE-REQUISITES

Wireless Communications Basics

IDENTIFICATION

CODE : IST-0-S1-EC-WCB
ECTS : 3.00

HOURS

Cours :	0h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	0h
Total :	20h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

English

CONTACT

M. Villemaud Guillaume :
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AIMS

This course focuses on wireless transmissions basics. Starting from results from Maxwell's equations, the principles of radiated fields are exposed. Common characteristics of antennas are detailed, and the main families of antenna structures(wired, patch, horn, reflectors, arrays¿) are exposed considering possible applications. The purpose is also to be able to establish a budget link of a radio transmission and to open on more advanced techniques which can enhance wireless systems¿ performance.

CONTENT

- Transmission chain - Radio channel - Elementary doublet - Reciprocity, image theory, theorem of Babinet - Antenna parameters: input impedance, bandwidth, directivity and gain - Radiation pattern - Budget link - Wired antennas - Slot antennas - Patch antennas - Horns - Reflectors - Antenna arrays

BIBLIOGRAPHY

[1] J.M. Laheurte, Compact Antennas for Wireless Communications and Terminals: Theory and Design, Wiley, 2011 [2] J.D. Kraus, Antennas, Mc Graw Hill, 2001 [3] C. A. Balanis, Antenna Theory: Analysis and Design, 3rd Edition, Wiley PRE-REQUISITE Basis of electromagnetism and transmission lines.

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Information Science & Technology Semester (IST)

Domaine Scientifique de la DOUA
20, Avenue Albert Einstein - 69100 Villeurbanne

Computer Networks: LAN & IP Networks

IDENTIFICATION

CODE : IST-0-S1-EC-NET1
ECTS : 3.00

HOURS

Cours :	0h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	0h
Total :	20h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

English

CONTACT

M. Boubrima Ahmed :
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AIMS

The main objective of this course is to understand the basic mechanisms of IP networks, both over Ethernet and 802.11 networks. After a general introduction to networking principles, we will introduce the classical OSI Network Stack as a comprehensive understanding to networking protocols and architectures. Medium Access Control protocols will be considered for wired and wireless environment: Ethernet (802.3) and Wi-Fi (802.11) will be discussed in depth. We will focus the main part of this course on TCP/IP (Data Link and IP - Communication over IP - Transport layer UDP/TCP - IP addressing and basic routing - Advanced Networking, Filters and VPN - C networking programming).

CONTENT

- Introduction to networking - Fundamentals of local networking (IEEE 802.11, 802.3) - Data Link and IP networks - Addressing and routing - Transport protocols (TCP, UDP) - Introduction to networking programming

BIBLIOGRAPHY

[1] TCP/IP Illustrated, Volume 1: The Protocols, W. R. Stevens, Addison Wesley [2] TCP/IP Illustrated, Volume 2: The Implementation, W. R. Stevens, Addison Wesley [3] The IEEE 802.11 Handbook: A Designer's Companion, B. O'hara, A. Petrick, Institute of Electric & Electronic Engineers. [4] Computer Networking: A Top-Down Approach: International Version, J. F. Kurose, K. W. Ross, Pearson Education. [4] Ad Hoc Mobile Wireless Networks: Protocols & Systems, C. K. Toh, Prentice Hall. [5] VANET: vehicular applications and inter-networking technologies, H. Hartenstein, K. Laberteaux, Wiley. PRE-REQUISITE Basic networking. Wireless networks are not pre-requisite but are recommended.

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Information Science & Technology Semester (IST)

Domaine Scientifique de la DOUA
20, Avenue Albert Einstein - 69100 Villeurbanne

Computer Networks: Routing in the Internet

IDENTIFICATION

CODE : IST-0-S1-EC-NET2
ECTS : 3.0

HOURS

Cours :	8h
TD :	2h
TP :	8h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	20h
Travail personnel :	0h
Total :	20h

ASSESMENT METHOD

A one hour written exam.

TEACHING AIDS

All class materials are available on Moodle.

TEACHING LANGUAGE

English

CONTACT

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AIMS

This course presents the routing protocols, the principles and associated algorithms and their implementation in network architectures.
Learning outcome:
- Configure active elements (switch, router) of a network in LAN and WAN elementary architectures
- Implement network routing across the Internet
- Implement routing of IPv6, RIPng and OSPFv4 networks
Professional skills developed:
- Principles of IP routing and associated algorithms Bellman Ford, Dijkstra
- Internal routing protocols RIP, OSPF
In addition, it requires the following professional skills:
- Specify, design and model communication networks and protocols
- Implement, implement, develop, deploy systems for transmission and processing of signals / images / data
- Interact with others, work in a team

CONTENT

1. Introduction to IPv6.
2. Course and laboratory work on interior gateway protocols RIP and OSPF.
3. Course on the exterior gateway protocol BGP.

BIBLIOGRAPHY

O. Bonaventure, “Computer Networking: Principles, Protocols and Practice”
A. Tanenbaum, “Computer Networks”
J. Kurose, K. Ross, “Computer Networking a Top-Down Approach”
Cisco Academy
RFCs

PRE-REQUISITES

This course treats the different routing protocols used in the Internet: interior (RIP, OSPF), exterior (BGP). A previous knowledge on networking fundamentals is mandatory: understanding of IPv4 networks, OSI/TCP-IP models, and basic network configuration.

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Information Science & Technology Semester (IST)

Domaine Scientifique de la DOUA
20, Avenue Albert Einstein - 69100 Villeurbanne

Data Bases

IDENTIFICATION

CODE : IST-0-S1-EC-DBM1
ECTS : 3

HOURS

Cours :	0h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	0h
Total :	20h

ASSESMENT METHOD

- Small project (with 4 hours of assistance) on computers
- 2 hours of presentation of the project by the students

TEACHING AIDS

TEACHING LANGUAGE

English

CONTACT

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AIMS

This course introduces the most important concepts concerning the design and the use of databases. It covers the main issues in data modeling when considering the relational data model (structure, languages like relational algebra and relational calculus) and the key features of attribute-oriented models with respect to constructor-oriented models (like, for instance, Extended Entity-Relationship models). The fundamental concepts like the constraints and the normal forms will be explained and their impact on the quality of designed databases will be discussed. Finally, practical aspects of relational database design and use will be discussed. It includes a presentation of the SQL query language but also a short introduction to data warehousing and On Line Analytical Processing queries (OLAP). To be concrete, the students will have to understand the design of a real relational database and to practice database querying with a professional DataBase Management System (DBMS).

CONTENT

Introduction to data models and application to databases
Studying the relational data model
Structure
Languages
Constraints
Introducing database design
Using the Extended Entity-Relationship Model
Normals forms and data dependencies
Practical issues
Using SQL
Introducting Data Warehousing.

BIBLIOGRAPHY

Heikki Mannila and Kari-Jouko Raiha. The Design of Relational Databases, 2nd Edition, 1994, Addison-Wesley.
Serge Abiteboul, Rick Hull, Victor Vianu, Foundations of databases, 685 pages, 1995, Addison-Wesley
Carlo Batani, Stefano Ceri, Shamkant B. Navathe. Conceptual Database Design: An Entity-Relationship Approach. 455 pages. Benjamin/Cummings.

PRE-REQUISITES

Set theory, basic notions in disccrete mathematics and algorithms.

IST Research Project

IDENTIFICATION

CODE : IST-0-S1-EC-REP
ECTS : 10.00

HOURS

Cours :	0h
TD :	0h
TP :	0h
Projet :	20h
Evaluation :	0h
Face à face pédagogique :	0h
Travail personnel :	0h
Total :	20h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

English

CONTACT

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AIMS

This project is a technical R&D project where the student has a lot of freedom to lead the project. The student will work on the project throughout the whole semester. A technical project means a final prototype which can be technological, software or a study.

CONTENT

The project can be done alone or by 2 students. The projects take place in an INSA lab, such as CITI, CREATIS, or LIRIS. Students need to work 100 to 150 hours on the project.

BIBLIOGRAPHY

PRE-REQUISITES