PEOPLE 'S DEMOCRATIC REPUBLIC OF ALGERIA

MINISTRY OF HIGHER EDUCATION
AND SCIENTIFIC RESEARCH

Amendment Canvas

TRAINING OFFER
L.M.D.

ACADEMIC LICENSE

■ 2018 - 2019

Institution	Faculty / Institute	Department
Université djilali bounaama khemis miliana	Sciences et technologie	Mathematique et informatique

Domain	Field	Specialty
Mathematics and Computer Science	Computer Science	Computer Systems (IS)

الجمهورية الجزائرية الديمقراطية الشعبية

وزارة التعليم العالي والبحث العلمي

نموذج تعديل

عرض تكوين
ل.م. دل

ليسانس أكاديمية

2019-2018

المؤسسة	الكلية\ المعهد	القسم
جامعةالجيلالي بونعامة بخميس مليانة	العلوم والتكنولوجيا	الرياضيات و الاعلام الآلي

الميدان	الفرع	التخصص
رياضيات واعلام الي	إعلام آلي	نظم معلوماتيه

II – Semi-annual teaching organisation sheet
of the Computer Systems License (SI)

Common Base Mathematics, Applied Mathematics and Computer Science

Semester : 1

Teaching Unit	SHV	V.H weekly				Coeff	Credits	Evaluation mode	
	14 wk	C	Tuto	Lab	Personal work			Continual	Examination
EU Fundamentals									
UEF11(O/P)		**4h30**	**4h30**		**6 h.**	**7**	**11**		
UEF111 : Analysis 1	**84h**	3h00	3h00		3h	4	6	40%	60%
UEF112 : Algebra 1	**42h**	1h30	1h30		3h	3	5	40%	60%
UEF12(O/P)		**4h30**	**3h**	**3h**	**6 h.**	**7**	**11**		
UEF121 : Algorithmics and Data Structure 1	**105h**	3h00	1h30	3h	3h	4	6	40%	60%
UEF122 : Machine structure 1	**42h**	1h30	1h30		3h	3	5	40%	60%
EU Methodology									
UEM11(O/P)		**3h**			**4 h**	**2**	**4**		
UEM111 : Scientific Terminology and Expression written	**21hrs**	1h30			2 hrs	1	2		100%
UEM112 : Foreign Language 1	**21hrs**	1h30			2 hrs	1	2		100%
EU Discovery									
UED11(O/P)		**1h30**	**1h30**		**2 hrs**	**2**	**4**		
UED111 : Choose a Material from : **-Physics** 1 (point mechanics) **-Electronics** and system components	**42h**	1h30	1h30		2 hrs	2	4	40%	60%
Total Semester 1	**357h**	**13h30**	**9h**	**3h**	**18h**	**18**	**30**		

Common Base Mathematics, Applied Mathematics and Computer Science

Semester 2

Teaching Unit	SHV	V.H weekly				Coeff	Credits	Evaluation mode	
	14 wk	C	Tuto	Lab	Work Personal			Continual	Examination
EU Fundamentals									
UEF21(O/P)		**4h30**	**3h**		**6 h.**	**6**	**10**		
UEF211 : Analysis 2	**63h**	3h00	1h30		3h	4	6	40%	60%
UEF212 : Algebra 2	**42h**	1h30	1h30		3h	2	4	40%	60%
UEF22(O/P)		**3h**	**3h**	**1h30**	**6 h.**	**6**	**10**		
UEF221 : Algorithmics and Data Structure 2	**63h**	1h30	1h30	1h30	3h	4	6	40%	60%
UEF222 : Machine structure 2	**42h**	1h30	1h30		3h	2	4	40%	60%
EU Methodology									
UEM21(O/P)		**4h30**	**1h30**	**1h30**	**6 h.**	**4**	**7**		
UEM211 : Introduction to Probability and descriptive statistics	**42h**	1h30	1h30		2 hrs	2	3	40%	60%
UEM212 : Information and Communication Technology Communication	**21hrs**	1h30			2 hrs	1	2		100%
UEM213 : Programming tools for mathematics	**42h**	1h30		1h30	2 hrs	1	2	40%	60%
EU Transversal									
UET21(O/P)		**1h30**	**1h30**		**2 hrs**	**2**	**3**		
UET211 : Physics 2 (general electricity)	**42h**	1h30	1h30		2 hrs	2	3	40%	60%
Total Semester 2	**357h**	**13h30**	**9h**	**3h**	**20H**	**18**	**30**		

Semester 3: Common Core in Computer Science

Teaching Unit	SHV	V.H weekly				Coeff	Credits	Evaluation mode	
	14 wk	C	Tuto	Lab	Personal work			Continual	Examination
EU Fundamentals									
UEF31(O/P)		**4h30**	**3h**	**3h00**	**6h00**	**6**	**11**		
UEF311: Computer Architecture	**63h**	1h30	1h30	1h30	3h00	3	5	40%	60%
UEF312 : Algorithms and structure of data 3	**84h**	3h00	1h30	1h30	3h00	3	6	40%	60%
UEF2(O/P)		**3h00**	**3h00**	**1h30**	**6h00**	**5**	**9**		
UEF321: Information Systems	**63h**	1h30	1h30	1h30	3h00	3	5	40%	60%
UEF322: Graph Theory	**42h**	1h30	1h30		3h00	2	4	40%	60%
EU Methodology									
UEM31 (O/P)		**3h**	**1h30**	**1h30**	**03h00**	**4**	**8**		
UEM311 : Digital Methods	**42h**	1h30		1h30	1h30	2	4	40%	60%
UEM312 : Mathematical Logic	**42h**	1h30	1h30		1h30	2	4	40%	60%
Transversal Unit									
UET31(O/P)		**1h30**			**2h00**	**1**	**2**		
UET311 : Foreign Language 2	**21hrs**	1h30			2h00	1	2		100%
Total Semester 3	**357h**	**12h**	**7h30**	**6 h.**	**17h00**	**16**	**30**		

Semester 3: Common **Core in Computer Science**

Teaching Unit	SHV	V.H weekly				Coeff	Credits	Evaluation mode	
	14 wk	C	Tuto	Lab	Personal work			Continual	Examination
EU Fundamentals									
UEF41(O/P)		**3h**	**3h**	**3h**	**6 h.**	**5**	**10**		
UEF411 : Language theory	**63h**	1h30	1h30	1h30	3h00	2	5	40%	60%
UEF412 : Operating System 1	**63h**	1h30	1h30	1h30	3h00	3	5	40%	60%
UEF42(O/P)		**3h**	**3h**	**3h**	**6 h.**	**6**	**10**		
UEF421 : Databases	**63h**	1h30	1h30	1h30	3h00	3	5	40%	60%
UEF422 : Networks	**63h**	1h30	1h30	1h30	3h00	3	5	40%	60%
EU Methodology									
UEM41 (O/P)		**3h**		**3h**	**3h**	**4**	**8**		
UEM411 : Oriented programming Object	**42h**	1h30		1h30	1h30	2	4	40%	60%
UEM412 : Development of Web Applications	**42h**	1h30		1h30	1h30	2	4	40%	60%
Transversal Unit									
UET41 (O/P)		**1h30**			**2 hrs**	**1**	**2**		
UET411 : Foreign Language 3	**21hrs**	1h30			2h00	1	2		100%
Total Semester 4	**357h**	**10h30**	**6 h.**	**9h**	**5 pm**	**16**	**30**		

Semester 5 : IS Track

Teaching Unit	SHV	V.H weekly				Coeff	Credits	Evaluation mode	
	14 wk	C	Tuto	Lab	Personal work			Continual	Examination
EU Fundamentals									
UEF51(O/P)		**3h**	**3h**	**3h**	**6 h.**	**6**	**10**		
UEF511 : Operating System 2	**63h**	1h30	1h30	1h30	3h00	3	5	40%	60%
UEF512 : Compilation	**63h**	1h30	1h30	1h30	3h00	3	5	40%	60%
UEF52(O/P)		**3h**	**3h**	**3h**	**7h30**	**6**	**10**		
UEF521 : Software Engineering	**63h**	1h30	1h30	1h30	3h00	3	5	40%	60%
UEF522 : Human Machine Interface	**63h**	1h30	1h30	1h30	4h30	3	5	40%	60%
EU Methodology									
UEM51 (O/P)		**3h**	**3h**		**6 h.**	**4**	**8**		
UEM511 : Linear Programming	**42h**	1h30	1h30		3h00	2	4	40%	60%
EMU512 : Probability and Statistics	**42h**	1h30	1h30		3h00	2	4	40%	60%
Transversal Unit									
UET51 (O/P)			**1h30**		**2 hrs**	**1**	**2**		
UET511 : Digital economy and strategic intelligence	**21hrs**		1h30		2h00	1	2	100%	
Total per semester	**357h**	**9h00**	**10h30**	**6h00**	**9:30 pm**	**17**	**30**		

Semester 6 : SI course

Teaching Unit	SHV	V.H weekly				Coeff	Credits	Evaluation mode	
	14 wk	C	Tuto	Lab	Personal work			Continual	Examination
EU Fundamentals									
UEF61 (O/P)		**3h**	**1h30**	**1h30**	**6 h.**	**6**	**10**		
UEF611 : Mobile Applications	**42h**	1h30		1h30	3h00	3	5	40%	60%
UEF612 : IT security	**42h**	1h30	1h30		3h00	3	5	40%	60%
EU Fundamentals									
UEF62 (O/P)		**3h**		**3h**	**6 h.**	**6**	**10**		
UEF621 : Artificial Intelligence	**42h**	1h30		1h30	3h00	3	5	40%	60%
UEF622 : Semi-structured data	**42h**	1h30		1h30	3h00	3	5	40%	60%
Methodology Unit									
UEM61 (O/P)			**1h30**		**13h**	**4**	**8**		
UEM611 : Project					10h00	3	6		100%
UEM612 : Scientific Writing	**21hrs**		1h30		3h00	1	2	100%	
Transversal Unit									
UET61 (O/P)		**1h30**			**3h**	**1**	**2**		
UET611 : Create and develop a startup	**21hrs**	1h30			3h00	1	2		100%
Total Semester 6	**210h**	**7h30**	**3h**	**4h30**	**28h**	**17**	**30**		

Overall summary of the training : (indicate the separate overall VH in progress, Tuto, Lab... for the 06 teaching semesters, for different types of TU)

TU / VH	UEF	UEM	UED	UET	Total
Course	588h	231h	21hrs	84h	**924h**
Tuto	462h	105h	21hrs	42h	**YCM8-630H**
Lab	357h	84h			**441h**
Personal work	1029h	476h	28h	154h	**1687h**
Other (Specify):					
Total	**2436h**	**896h**	**70h**	**280h**	**3682h**
Credits	**122**	**43**	**4**	**11**	**180**
% in credits for each TU	**67,77%**	**23.88%**	**2 22**	**6.11%**	**100%**

III - Detailed programme by subject of the semesters

(1 detailed sheet per subject)

(All fields must be filled in)

Semester : 01
Teaching Unit: Fundamental Subject : Analysis1
Credits : 6
Coefficient : 4
Course Objective

The objective of this module is to familiarize students with the set vocabulary, to study the different methods of convergence of real sequences and the different aspects of the analysis of the functions of a real variable.

Recommended prior knowledge : Mathematics at the 3rd year of secondary science and technology.

Chapter I : The Real Body

$\mathbb{R}$ is a commutative field, $\mathbb{R}$ is a totally ordered field, Reasoning by induction, $\mathbb{R}$ is a valued field, Intervals, Upper and lower bounds of a subset of $\mathbb{R}$, $\mathbb{R}$ is an Archimedean field, Characterization of the upper and lower bounds, The integer part function.
Boundary Sets, Extension of $\mathbb{R}$: Completed Digital Right $\mathbb{R}$, Topological Properties of $\mathbb{R}$, Closed Open Parts.

Chapter II : The Body of Complex Numbers

Algebraic operations on complex numbers, Module of a complex number z, Geometric representation of a complex number, trigonometric form of a complex number, Euler formulas, exponential form of a complex number, n-th roots of a complex number.

Chapter III : Sequences of Real Numbers

Boundary sequences, convergent sequences, properties of convergent sequences, arithmetic operations on convergent sequences, infinite limit extensions, Infinitely small and Infinitely large, monotonous sequences, extracted sequences, Cauchy sequence, generalization of the notion of the limit, upper limit, lower limit, recurrent sequences.

Chapter IV: Real Functions of a Real Variable

Graph of a real function of a real variable , Even-odd functions, Periodic functions, Bounded functions, Monotonic functions, Local maximum, Local minimum, Limit of a function, Theorems on limits, Operations on limits, Continuous functions, Discontinuities of first and second kind, Uniform continuity, Theorems on continuous functions over a closed interval, Continuous reciprocal function, Order of a variable-equivalence (Landau notation).

Chapter V: Derivative Functions

Derivative on the right, derivative on the left, Geometric interpretation of the derivative, Operations on differentiable functions , Differential-Differentiable functions , Fermat 's theorem, Rolle 's theorem, Finite increments theorem, Higher order derivatives, Taylor 's formula, Local extremum of a function, Terminals of a function on an interval, Convexity of a curve. Inflection point, Asymptote of a curve, Construction of the graph of a function.

Chapter VI : Elementary Functions

Natural logarithm, Natural exponential, Any basic logarithm, Power function, Hyperbolic functions, Reciprocal hyperbolic functions.

Evaluation mode: Examination (60%), continuous monitoring (40%)

References

- J.-M. Monier, Analyse PCSI-PTSI, Dunod, Paris 2003.
- Y. Bougrov and S. Nikolski, Cours de Mathématiques Supérieures, Editions Mir, Moscow, 1983.
- N. Piskounov, Differential and Integral Calculus, Volume 1, Mir Editions, Moscow, 1980.
- K. Allab, Elements of Analysis, OPU, Algiers, 1984.
- B. Calvo, J. Doyen, A. Calvo, F. Boschet, Cours d 'analyse, Librairie Armand Colin, Paris, 1976.
- J. Lelong-Ferrand and J. M. Arnaudiès, Cours de mathématiques, tome 2, Edition Dunod, 1978.

Semester : 01
Teaching Unit: Fundamental Subject : Algebra1
Credits : 5
Coefficient : 3
Teaching objectives:
The purpose of this subject is to introduce the basics of algebra and set theory.
Recommended prior knowledge : Notions of classical algebra
Content of the material :
Chapter 1 : Notions of Logic

- Truth table, quantifiers, types of reasoning.

Chapter 2 : Sets and Applications.

- Definitions and examples.
- Applications : injection, surjection, bijection, direct image, reciprocal image, restriction and extension.

Chapter 3 : Binary Relationships on a Set.

- Basic definitions : reflexive, symmetrical, antisymmetrical, transitive relationship.
- Order relationship - Definition. Total and partial order.
- Equivalence relationship: equivalence class.

Chapter 4 : Algebraic Structures.

- Internal composition law.
- Stable part. Properties of an internal composition law.
- Groups : Definitions. Subgroups : Examples-Group homomorphism-Group isomorphism. Examples of finite groups Z/nZ (n= 1, 2, 3,…) and the permutation group S_3.
- Rings : Definition- Under rings. Calculation rules in a ring. Invertible Elements, Zero-Homomomorphism Dividers of Rings-Ideals.
- Body : Definitions-Processing the case of a finite body through the example Z/pZ where p is prime, R and C

Chapter 5 : Polynomial Rings.

- Polynomial. Degree.
- Construction of the ring of polynomials.
- Arithmetic of polynomials : Divisibility, Euclidean division, Pgcd and ppcm of two polynomials-Polynomials prime to each other, Decomposition into product of irreducible factors.
- Roots of a polynomial : Roots and degree, Multiplicity of roots.

Evaluation mode: Examination (60%), continuous monitoring
(40%) References

- M. Mignotte and J. Nervi, Algebra : 1st year science degrees, Ellipses, Paris, 2004.
- J. Franchini and J. C. Jacquens, Algebra : courses, corrected exercises, directed works, Ellipses, Paris, 1996.
- C. Degrave and D. Degrave, Algebra 1st year : courses, methods, resolute exercises, Bréal, 2003.
- S. Balac and F. Sturm, Algebra and Analysis : First Year Mathematics Courses with Corrected Exercises, Presses Polytechniques et Universitaires Romandes, 2003.

Semester : 01
FUNDAMENTAL TEACHING UNIT
Subject : Algorithms and data structure 1
Credits : 6
Coefficient : 4

Teaching objectives: Introduce the concepts of algorithm and data structure.

Recommended prior knowledge : Notions of computer science and mathematics.

Content of the material :

Chapter 1 : Introduction
1. Brief history on computing
2. Introduction to Algorithms

Chapter 2 : Simple Sequential Algorithm
1. Notion of language and algorithmic language
2. Parts of an Algorithm
3. Data : variables and constants
4. Data types
5. Basic Operations
6. Basic instructions
   - Appropriation
   - Input Statements
7. Construction of a simple algorithm
8. Representation of an algorithm by a flowchart
9. Translation into C language

Chapter 3 : Conditional structures (in algorithmic language and C)
1. Introduction
2. Simple conditional structure
3. Compound Conditional Structure
4. Conditional multiple choicestructure
5. The connection

Chapter 4 : Loops (in algorithmic language and C)
1. Introduction
2. The loop As long as
3. The loop Repeat
4. The Loop For
5. Nested loops

Chapter 5 : Charts and Strings
1. Introduction
2. The table type
3. Multidimensional arrays
4. Strings

Chapter 6 : Custom Types
1. Introduction
2. Enumerations
3. Records (Structures)
4. Other Type Definition Possibilities

NB : TP in C, it must be complementary to TD.

Evaluation mode: Examination (60%), continuous monitoring

(40%) References

- Thomas H. Cormen, Algorithms Basics *Collection : Sciences Sup, Dunod,* 2013.
- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest Algorithmic - 3rd edition - Course with 957 exercises and 158 problems Paperback, Dunod, 2010.
- Rémy Malgouyres, Rita Zrour and Fabien Feschet. *Introduction to algorithmics and programming in C : course with 129 corrected exercises*. 2nd Edition. Dunod, Paris, 2011. ISBN : 978-2-10-055703-5.
- Damien Berthet and Vincent Labatut. *Algorithmics & programming in C language - vol.1 : Course materials*. License. Algorithms and Programming, Istanbul, Turkey. 2014, pp.232.
- Damien Berthet and Vincent Labatut. *Algorithms & programming in C language - vol.2 : Practical work topics*. License. Algorithms and Programming, Istanbul, Turkey. 2014, pp.258. <cel- 01176120>
- Damien Berthet and Vincent Labatut. *Algorithmics & programming in C language - vol.3 : Corrected from practical work*. License. Algorithms and Programming, Istanbul, Turkey. 2014, pp.217. <cel-01176121>
- Claude Delannoy. *Learn to program in Turbo C.* Chihab-Eyrolles , 1994.

Semester: 01
Teaching Unit: Fundamental
Subject: Machine Structure 1
Credits: 5
Coefficient: 3
Teaching Objectives:
The purpose of this course is to present and deepen the concepts related to different numbering systems as well as the representation of information, whether numeric or character-based. The basics of Boolean algebra are also covered in depth.
Recommended Prior Knowledge:
Elementary mathematics.
Course Content:
Chapter 1:

- General introduction.

Chapter 2: Numbering Systems

- Definition
- Presentation of decimal, binary, octal, and hexadecimal systems.
- Conversion between these different systems.
- Basic operations in the binary system:
    - Addition
    - Subtraction
    - Multiplication
    - Division

Chapter 3: Information Representation

- Binary coding:
    - Pure binary coding.
    - Reflected binary code (or GRAY code)
    - BCD (Binary Coded Decimal)
    - Excess-3 code.
- Character representation:
    - EBCDIC code
    - ASCII code
    - UTF code.
- Number representation:
  1- Integer numbers:
    - Unsigned representation.
    - Signed and absolute value representation.
    - One's complement (or restricted complement)
    - Two's complement (or true complement)
      2- Fractional numbers:
    - Fixed point.
    - Floating point (IEEE 754 standard)

Chapter 4: Binary Boolean Algebra

- Definition and axioms of Boolean algebra.
- Theorems and properties of Boolean algebra.
- Basic operators:
    - AND, OR, logical negation.
    - Schematic representation.
- Other logical operators:
    - NAND and NOR circuits
    - Exclusive OR
    - Implication
    - Schematic representation.
- Truth table.
- Logical expressions and functions.
- Algebraic writing of a function in first and second normal form.
- Expression of a logical function using NAND or NOR circuits exclusively.
- Logical diagram of a function.
- Simplification of a logical function:
    - Algebraic method.
    - Karnaugh maps.
    - Quine-McCluskey method.

Evaluation method: Exam (60%), continuous assessment (40%)

References

1- John R. Gregg, Ones and Zeros: Understanding Boolean Algebra, Digital Circuits, and the Logic of Sets 1st Edition , Wiley & sons Inc. publishing, 1998, ISBN: 978-0-7803-3426-7.

2- Bradford Henry Arnold , Logic and Boolean Algebra, Dover publication, Inc., Mineola, New York, 2011, ISBN-13: *978-0-486-48385-6*

3- Alain Cazes,Joëlle Delacroix, Architecture of Machines and Computer Systems : Courses and Corrected Exercises, 3rd edition, Dunod 2008.

Semester : 01
Study **unit**
Subject : Scientific terminology and written and oral expression
Credits : 2
Coefficient : 1
Objectifs de l'enseignement :
- Written expression techniques: learn how to write a dissertation, make a report or a summary.
- Oral expression techniques: giving a presentation or a defense, learning to express oneself and communicate within a group.

Recommended prior knowledge : Knowledge of French language.

Content of the material :

Chapter 1 : Scientific Terminology
Chapter 2 : Technique of written and oral expression (report, synthesis, use of means of modern communications) in the form of presentations
Chapter 3 : **Expression and Communication in a Group. In** the **formof a mini group project**

Assessment mode: Examination (100%)

References

- L. Bellenger, L 'expression orale, Que sais-je ?, Paris, P. U. F., 1979.
- Canu, Rhétorique et communication, P., Éditions Organisation-Université, 1992.
- R. Charles and C. Williame, La communication orale, Repères pratiques, Nathan, 1994.

Semester : 01
Teaching Unit: Methodology Subject : Foreign Language 1
Credits (2)
Coefficient : 1

Objectifs de l'enseignement :
The purpose of this subject is to enable students to improve their general language skills in terms of comprehension and expression, as well as the acquisition of the specialized vocabulary of scientific and technical English.

Recommended prerequisite knowledge : Basic knowledge of English

Content of the material :

1. **Reminders of the essential basics of English grammar**

- Times (present, past, future,...)
- In your lifetime (1)
- Adjectives
- Auxiliaries.
- Construct sentences in English: affirmative, negative and interrogative, sentence formation.
- Other structures of English grammar.

2. Vocabulary, expressions and construction of technical texts

- Computing and the Internet: technical vocabulary.
- Construction of technical texts in English.

Assessment mode: Examination (100%)

References

- DAV E MUR P H YEnglish Grammar in Use. Cambridge University Press. 3rd edition, 2004
- M. McCarthy and F. O'Dell, English vocabulary in use, Cambridge University Press, 1994
- L. Rozakis, English grammar for the utterly confused, Mc Graw-Hill, 1st edition, 2003
- Oxford Progressive English books.

Semester : 01
Teaching unit: Discovery Subject : Physics 1 (point mechanics)
Credits : 4
Coefficient : 2

Objectifs de l'enseignement :

At the end of this course, the student should acquire the basic knowledge of point mechanics (point kinematics, point dynamics, work and energy in the case of a material point, non-conservative forces...), so as to be able to analyze and interpret the phenomena related to it

Recommended Prior Knowledge : Physics Basics

Content of the material :

Chapter 1 : Point Kinematics

- Rectilinear Motion-Movement in Space
- Study of particular movements
- Study of movements in different systems (polar, cylindrical and spherical)
- Relative movements.

Chapter 2 : Point Dynamics.

- The principle of inertia and Galilean standards
- The principle of conservation of momentum
- Newtonian Definition of Force (Newton 's 3 Laws) - Some Laws of Forces

Chapter 3 : Work and energy in the case of a material point.

a. Kinetic energy-Potential gravitational energy and elasticity.
b. Force field - Non-conservative forces.

Evaluation mode: Examination (60%) , continuous monitoring

(40%) References

- A. Thionne, Point Mechanics. 2008. Ellipses Editions
- [A. Gibaud, M. Henry. Point mechanics. Physics class. 2007. Dunod Editions
- S. Khène, Mechanics of the material point. 2015). Editions Sciences Physique.

Semester : 01
Study **unit**
Material : Electronics, system components
Credits : 4
Coefficient : 2

Objectifs de l'enseignement :
Introduce the main units of a computer and explain how they work as well as the principles of their use.

Recommended prior knowledge : General computer knowledge.

Instruction

Chapter 1. Preamble – Definitions and General
Chapter 2. of a computer.
Chapter 3. Electronic components of a computer
- 3.1. The main components of a computer and their role
  - 3.1.1. The motherboard
  - 3.1.2. The processor
  - 3.1.3. Memory
  - 3.1.4. The graphics card
  - 3.1.5. HDD
- 3.2. The main elements connected to the motherboard of the computer

Chapter 4. Different types of devices
- 4.1. input device
- 4.2. Output devices
- 4.3. Input-output devices **Chapter 5.**

Computer Connections **Chapter 6.** Operating systems
- 6.1 Definition
- 6.2 Missions
- 6.3 types of systems
- 6.4 The elements of a system
  - 6.4.1 Core : functionalities, -types, -typology of systems
  - 6.4.2 System Libraries
  - 6.4.3 Systems Services

Chapter 7. Introduction to Networks
- 7.1 rNetworks :
  - 7.1.1 Areas of use
  - 7.1.2 - The Internet .
  - 7.1.3. Objectives sought (of networks)
- 7.2. Network Categories
- 7.3. Physical & logical structuring
  - 7.3.1 The equipment
  - 7.3.2 The software
- 7.4. Types of networks
  - 7.4.1. The " Peer to Peer"
  - 7.4.2. The "Client / Server
- 7.5. Hardware
  - 7.5.1. Transport media
  - 7.5.2. Topologies
  - - Bus topology
  - - Star topology
  - - Ring topology
- 7.6. Software & protocols

7.6.1. ETHERNET
7.6.2. Token Ring
7.6.3. popular protocols

Chapter 8. Wireless networks

8.1 Definitions
8.2 Putting into practice
8.3 Classification

Evaluation mode: Examination (60%) , continuous monitoring

(40%) References

- T. Floyd. Electronics Application components and systems. 2000 Dunod Editions

- Jacques Lonchamp, Introduction aux systèmes informatique Architectures, composants, prise en main, 2017 collection infosup, Dunod.

Semester: 02
Teaching Unit: Fundamental Subject : Analysis 2
Credits : 6
Coefficient : 4

Course Objective :

This subject aims to introduce students to the different aspects of integral calculus : Riemann integral, different techniques for calculating primitives, initiation to the solution of differential equations.

Recommended Prior Knowledge : Analysis 1.

Chapter I : Undefined Integrals

Indefinite integral, Some properties of the indefinite integral, Integration methods, Integration by variable change, Integration by parts, Integration of regular expressions, Integration of irrational functions.

Chapter II : Defined Integrals

Defined integral, Properties of defined integrals, Integral function of its upper bound , Newton-Leibniz formula, Cauchy-Schwarz inequality, Darboux sums-Conditions of the existence of the integral, Properties of Darboux sums, Integrability of continuous and monotonic functions.

Chapter III : First Order Differential Equations

General, Classification of First Order Differential Equations, Separable Variable Equation, Homogeneous Equations, Linear Equations, Bernoulli Method , Lagrange Constant Variation Method, Bernoulli Equation, Total Differential Equation, Riccati Equation.

Chapter IV : Second-order differential equations with constant coefficients

Homogeneous second-order differential equations with constant coefficients, Non-homogeneous second-order differential equations with constant coefficients, Methods of solving second-order differential equations with constant coefficients.

Evaluation mode : Examination (60%), continuous

monitoring (40%) References

- J.-M. Monier, Analyse PCSI-PTSI, Dunod, Paris 2003.
- Y. Bougrov and S. Nikolski, Cours de Mathématiques Supérieures, Editions Mir, Moscow, 1983.
- N. Piskounov, Differential and Integral Calculus, Volume 1, Mir Editions, Moscow, 1980.
- K. Allab, Elements of Analysis, OPU, Algiers, 1984.
- B. Calvo, J. Doyen, A. Calvo, F. Boschet, Cours d 'analyse, Librairie Armand Colin, Paris, 1976.
- J. Lelong-Ferrand and J. M. Arnaudiès, Cours de mathématiques, tome 2, Edition Dunod, 1978.

Semester: 02
Teaching Unit: Fundamental Subject : Algebra 2
Credits : 4
Coefficient : 2

Objectifs de l'enseignement :
Implementation of the basic principles of vector spaces
Recommended prior knowledge : Algebra concepts.

Chapter 1 : Vector Space.

- Definition
  Under vector space.
  Examples
  Free families. Generators. Bases. Size. Vector space of finite dimension (properties). Additional vector space.

Chapter 2 : Linear Applications.

- Definition
- Image and core of a linear application.
- Rank of an application, rank theorem.
- Composed of linear applications. Inverse of a bijective linear application, Automorphism

Chapter 3 : The matrices.

a. Matrix associated with a linear application.
b. Operations on matrices : sum, product of two matrices, transposed matrix.
c. Vector space of matrices with n rows and m columns.
d. Square matrix ring. Determinant of a square matrix and properties. Invertible matrices.
e. Rank of a matrix (associated application). Rank invariance by transposition.

Chapter 4 : Solving Systems of Equations.

1. System of equations – matrix writing - rank of a system of equations.
2. Cramer 's method.

Evaluation mode : Examination (60%), continuous monitoring

(40%) References

- S. Lang : Algebra : courses and exercises, 3rd edition, Dunod, 2004.
- E. Azoulay and J. Avignant, Mathematics. Volume 1, Analysis. Mc Graw-Hill, 1983.
- M. Mignotte and J. Nervi, Algebra : 1st year science degrees, Ellipses, Paris, 2004.
- J. Franchini and J. C. Jacquens, Algebra : courses, corrected exercises, directed works, Ellipses, Paris, 199

Semester: 02
Fundamental Teaching Unit : UEF22 Subject : Algorithms and Data Structure 2
Credits : 6
Coefficient : 4

Teaching objectives: to enable the student to acquire the fundamentals of programming
Recommended prior knowledge : Notions of algorithmic and data structure.

Content of the material :

Chapter 1 : Sub-programs : Functions and Procedures

1. Introduction
2. Definitions
3. Local variables and global variables
4. Passing the parameters
5. Recursion

Chapter 2 : Files

1. Introduction
2. Definition
3. File types
4. Manipulation of files

Chapter 3 : Chained Lists

1. Introduction
2. Pointers
3. Dynamic memory management
4. Linked lists
5. Operations on linked lists
6. Double-chained lists
7. Specific linked lists
   7.1. Batteries
   7.2. The queues

NB : TPs in C (Complementary to TDs).

Evaluation mode: Examination (60%) , continuous monitoring

(40%) References

- Thomas H. Cormen, Algorithms Basics *Collection : Sciences Sup, Dunod,* 2013.
- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest Algorithmic - 3rd edition - Course with 957 exercises and 158 problems Paperback, Dunod, 2010.
- Rémy Malgouyres, Rita Zrour and Fabien Feschet. *Introduction to algorithmics and programming in C: course with 129 corrected exercises*. 2nd Edition. Dunod, Paris, 2011. ISBN : 978-2-10-055703-5.
- Damien Berthet and Vincent Labatut. *Algorithmics & programming in C language - vol.1 : Course materials*. License. Algorithms and Programming, Istanbul, Turkey. 2014, pp.232.
- Damien Berthet and Vincent Labatut. *Algorithms & programming in C language - vol.2 : Practical work topics*. License. Algorithms and Programming, Istanbul, Turkey. 2014, pp.258. <cel-01176120>
- Damien Berthet and Vincent Labatut. *Algorithmics & programming in C language - vol.3 : Corrected from practical work*. License. Algorithms and Programming, Istanbul, Turkey. 2014, pp.217. <cel-01176121>
- Claude Delannoy. *Learn to program in Turbo C.* Chihab-Eyrolles , 1994.

Semester: 2
Fundamental Teaching Unit: UEF22
Subject: Machine Structure 2
Credits: 4 Weighting: 2
Course Objectives: By the end of the semester, students will have a basic understanding of basic logic functions and circuits. This knowledge will serve as a platform for other computer-related aspects (computer architecture, programming, databases, networks, etc.).
Recommended Prior Knowledge: Students should have basic computer science knowledge.
Course Content:
Chapter 1: Introduction
Chapter 2: Combinational Logic
- Definition
- Combinational Circuits
- Steps in Designing a Combinational Circuit:
• Establishing the Truth Table
• Simplifying Logic Functions
• Creating the Logic Diagram
- Study of some common combinational circuits:
• The half-adder.
• The full adder.
• The adder-subtractor (true complement)
• Decoders.
• Multiplexers.
• Priority encoders.
• Demultiplexers.
- Other examples of combinational circuits.
Chapter 3: Sequential Logic.
- Definition.
- Flip-flops (RS, JK, D)
- Registers (parallel-load and shift)
- Memories.
- Synthesis of a sequential circuit (automata):
• Moore automaton and Mealy automaton.
• Transition graph and matrix.
• Selection of flip-flops and state coding.
• Flip-flop excitation matrix.
• Simplification of logic functions.
• Establishment of the logic diagram.
- Creation of automata:
• Up/down counters. • Other examples of automata.
Chapter 4: Integrated Circuits.
- Definition
- Study of the characteristics of a simple integrated circuit (example circuit or 7432)
- Concepts on the construction of a simple combinational circuit using integrated circuits.

Assessment method: Exam (60%), continuous assessment (40%)

References

- John R. Gregg, Ones and Zeros: Understanding Boolean Algebra, Digital Circuits, and the Logic of Sets 1st Edition , Wiley & sons Inc. publishing, 1998, ISBN: 978-0-7803-3426-7.
- Bradford Henry Arnold , Logic and Boolean Algebra, Dover publication, Inc., Mineola, New York, 2011, ISBN-13: *978-0-486-48385-6*
- Alain Cazes,Joëlle Delacroix, architecture of machines and computer systems : Courses and corrected exercises, 3rd edition, Dunod 2008.

Semester: 02
Study **unit**
Subject : Introduction to Probability and Descriptive Statistics
Credits : 3
Coefficient : 2

Objectifs de l'enseignement :
Introduce the fundamentals of probability and statistical series with one and two variables.
Recommended Prior Knowledge : Basic Mathematics
Content of the material :

Chapter 1 : Statistical Basics and Vocabulary

- Basic concepts of statistics (Population and individual, Variable (or character))
- Statistical tables : Case of qualitative variables (Circular representation by sectors, Organ pipe representation, Band diagram), case of quantitative variables (The bar chart, Histogram, Polygon).

Chapter 2 : Numerical Representation of Data

- Central tendency or position characteristics (Median, Quartiles, Interquartile range, Mode, Arithmetic mean, Weighted arithmetic mean, Geometric mean, Harmonic mean, Quadratic mean).
- The dispersion characteristics (The extent, The standard deviation, The average absolute deviation, The coefficient of variation).

Chapter 3 : Probability Calculation

a. Combinatorial analysis : (Fundamental principle of combinatorial analysis, Arrangements, Permutations, Combinations).
b. Probable Space: (Random Experience, Elementary and Compound Events, Event Realization, Incompatible Event, Complete Event System, Event Algebra, Probable Space, Probability Concept).
c. Probabilized space : (Definitions, consequence of definition, conditional probability, independent events, independent experiments)
d. Construction of a Nursery School in Cameroon
e. Conditional probabilities, independence and compound probabilities (Conditional probabilities, Independence, Mutual independence, Compound probabilities, Bayes formula).

Evaluation mode: Examination (60%), continuous monitoring (40%) References

- G. Calot, Cours de statistique descriptive, Dunod, Paris, 1973.
- P. Bailly, Corrected exercises in descriptive statistics, OPU Algiers, 1993.
- H. Hamdani, Descriptive statistics with introduction to methods of analysis of economic information: exercises and corrections, OPU Algiers, 2006.
- K. Redjdal, Probabilities, OPU Algiers, 2004

Semester: 2

Course Unit: Methodological

Subject: Information and Communication Technology Credits: 2

Coefficient: 1

Subject Content:

Course Objectives: Familiarization with computers and the Internet.

Recommended Prior Knowledge: General computer knowledge.

Subject Content:

Chapter 1: ICT: Tools and Applications

a. Definition

b. ICT Tools:

i. Computers

ii. Software

iii. Communication Networks

iv. Smart Chips

c. ICT Applications

i. Communication Spaces: Internet, Intranet, Extranet

ii. Databases

iii. Multimedia: Audioconferencing, Videoconferencing

iv. Electronic Data Interchange (EDI)

v. Workflows

Chapter 2: Introduction to Web Technology

2.1 Introduction to the Internet

2.1.1 Definition

2.1.2 Applications

2.1.3 Terminology

2.2 Web Searching

2.2.1 Search Tools

2.2.1.1 Search Engines

2.2.1.2 Directories

2.2.1.3 Automatic Indexing

2.2.1.4 Browsers

2.2.2 Search Refinement

2.2.2.1 Choosing Keyword(s)

2.2.2.2 Boolean Operators

2.2.2.3 Adjacency, Truncation

2.2.3 Field-Based Queries, Advanced Search

2.2.4 Other Search Tools

Chapter 3: Contributions of ICT to External Communication

3.1 Internet Advertising

3.1.1. Banners

3.1.2. Interstitials

3.1.3. Windows

3.2 Online Website Promotion:

3.2.1 Sponsorship

3.2.2. The Electronic Community

3.2.3. Email Marketing

3.3 Online Payment System Security

3.3.1. Encryption

3.3.2. Website Data Protection

Assessment Method: Exam (100%)

References

- Eni Collective **,** Microsoft Office 2016Word, Excel, PowerPoint, Outlook 2016 - Basic Functions**,** Eni Collection : Office Reference ,2016
- Dan Gookin, Greg Harvey, Word and Excel 2016 for Dummies, First, Collection : For Dummies - Pocket (IT), 2016
- Myriam GRIS, Introduction to the Internet, Eni editions, 2009

Semester: 02
Study **unit**
Subject : Mathematical Programming Tools Credits : 2
Coefficient : 1

Teaching objectives: Mastery of scientific software. **Recommended Prior**

Knowledge : Programming Concepts **Subject Content :**

Chapter 1 : Mastery of Software (MATLAB, Scilab, mathematica , etc.) Chapter 2 : Examples of Applications and Resolution Techniques

Evaluation mode: Examination (60%), continuous monitoring

(40%) References

- Data Analysis Software: Gnu Octave, Mathematica, MATLAB, Maple, Scilab, Social Network Analysis Software, LabVIEW, Eicaslab. 2010. Publisher Books LLC., 2010.
- J.T. Lapresté., Mathematical Tools for the Student, Engineer and Researcher with MATLAB, 2008; Elliptical Editor.
- Jean-Pierre Attic, Beginning in Algorithms with MATLAB and SCILAB, Ellipses Editor, 2007

Semester: 02
Teaching unit: Transversal Subject : Physics
2 (general electricity) Credits : 3
Coefficient : 2

Objectifs de l'enseignement :
At the end of this course, the student will have to acquire the basic knowledge of electricity and magnetism (Calculation of electric and magnetic fields and potentials, Calculation of currents,etc.), so as to be able to analyze and interpret the phenomena related to it.
Recommended Prior Knowledge : Physics Basics

Content of the material :
Chapter 1 : Electrostatics

- Electrostatic forces
- Fields
- Potential
- Electrical dipole
- Gauss 'theorem

Chapter 2 : Drivers

- Total and partial influence
- Calculation of capacities – Resistors – Laws
- Ohm's law generalized

Chapter 3 : Electrokinetics

- Ohm's law
- Kirchoff 's Law
- Thevenin 's Law - Norton

Chapter 4 : Magnetostatics

- Magnetostatic force (Lorentz and Laplace)
- Magnetic Fields
- Biot and Sawark's Law

Evaluation mode: Examination (60%) , continuous monitoring

(40%) References

- T. Neffati. General electricity. 2008. Dunod Editions
- D. Bohn. . General electricity. 2009. SAEP editions
- Y. Granjon. General electricity. 2009. Dunod Editions

Semestre : 03
Fondamental Unit : FU1
Matière : Computers architecture
Crédits : 5
Coefficient : 3
Objectives: The aim of this subject is to clarify the principle of the computer functioning with a detailed presentation of the computer architecture.

Prerequisite:
Contents :
Chapter 1 :
- Introduction and Basics
- Von Neumann and Harvard architecture

Chapter 02: Principals components of a computer
- Global schema architecture
- ALU Arithmetic and Logic Unit
- Bus
- Registers
- Internal memory: RAM memory (SRAM et DRAM), ROM, access time, latency,...
- Cache memory: Utility and principle, cache memory management algorithms (Basics)
- Memory hierarchy.

Chapter 03: The processor instruction set
- High-level programming language, Assembly language and machine language
- Instruction set (Arithmetic, Logic, comparison, Load, Store, Transfer and Jump)
- Compilation and assembly principles (Basics)
- The control unit
- Instruction execution phases (Fetch, Decode, Address Calculations, execution)
- pipelining
- Clock and Sequencer

Chapter 4: The processor
- The processor function, CPI calculation (Cycle per Instruction), CISC and RISC architecture.
- The MIPS R3000 processor
- Extern architecture of the MIPS R3000 processor
- Internal architecture of the MIPS R3000 processor
- MIPS R3000 Instruction set.
- MIPS R3000 programming.

Chapitre 5 : Spécial instructions
Interrupts, Inputs/Outputs and system instructions (MIPS R3000)
Evaluation mode: Exam (60%), continuous control (40%)

Références

- Alain Cazes , Joëlle Delacroix, Architecture des machines et des systèmes informatiques 4 ème édition, *Collection : Informatique, Dunod, 2011.*
- Andrew S. Tanenbaum, Todd Austin Structured Computer Organization, Pearson, 2012.
- Paolo Zanella, Yves Ligier, Emmanuel Lazard, Architecture et technologie des ordinateurs : Cours et exercices - *Collection : Sciences Sup, Dunod*, 5ème édition, 2013.
- Liens vers le microprocesseur MIPS R3000
- ftp://132.227.86.9/pub/mips/mips.asm.pdf
- ftp://asim.lip6.fr/pub/mips/mips.externe.pdf
- ftp://asim.lip6.fr/pub/mips/mips.interne.pdf

Semester: 03
Fundamental teaching unit : UEF1 Algorithmic subject and data structure 3
Credits : 6
Coefficient : 3

Teaching objectives: this module will allow students to learn on the one hand the development of certain basic algorithms in computer science, on the other hand, they will learn to manipulate more developed data structures.

Recommended Prior Knowledge : Basic Algorithmic

Content of the material :

Reminder

Chapter 1 : Algorithmic Complexity

1. Introduction to Complexity
2. Complexity calculation

Chapter 2 : Sorting Algorithms

1. Overview
2. Bubble sorting
3. Sort by selection
4. Sort by insertion
5. Sort fusion
6. Quick sorting

Chapter 3 : Trees

1. Introduction
2. Definitions
3. Binary Tree
   3.1. Definition
   3.2. Passage from an n-ary tree to a binary tree
   3.3. Chained representation of a binary tree
   3.4. Binary Tree Journey
      3.4.1. Prefixed route (preorder or RGD)
      3.4.2. Infixed path (projective, symmetrical or GRD)
      3.4.3. Post-fixed route (terminal order or GDR)
      3.5. Particular binary trees
         3.5.1. Full Binary Tree
      3.5.3. Binary Search Tree

Chapter 4 : Graphs

1. Definition
2. Graph Representation
3. Graph Journey

NB : TP in C.

Evaluation mode: Examination (60%), continuous monitoring (40%)

- Thomas H. Cormen, Algorithms Basics *Collection : Sciences Sup, Dunod,* 2013.
- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest Algorithmic - 3rd edition - Course with 957 exercises and 158 problems Paperback, Dunod, 2010.

- Rémy Malgouyres, Rita Zrour and Fabien Feschet. *Introduction to algorithmics and programming in C : course with 129 corrected exercises*. 2nd Edition. Dunod, Paris, 2011. ISBN : 978-2-10-055703-5.
- Damien Berthet and Vincent Labatut. *Algorithmics & programming in C language - vol.1 : Course materials*. License. Algorithms and Programming, Istanbul, Turkey. 2014, pp.232.
- Damien Berthet and Vincent Labatut. *Algorithms & programming in C language - vol.2 : Practical work topics*. License. Algorithms and Programming, Istanbul, Turkey. 2014, pp.258. <cel- 01176120>
- Damien Berthet and Vincent Labatut. *Algorithmics & programming in C language - vol.3 : Corrected from practical work*. License. Algorithms and Programming, Istanbul, Turkey. 2014, pp.217. <cel-01176121>
- Claude Delannoy. *Learn to program in Turbo C.* Chihab-Eyrolles , 1994.

Semester: 03
Fundamental Teaching Unit Subject : Information Systems
Credits : 5
Coefficient : 3

Teaching objectives: Understand what a corporate information system is; (2) Understand the different constituent dimensions of an IS: a. Technical dimension b. Organizational dimension c. Managerial dimension (3) Understand the different elements of an IS: a. Management system b. Decision system c. Operational system (4) Understand the articulation of the IS with the corporate strategy (IS governance – IS project management)

Recommended prior knowledge : algorithmic,

Content of the material :
Chapter 1 : General

- Definitions and characterizations of the company (functional and structural aspects),
- Systemic approach of organizations : Overall presentation of the three systems (the decision system, classification of decisions: by level and by method , a programmable decision technique, decision tables), The information system (Functional aspects and Structural aspects : concept of station, workstation , flow, documents), The flow diagram.

Chapter 2 : Information Representation Techniques

Notion of information, Forms and manipulation of information, Study of information: Class and class achievement, class description, etc. Schema and codification of information

Chapter 3 : Information Capture and Control

Different types of information control

Chapter 4 : Methodology for the development of an IS: Merise

- IS development process
- Data model and processing abstraction level
- Merised methodology
- Concepts for static modeling (Concept of entity and association, a conceptual data model : the MCD of MERISE. Concepts for dynamic modelling : MCT from Merise.

Evaluation mode: Examination (60%) , continuous monitoring
(40%) References

- Articles of As. P. Vidal, P. Planeix, Organizational Information Systems, 2005.
- Coord. M-L. Caron-Fasan & N. Lesca, Presents et futures des systèmes d 'information, 2003, PUG. p.
- Kalika M. & alii, Le e-management. What transformations for the company? , 2003, Editions Liasons.
- J.L. Lemoigne, The Theory of the General System. PUF.
- V. Bertalanfy, General Systems Theory. Dunod.
- X. Castellani, General method for analyzing a computer application. Masson.
- Tardieu et al. , "la méthode merise: principes et outils", ed. d 'organisation, 1983.-
- Tardieu et al. , "la méthode merise: démarche et pratique" ed. d 'organisation, 1985.-
- Tabourier, "on the other side of Merise", organizational edition, 1986.-
- J. P. Mathéron, " Comprendre Merise ", 1990

Semester: 03
Fundamental Teaching Unit Subject : Graph Theories Credits : 4
Coefficient : 2

Teaching objectives: Graph theories have become an essential theoretical and practical foundation in the process of modeling certain problems in several areas. The contribution of graphs in solving problems lies in the graphical simplicity, the similarity with distributed aspects and the notions of paths and path searches. The objective of this course is to present to the student on the one hand a solution modeling in graph form, on the other hand this course will contain a set of techniques allowing the student to solve his problems through algorithms such as minimum path search, maximum flow etc.

Recommended Prior Knowledge Subject

Content :

Chapter I. Définitions de base

I.1. "Intuitive" definition of a graph
2. Mathematical definition of a graph
3. Order, orientation and multiplicity
    3.1. Order
    3.2. Orientation
    3.3. Multiplicity
4. Relationships between elements of a graph
    4.1 Relationships between vertices
    4.2 Relations between arcs and vertices
    4.3 Graph Qualifiers
5. Matrices associated with a graph
    5.1 Summit-arc incidence matrix
    5.2 Vertex-summit adjacency or incidence matrix
    5.3 Condensed form of hollow dies
6. Connectedness Vocabulary
    6.1 Chain, path, length
    6.2 Privity
    6.3 Cycle and circuit
    6.4 Bicycle and cocircuit.

Chapter II. Cycles

1. Cyclomatic and cocyclomatic numbers
    1. Breakdown of cycles and cocycles into elementary sums
    2. Lemma of coloured arcs (Minty 1960)
    3. Cycle base and cocyclic base
2. Planarity
    1. Planar Graph
    2. Euler 's formula
    3. Kuratowski 's theorem (1930)
    4. Dual Graph
3. Tree, forest and tree structure
    1. Definitions
    2. Properties
    3. Maximum shaft (or covering).

Chapter III. flow-system

1. Definitions
2. Search for a maximum flow in a transport network
    4. Definition

5. Ford-Fulkerson Theorem
6. Ford-Fulkersonalgorithm

3. Search for a compatible flow

Chapter IV. Traverse Issues

1. Search for related components
    1. Presentation of objectives
    2. Trémeaux-Tarjan algorithm
2. Finding the shortest path
    1. Presentation of the conditions
    2. Moore-Dijkstra algorithm
3. Search for an extremum weight tree
    1. Presentation of objectives
    2. 1956 Kruskalalgorithm

Chapter V. Hamiltonian and Eulerian Problems

1. Hamiltonianproblem
    1. Definitions
    2. Necessary condition for the existence of a Hamiltonian cycle
    3. Sufficient condition for the existence of a Hamiltonian circuit
    4. Sufficient condition for the existence of a Hamiltonian cycle
2. Eulerian problem
    1. Definitions
    2. Necessary and sufficient condition for the existence of an Eulerian chain
    3. Local algorithm for tracing an Eulerian cycle
    4. Link between Eulerian and Hamiltonian problem

Chapter VI. Tinting

1. Definitions
2. Colouring the vertices
3. Edge staining
4. Recommendations
5. The " 4 Colors" Theorem
6. Perfect Graph

Evaluation mode: Examination (60%) , continuous monitoring (40%)

References

- Claude Berge, Graphs and Hypergraphs, Bordas 1973, (300 pages).
- Nguyen Huy Xuong, Discrete Mathematics and Computer Science, Masson, 1997
- Aimé Sache, La théorie des graphes, Que-Sais-Je ?, 1974 ; reprint planned for 2004 by Cassini.
- M. Kaufmann , Arrow points, graph theory , Dunod, Sciencespoche , exhausted.
- Alan Gibbons, Algorithmic graph theory, Cambridge University Press, 1985
- Reinhard Diestel, Graph Theory, Second Edition, Springer-Verlag, 2000.
- Bojan Mohar, Carsten Thomassen, Graphs on surfaces, John Hopkins University Press, Baltimore, 2001.

Semester: 03
Methodological Teaching Unit : EMU Subject :
Numerical Methods
Crédits : 4
Coefficient : 2

Teaching objectives: this subject will allow students to invest in the field of methods necessary for problem solving

Recommended Prior Knowledge : Basic Mathematics

Content of the material :

Chapter 1 : General information on numerical analysis and scientific calculation
- 1.1 Motivations.
- 1.2 Floating-point arithmetic and rounding errors
  - 1.2.1 Machine representation of numbers
  - 1.2.2 Rounding Errors
- 1.3 Stability and error analysis of numerical methods and problem conditioning

Chapter 2 : Direct Methods of Solving Linear Systems
- 2.1 Notes on resolving triangular systems
- 2.2 Gauss removalmethod
- 2.3 Matrix interpretation of Gauss elimination : LU factorization

Chapter 3 : Iterative Methods of Solving Linear Systems
- 3.1 General
- 3.2 Jacobi and over-relaxation methods
- 3.3 Gauss-Seidel and successive over-relaxation methods
- 3.4 Notes on the implementation of iterative methods
- 3.5 Convergence of Jacobi and Gauss-Seidel methods

Chapter 4 : Calculation of eigenvalues and vectors
- 4.1 Locating Eigenvalues
- 4.2 Power method

Chapter 5 : Matrix Analysis
- 5.1 vector space
- 5.2 Matrices
  - 5.2.1 Matrix operations
  - 5.2.2 Links between linear applications and matrices
  - 5.2.3 Reverse of a matrix
  - 5.2.4 Trace and determinant of a matrix
  - 5.2.5 Eigenvalues and vectors
  - 5.2.6 Similar matrices
  - 5.2.7 Some particular matrices
- 5.3 Scalar standards and products
  - 5.3.1 Definitions
  - 5.3.2 Scalar Products and Vector Norms
  - 5.3.3 Matrix standards . . . .

Evaluation mode: Examination (60%), continuous monitoring (40%).

References**:**

- M. Schatzman Numerical Analysis : A Mathematical Approach, Dunod 2004.
- P.G. Ciarlet, Introduction to Matrix Analysis and Optimization, Masson 1990.
- J. Demmel, Applied Numerical Linear Analysis, SIAM 1997 ;
- C. D. Meyer, Matrix Analysis and Applied Linear Algebra, SIAM 2000 ;
- P. Lascaux and J. Théodor, Numerical Matrix Analysis Applied to the Art of Engineering, 2 volumes, Masson 1988.
- G. H. Golub, C. F. van Loan, Matrix Computations, The Johns Hopkins University Press, 1989.

Semester: 03
Methodological teaching unit Subject :
Mathematical logic Credits : 4
Coefficient : 2

Teaching objectives: Formalization of human reasoning

Recommended prior knowledge : basic knowledge of mathematics and Boolean algebra.
Content of the material :
Chapter 1 : Introduction

a. Logic objects
b. Syntax and semantics

Chapter 2 : Proposal Logic

i. Syntax
    1. The proposals
    2. Logical connectors
    3. Variables and propositional formulas
    4. Substitution in a formula
    5. Logic formulas and trees
ii. Semantics
    1. Interpretation
    2. Truth Tables
    3. Tautologies and antilogies
    4. Semantic equivalence
    5. Conjunctive and disjunctive normal forms
    6. Satisfiability and validity
iii. Resolution
    1. Objection
    2. Clausal formatting
    3. Proposalal Resolution Rule
    4. The propositional resolution method

Chapter 3: Predicate Logic

c. Syntax
    i. Terms
    ii. Predicates
    iii. Quantifiers
    iv. Formulae
        1. Scope of an identifier
        2. Free variables, related variables
d. Semantics
    i. Structure
    ii. Satisfaction with a formula

Evaluation mode: Examination (60%) , continuous monitoring (40%) References

1. S.C. Kleene. Mathematical logic. Collection U, Armand Colin, Paris 1971.
2. J.L. Krivine. Elements of Mathematical Logic. North-Holland Publishing Company Amsterdam, 1967.
3. r. Mathematical logic. Volume 1 : Propositional calculation , Boolean algebra, predicate calculation. Dunod, 2003.

Semester: 03
Transversal teaching unit : UT Subject :
Foreign language 2
Credits (2)
Coefficient : 1

Teaching objectives: Deepening and use of the English language in the handling of documents.

Recommended prior knowledge : Good knowledge of English.

Content of the material :
- Didactic activities.
- Comprehension of documents written in English.
- Recaps
- Written production.
- Translation exercises : French – English and English – French.
- Essays on writing small technical reports.

Assessment mode: Examination (100%)

References

- DAV E MUR P H YEnglish Grammar in Use. Cambridge University Press. 3rd edition, 2004
- M. McCarthy and F. O'Dell, English vocabulary in use, Cambridge University Press, 1994
- L. Rozakis, English grammar for the utterly confused, Mc Graw-Hill, 1st edition, 2003
- Oxford Progressive English books.

Semester: 04
Basic teaching unit : UEF1 Subject : Theory of languages
Credits : 5
Coefficient : 2

Teaching objectives: to understand the theory and tools of language theory

Recommended prerequisite knowledge : Basic knowledge of mathematics and computer science

Content of the material :
CHAPTER 1: INTRODUCTION Chapter 2 :
Alphabets, Words, Languages Chapter 3 :
Grammars

1. Definitions
2. Derivation and generated language
3. Bypass Shaft
4. Chomsky Hierarchy

Chapter 4: Finite State Automata (FSA)

1. AEF deterministic
2. Representations of a PLC
3. Equivalent and complete PLCs
4. Non-deterministic AEF (determination)
5. Automata and regular languages (transformations and properties))

Chapter 5: Regular Expressions

1. Definitions
2. Kleene 's theorem
3. Star Lemma **Chapter 6:**

Minimizing an AEF **Chapter 7:**
Algebraic Languages

1. Properties of a regular grammar
2. Grammar transformations
3. Reduced grammar
4. Clean grammar
5. Removal of left recursion
6. Normal Shapes

Chapter 8: Battery Controllers

1. Definition
2. Setup, Transition & Calculation
3. Acceptance criteria
4. Deterministic Battery PLCs

Chapter 9: Turing Machine

1. Definition
2. Setup, Transition & Calculation
3. Accept

Evaluation mode: Examination (60%) , continuous monitoring

(40%) References

1. P. Wolper. Introduction to calculability. 2006, Dunod.
2. P. Séébold. Automaton theory. 2009, Vuibert.
3. J.M. Autebert Theory of languages and automata. 1994, Masson.
4. J. Hopcroft, J. Ullman. Introduction to Automata Theory, Languages and Compilation 1979, Addison-Wesley

Semester: 04
Basic Teaching Unit : UEF1 Subject : Operating System 1
Credits : 5
Coefficient : 3

Teaching objectives: Introduce the basics of operating systems, their roles in the management of machine resources : processor and central memory and then present the mechanisms and techniques used for these purposes.

Recommended prior knowledge : algorithmic and data structures, machine structure.

Content of the material :

Chapter 1 : Introduction

- Operating system ID
- Functions and Roles.
- Examples of operating systems (Windows, UNIX, Android,etc.)

Chapter 2 : Processor Management

- Definitions
  - Concept of Program.
  - Concept of Process.
  - Concept of Thread.
  - Concept of resource
  - Concept of work (Job)
- Different states of a process.
- Process hierarchies.
- Relationships between processes (competition, cooperation and synchronization).
- Process scheduling techniques:
  - Criteria (Fairness, efficiency, response time, turnaround time, efficiency)
- Scheduling algorithms (some of the most used) :
  - Turnstile (Round Robin RR).
  - First in, first served or FCFs (First Come First-Served) algorithm.
  - Shortest Job First (SJF) algorithm.
  - Shortest Remaining Time (SRT) algorithm.
  - Algorithm with priority.

Chapter 3 : Memory Management

- Objectives
- Monoprogramming.
- Multiprogramming :
  a) contiguous multiple partitions.
  - Fixed contiguous partitions.
  - Dynamic contiguous partitions:
    1- First Fit Strategy
    2- Best Fist Strategy (Best Fist)
    3- Worst fit strategy .
       a. Siamese contiguous partitions (Buddy system)
       b. Reallocation and protection
       c. Back and forth (Swap)
       d. Fragmentation and Compaction
- Multiprogramming and multiple non-contiguous partitions
  1. Page number
  2. Segmentation
  3. Paginated segmentation.
- Virtual memory
  - Virtual memory concept.
  - Overlays
  - Pagination on demand
  - Some page replacement algorithms :

-Optimalalgorithm

-Random Replacement

- Chronological Loading Order (FIFO) (with comment on the Belady anomaly).
- Chronological Order of Use (LRU: Least Recently Used).
- Least Frequently Used (LFU).
- Second chance algorithm.

Chapter 4 : The Unix System.

Directed and practical work

The TDs will focus on proposals for algorithms around the different chapters. These algorithms will be developed in TP using the C language under Unix. The UNIX system will be the subject of the first TPs sessions.

Evaluation mode: Examination (60%) , continuous monitoring

(40%) References

- Tanenbaum, Modern operating systems, thirth edition, Pearson, 2014
- A. Tanenbaum, Operating Systems, Dunod, 1994.
- Michel Divay, Unix, Linux and Operating Systems : Courses and Corrected Exercises , Dunod, collection : Sciences sup, 2004.
- Crocus, Computer Operating Systems , Dunod, 1993.
- Sacha Krakowiak, Principles of Computer Operating Systems, Dunod, 1993

Semester: 4
Fundamental teaching unit Subject : Databases
Credits : 5
Coefficient : 3

Teaching Objectives: This course should enable the student to identify the value of structuring and manipulating data in tabular form. Through the relational model and the underlying relational algebra oriented more towards the practical aspect, the student should understand the importance of structuring the data, the concept of data and processing independence, as well as the integrity and consistency of the data.
Recommended prior knowledge : The student is expected to understand what files (texts, binary or typed) and have created them with the languages previously studied.

Content of the material :

Chapter 1 : Database Overview

1. File concepts (interests and limits)
2. Database Definition
3. Database Management System Definition
4. Types of data models (semantics, entity-association, hierarchical, network, relational)

Chapter 2 : Relationship Model

1. Definition of the relational model
2. Basic concepts (Attribute, Tuple, Domain, Relationship)
3. Relationship Diagram
4. Standardisation
   a. Relationship Key and Functional Dependency (Primary Key and Foreign Key)
   b. Integrity constraints
   c. Normal shapes (1FN, 2FN, 3FN, Boyce-Codd FN)
   d. Databaseschema
5. Logical Relational Model (SQL)
   a. Table, Column, and Row
   b. Structured Query Language (SQL) Description
   c. Data Definitions
      i. Table creation (CREATE)
      ii. Schema modification (ALTER, DROP)
   d. Data manipulation (INSERT, UPDATE, DELETE)

Chapter 3 : Relational Algebra

1. Definition
2. Unitary operations and operators
   a. Selection
   b. Projection
   c. Translation to SQL
      i. Simple queries (SELECT-FROM)
      ii. Column selection (WHERE CLAUSE)
      iii. Sorting results (ORDER BY)
3. Assembly operations and operators
   a. Union
   b. Intersection:
   c. Difference
   d. Cartesian product
   e. Joint (Theta, natural, equijointure, external)
   f. Division
   g. Translation to SQL
      i. Union, Intersection, and Difference Operators
      ii. Cartesian product (seamless)

iii. Table join (join condition)
iv. Aggregate Functions
v. GROUP BY clause ... Having fun.

Evaluation mode: Examination (60%) , continuous monitoring (40%)

References:

- Databases. Georges Gardarin. 5th edition 2003
- SQL Fundamentals of Language. Eric Godoc and Anne-Christine Bisson. Eni Edition. 2017
- Databases : concepts, use and development. Jean-Luc Hainaut. DUNOD Edition. 2015

Semester: 04
Fundamental teaching unit : UEF2 Subject : Networks
Credits : 5
Coefficient : 3

Teaching objectives: this subject aims to give students the essential notions for a good understanding of networks. They must be able to explain what a network is, what it consists of, how computers can communicate with each other, describe the different types of media, the different types of topologies as well as a detailed study of the five layers of the Internet model.

- To make the student able to understand the operation, to plan the installation and to use a network of computers.
- Familiarize the student with the various layers of implementation of a computer network.
- Introduce the student to the main communication and message routing protocols.
- Familiarize the student with the main components of a computer network.
- To make the student able to use the basic services of a network within a program.

Recommended prior knowledge : Machine structure, components and systems.

Content of the material :

Chapter I : Introduction to Networks

- Network Usage
- Physical Characteristics
- Network topologies
- Reference models (OSI, TCP/IP)
- Gateway types

Chapter II: Physical Layer

- Network Terminology
- Signals, decomposition, noise
- Guided and unguided transmission brackets
- Digital transmission : Conversion from analogue to digital
- Digital transmission : Conversion from digital to digital
- Sampling
- Analogue transmission : Conversion from digital to analogue
- Analogue transmission : Conversion of analogue to analogue
- Multiplexer and Concentrator

Chapter III: Data Link Layer

- Addressing type
- Flowcontrol
- Standard 802.3 and Ethernet format
- Error Checking
- Multiple access point.
- Circuit Switching

Chapter IV: Network Layer

- IP addressing, classes, notion of subnets
- IP protocol : IPV4, IPV6
- Bundle Fragmentation
- Packetswitching
- Routing : centralized techniques, distributed techniques
- Static Routing and Dynamic Routing
- Hierarchical and external routing

Chapter IV: Transport Layer

- Notion of transport address
- UDP and TCP protocols
- Quality of service

- Congestioncontrol

Chapter IV: Application Layer

- Protocol:
- Protocol:
- Protocol:
- Protocol:
- Protocol:

Labs

TP 1: Basic configuration of a network
TP 2 : Network programming (Socket)
TP 3 : Routing
TP 4 : Protocol Analyzer

Evaluation mode: Examination (60%) , continuous monitoring (40%)

References

- Forouzan, Behrouz A., and S. C. Fegan. "Data communication and computer networks." (2007).
- Tanenbaum, Andrew S. "Computer networks, 4-th edition." ed: Prentice Hall (2003).

4th semester
Methodological teaching unit: MTU
Module: Object Oriented Programming
Credits: 4
Coefficient: 2

Teaching goals: The basic objective of this course is to introduce the basic concepts of object-oriented programming (OOP) by practice using the Java language. Each chapter includes concepts that are translated at the end into java, so that the student can translate the theoretical concepts acquired into practice. At the end of the semester, the student is expected to have acquired the following skills:

1. The essence of object programming and its transformation into the Java language
2. To acquire an intuitive reasoning to give a solution to a simple problem according to the object-oriented
3. Write a program in Java that is functional
4. The essence and importance of OO reasoning and OOP

Prerequisite knowledge: C language
Module Content:
Chapter 1. Basics of OOP

1. Introduction
2. Fundamental concepts of OOP
    a. Short history of OOP
    b. Procedural programming vs. object-based programming
    c. Code reuse
    d. Introduction to modularity
3. Objects and classes
    a. Notions of object
    b. Notions of class
    c. Attributes
    d. Notion of message
    e. Problem solving by message exchange
4. Introduction to Java
    a. Types and control structures in Java
    b. Classes and instantiation
    c. Methods
    d. References and parameter passing
    e. Inputs /Outputs
    f. Default constructor and other constructors
    g. Destructors

Chapter 2: Encapsulation

1. Levels of visibility
2. Encapsulation
    a. Encapsulation of data (attributes)
    b. Code encapsulation (Messages)
3. Encapsulation in Java
    a. Access control (public, private)
    b. Accessors (get and set)
    c. Access to the instance (this)
    d. Class variables and methods (static)

Chapter 3: inheritance

1. Subclasses and inheritance
2. Simple inheritance, multiple inheritances
3. Class hierarchy
4. Polymorphism
5. Inheritance and polymorphism in Java
    a. Simple inheritance (extends)
    b. Encapsulation in heritage

i. Member protection (protected)
ii. Class constructors (this (), super ())
iii. 'Object' class
iv. Implicit and explicit transtyping
v. Limitation of heritage (final)

c. Polymorphism
i. Method overloading
ii. Method redefinition

d. Abstract classes (use and importance)
e. Interfaces (use and importance)

Evaluation method: Examination (60%), continuous control (40%)

References

1. Apprendre la Programmation Orientée Objet avec le langage Java. Luc Gervais. Eni. 2ème édition.
2. https://openclassrooms.com/courses/apprenez-a-programmer-en-java
3. Java 8 - Apprendre la Programmation Orientée Objet et maîtrisez le langage. Thierry GROUSSARD Luc GERVAIS. Edition ENI. 2015.
4. La programmation objet en Java. Michel Divay. Edition DUNOD. 2006.

Semester: 04
Methodological Teaching Unit: MTU
Subject: Web Applications Development
Credits: 4
Coefficient: 2
Educational Goals: The ultimate goal is to learn how to implement a web application.

Recommended prior knowledge: Fundamentals of algorithms and programming.
Basics of Internet and Networks.

Content:

Chapter 1: Introduction to World Wide Web

1. Definition and history
2. Client/Server architecture
3. HTTP protocol.

Chapter 2: Web Programming Languages

1. Overview: static page, dynamic page and web applications
2. Markup languages: definition and history
3. HTML
   - 3.1. What is HTML?
   - 3.2. HTML runtime environment
   - 3.3. Basic HTML
     - 3.3.1.Structure of HTML documents (header, body, links ...)
     - 3.3.2.Tables, Frames, Forms
     - 3.3.3.HTML 5.0
     - 3.3.4.Style Sheets (CSS 3)
     - 3.3.5.JavaScript
     - 3.3.6.Controlling HTML Forms in JavaScript
4. XML
   - 4.1. Structure of an XML document
   - 4.2. DTD (Document Type Definition)
   - 4.3. XML Schema
   - 4.4. XSLT

Chapter 3: Server-side programming language (PHP)

1. Introduction
2. Basic syntax
   - 2.1. Escaping from HTML
   - 2.2. Instruction separation
   - 2.3. Comments
3. Types, variables and operators
4. Control structures
5. Classes and objects
6. Features
   - 6.1. Error handling
   - 6.2. Managing file uploads
   - 6.3. Working with Remote Files
   - 6.4. Connection management
   - 6.5. Persistent Connections to Databases.
   - 6.6. Session management
   - 6.7. Business web applications in PHP

Chapter 4: Web Services: Basics

1. Introduction

2. Service Oriented Architecture (SOA)
3. Web Services Features
   3.1. Definition of web services
   3.2. Web Services Architecture
4. Web Services Standards
   4.1. SOAP
   4.2. WSDL
   4.3. UDDI
5. Web services development platforms
   5.1. Web services development (Server-side)
   5.2. Web services development (Client-side)
6. Platform .NET and Java.
   6.1. JSP
   6.2. ASP

Chapter 5: Case Study: Developing a Web Service (server-side then client-side)

Evaluation method: Exam (60%), continuous assessment (40%)

Reference:

- Web development courses. From: https://openclassrooms.com/courses.
- Jean Engels & Olivier Salvatori, "PHP 5: cours et exercices". Eyrolles editions, 2005
- Mathieu Lacroix, "Introduction Web: Cours". Université paris 13, 2013.
- Société Digimind. "Le Web 2.0 pour la veille et la recherche d'information, Exploitez les ressources du web social", Digimind, juin 2007.

Semester: 04
Transversal teaching unit Subject :
foreign language 3 Credits : 2
Coefficient : 1

Teaching objectives: Written and oral expression techniques in English: presentation, defense, group communication. This course should leave students as much freedom as possible to be able to express themselves in English around a specific theme. Each group of students prepares a presentation that they will support in front of their classmates in English.

Recommended prerequisite knowledge English subject of L1 and Semester 3

Content of the material :

Oral and written expression techniques in English:
- Presentations
- Defense
- Group communication
- …

Assessment mode: Examination (100%)

Semester: 5
Program: SI (Computer Science – Information Systems)
Fundamental Teaching Unit: UEF1
Subject: Operating System 2
Credits: 5
Coefficient: 3
Objectives of the Course
This course provides an **in-depth study of the Unix operating system**, recommended during tutorial and lab sessions. Students will learn **thread programming and mutual exclusion mechanisms** using **C under Unix**. Theoretical studies will cover **producer/consumer models, reader/writer models, and the philosopher's problem**, including multiple variations. Students will develop **algorithms in pseudo-code** during tutorials and **implement them in C under Unix** during lab sessions.
Recommended Prerequisites
Operating System 1 – Fundamental concepts of operating systems.
Course Content
Chapter 1: Operating System Fundamentals

- **Review of OS concepts**
- Understanding **programs, processes, threads, and shared resources**

Chapter 2: Process Synchronization

- **Concurrent access issues** – managing **critical sections** and **mutual exclusion** problems
- **Synchronization tools:**
    - Events and Locks
    - **Semaphores**
    - **Monitors**
    - **Critical regions**
    - Path expressions

Chapter 3: Interprocess Communication

- **Shared Variables** – (Models: **Producer/Consumer, Reader/Writer)**
- **Message Exchange:**
- **Mailbox-based communication (Client/Server model)**

Chapter 4: Deadlock Management

- **Models of Deadlocks**
- **Prevention Strategies**
- **Avoidance Techniques**
- **Detection & Recovery Methods**

Evaluation Method : Final Exam: 60%, **Continuous Assessment:** 40%

References

1. **Andrew Tanenbaum**, *Modern Operating Systems*, 3rd Edition, Pearson, 2014
2. **A. Tanenbaum**, *Systèmes d'exploitation*, Dunod, 1994
3. **Michel Divay**, *Unix, Linux et les systèmes d'exploitation – Cours & Exercices*, 2004
4. **Crocus**, *Systèmes d'exploitation des ordinateurs*, 1993
5. **Sacha Krakowiak**, *Principes des systèmes d'exploitation des ordinateurs*, Dunod, 1993

Semester : 5
Fundamental teaching unit: UEF1
Module: Compilation
Credits: 5
Coefficient: 3

Teaching goals: understand how programs are compiled then executed
Recommended Prerequisites knowledge**: language theory**
Module Content:

Chapter 1: introduction (goals) …
Chapter 2 : Compilation
- i. Compilator definition
- ii. Compilator design

Chapter 3 : lexical analysis
Chapter 4 : Syntax analysis
- i. The left most derivation and derivation tree
- ii. Ambiguous grammar
- iii. programmation language and grammar
- iv. Syntax analyzers and there types
- v. tools in practice

Chapter 5 : Top down parsing
- i. The LL(1) parsing (principe)
- ii. Parsing table
- iii. The LL(1) grammer

Chapter 6 : Bottom up parsing
- i. LR parsing (principe)
- ii. LR(0) parsing
- iii. SLR(1) parsing
- iv. LR(1) parsing
- v. LALR(1) parsing

Chapter 7 : Syntax- Directed translation
Chapter 8 : Type control
Chapter 9: Runtime Environnements
Chapter 10 : code generation
Evaluation method: Examination (60%), continuous control (40%)

References
1. Alfred Aho, Ravi Sethi et Jeffrey Ullman « Compilers, Principles techniques and tools » AddisonWesley 1986

Semester :5 SI courses
Basic Teaching Unit : UEF2 Subject : Software Engineering
Credits : 5
Coefficient : 3
Teaching Objectives: Learn how to apply an analysis and design methodology for software development. In particular, learn object modeling with the universal UML language. **Recommended prior knowledge :** Algorithmic, Information System, Object Oriented Programming.

Content of the material :

Chapter 1. Introduction
1. Definitions and objectives
2. Software Engineering Principles
3. Expected qualities of a software
4. 'software life cycle' means:
5. Software lifecycle models

Chapter 2. Modeling with UML
1. Introduction
Modeling, Modeling, Object Oriented Modeling, UML in application.
2. General elements and mechanisms
3. UML diagrams
4. Packages

Chapter 3. UML Use Case Diagram: Functional View
Interest and definition, Rating

Chapter 4. UML class and object diagrams: static view
1. Class Diagram
2. Object Diagram

Chapter 5. UML diagrams : dynamic view
1. Interaction diagram (Sequence and collaboration)
2. Activity Diagram
3. statechart diagram

Chapter 6. Other UML concepts and diagrams
1. Components, deployment, composite structures.
2. Extension mechanisms : OCL language + profiles.

Chapter 7. Introduction to development methods : (OR, XP)

Chapter 8. Design patterns and their place in the development process

Evaluation mode: Examination (60%) , continuous monitoring (40%)

References:

- Bern Bruegge and Allen H. Dutoit, *Object-Oriented Software Engineering – using UML, Patternsand Java*. Third Edition, Pearson, 2010.
- G. Booch, J. Rumbaugh, I. Jacobson, "The Unified Modeling Language (UML) Reference Guide", Addison-Wesley, 1999.
- G. Booch, J. Rumbaugh, I. Jacobson, "The Unified Modeling Language (UML) User Guide", Addison-Wesley, 1999.
- G. Booch et al., "Object-Oriented Analysis and Design, with applications", Addison-Wesley, 2007.
- Laurent Audibert. UML 2.0 course, available at http://www.developpez.com.
- M. Blaha and J. Rumbaugh. *Object-oriented modeling and design with UML 2*. 2nd edition. Pearson Education, 2005.
- Pierre-Alain Muller. *Object modeling with UML*. Editions Eyrolles, 2003.
- Shari Lawrence Pfleeger and Joanne M. Atlee.*Software Engineering*. Fourth Edition, Pearson, 2010.

Semester : 5 SI courses
Basic teaching unit : UEF2 Subject : Human-Machine Interface
Credits : 5
Coefficient : 3

Teaching objectives: to enable students to acquire skills for making visual graphical interfaces by respecting the ergonomic criteria and standards of the design of interactive and user-friendly interfaces.

- Knowledge of ergonomic rules
- Knowledge of a HMI development method
- Coupling with Object-Based Development Method
- Implementation of these methods in a project

Recommended prior knowledge : Algorithms and data structure, software engineering

Content of the material :

Chapter I: Notions of Interaction

I.1 - Definitions : Interaction, Interactivity, ...
I.2 – Causes of rejection of certain applications.
I.3- Challenges : savings, changes in the workstation, consequences of an interface expression
I.4- Difficulties : the variety of users, difficult manufacturing, link between designer and developer
I.5- Definition of an HMI.
I.6- History of HMIs.

Chapter II: Methodology for building a HMI

II.1- Classic Methodology**.**
II.2- Identification step : identification of functional areas, definition of the user model (notion of user profile), definition of the task model (task types) and technical environment.
II.3- Task analysis step (concept of action-objective sequence).
II.4- Modelling step (requires choosing a model and an architecture). II**.**5- Specification step (specifications)

- Needs study
- Conceptual specification
- Functional Specification
- Syntactic specification
- Lexical specification

Chapter III : Models & Architectures

III.1- The Dialogue Controller (definition & role).
III.1- Presentation of the Seeheim model
III.2- Presentation of the PAC model III.3- Presentation of the MVC model
III.4- Presentation of agent models.

Chapter IV : Ergonomic rules in HMIs

IV.1- Nielsen heuristics .
IV.2- Bastien and Scapin ergonomic criteria
IV.3- golden rules of Coutaz

Chapter V: Designing Multi-User Interfaces

V.1- Comparative study between single user and multi user HMI. V.2- The CCU method (user-centered design).
V.3- Examples of multi-user interfaces.

Chapter VI : Adaptive Interfaces

- The Vaudry Model.
- Study of an example: Agent model.

Chapter VII : Multimodal Interfaces and Future Interfaces

- Advanced Interaction Techniques, Augmented Reality, Tangible Interface, 3D Projection, Motion Analysis)
- Visual Programming Elements.

Evaluation mode: Examination (60%), continuous

monitoring (40%) References:

- **Ménadier Jean-Paul,** l 'interface utilisateur: Pour une informatique convivial, DUNOD, Informatique et Stratégie, 1991
- **Coutaz Joelle,** Human-computer interface : design and implementation Dunod-Informatique 1990
- **Kolski, C, Ezzedine, H and Abed, M,** " *Software Development :* From *Classical Cycles to HMI-Enriched* Cycles", collective work, HMI Analysis and Design , Human-Machine Interaction for Information Systems Vol 1, Hermès, 2001, 250 p, ISBN 2-7462-0239-5, p23
- **Drouin, A, Valentin, A and Vanderdonckt, J,** " *Les contributions de l 'ergonomie à l 'analyse et à la conception des systèmes d 'information*", in Christophe KOLSKI, (ed.), HMI Analysis and Design, Human-Machine Interaction for Information Systems Vol 1, Hermès, 2001, 250 p, ISBN 2- 7462-0239-5 , p. 51-83.
- **David Benyon**, Designing Interactive Systems: A Comprehensive Guide to HCI, UX and Interaction Design,Pearson; 3 edition, 2013
- **Yvonne Rogers, Helen Sharp & Jenny Preece,** Interaction Design: beyond human-computer interaction (3rd edition), Wiley, 2011
- **Norman DA,** The Design of Everyday Things, Basic Books, 2002. Serengul Smith-Atakan The
- FastTrack to Human-Computer Interaction, (Paperback) Thomson Learning, 2006.

Semester: 5
Program Track: Information Systems (IS)
Methodological Teaching Unit: UEM
Subject: Linear Programming
Credits: 4
Coefficient: 2

Course Objectives:
This module aims to raise student awareness of the practical importance of linear optimization problems,
to master the underlying theoretical framework, and to be able to use these techniques in practical problems.

Recommended Prerequisite Knowledge: General mathematics and computer science

Course Content:
Chapter 1: General Introduction
1.1 History of linear programming
1.2 Examples of modeling real-world problems as linear programs

Chapter 2: Geometry of Linear Programming
2.1 Vector spaces, matrix rank, systems of linear equations
2.2 Convex sets, hyperplane, polyhedron, simplex, extreme point

Chapter 3: Primal Method for Solving a Linear Program
3.1 Problem setup
3.2 Characterization of extreme points
3.3 Optimality at an extreme point
3.4 Optimality criteria: objective function decrease formula, optimality criterion, sufficient condition for existence of a bounded solution
3.6 Simplex algorithm: improving the objective function by moving from one extreme point to another,
matrix form of the simplex algorithm, finiteness of the algorithm, simplex algorithm and tableau
3.7 Initialization of the simplex algorithm: normal form linear program, Big M method, two-phase method

Chapter 4: Dual Methods in Linear Programming
4.1 Definitions
4.2 Decrease formula for the dual function and optimality criterion
4.3 Sufficient condition for feasible solutions in the primal problem
4.4 Dual simplex algorithm
Initialization of the dual simplex algorithm

Evaluation Method: Final Exam (60%), Continuous Assessment (40%)

References:

1. M. Sakarovicth, Graphes et programmation linéaire, Ed. Hermann. 1984.
2. H. Mauran, Programmation linéaire appliquée, Ed. Technip, 1967.
3. A. Kauffman, Méthodes et modèles de R.O., Ed. Dunod, 1976.
4. V. Chvatal, Linear programming. W.H. Freeman and Company, 1983

Semester: 5
Specialization: Information Systems (SI)
Methodological Teaching Unit: UEM
Subject: Probability and Statistics
Credits: 4
Coefficient: 2
Course Objectives:
This course is an introduction to the study of simple random models. The objective is to provide essential tools in the field of probability, and also to address statistical aspects. By the end of this module, the student should be able to calculate various measures of dispersion in statistics and perform probability-based calculations using probability laws, as well as conduct tests on data using probability theories.
Recommended Prior Knowledge:
Course Content:
1. Probability spaces
2. Discrete random variables
3. Continuous random variables
4. Characteristic functions
5. Limit theorems
6. Gaussian vectors
7. Simulation
8. Estimators
9. Tests
10. Confidence intervals and regions
11. Problems (probability)
12. Problems (probability and statistics)
Evaluation Method: Final exam (60%), continuous assessment (40%)
Références:
1. Lecoutre B., Tassi Ph. (1987) Statistique non paramétrique et robustesse Paris : Economica.
2. Tassi Ph. (1989) Méthodes statistiques Paris: Economica –
3. Tassi Ph., Legait S. (1990) Théorie des probabilités en vue des applications statistiques Paris : Ed.
Technip
4. Saporta, G., Probabilités, Analyse des données et Statistique, Technip, 2ème édition, 2006
5. Jean-Pierre Lecoutre, Statistique et probabilités, Editions Dunod, 2012.
6. Yadolah Dodge, Valentin Rousson, Analyse de régression appliquée, Editions Dunod, 2004.

Semester :5 SI courses
Transversal Teaching Unit d
Subject : Digital economy and business intelligence
Credits :2
COEFFICIENT:
Objectives of education: The information age has prevailed in the 21st century. The objective of this subject and to equip the student with knowledge on two concepts of the near and distant future, it is the digital economy and business intelligence.
Instruction

Chapter **1 – Digital** Economy

- Definition & History
- Electronic commerce
- Electronic contract and electronic signature
- Electronic prospecting and advertising
- Intellectual and Commercial Property

Chapter 2 : **Strategic Vision**

- Standby concepts and types of standby
- Standby process templates
- The detailed steps of the monitoring process
- Overview of several free monitoring tools for collection, management and dissemination gathering

Chapter 3 : **Monitoring and social networks**

- Plan, collect and organize information
- The reputation watch
- Content curation
- Features of the day before on social networks
- Create a (good) LinkedIn profile and build your network
- Practical workshop : Twitter, LinkedIn, Mention,

Tweetdeck Chapter 4 : **Managing a monitoring project**

- Manage a monitoring project
- Work as a team effectively
- Identify sources of information

Assessment mode: Examination (100%)

References

- Information system for strategic management : the intelligent company. Ed. McGraw Hill , Paris, 146 p This book was awarded the Harvard Prize
- Francine Séguin, Taïeb Hafsi and Christiane Demers, Strategic management, from analysis to action, Les Transcontinental Publishing, 2008.
- Strategic intelligence : How not to be drowned in information. Economies and Societies, Management Sciences Series, No.2/1998, p.159-177. LESCA, H. (2001)
- Strategic watch: transition from the notion of a weak signal to the notion of an early warning sign. Colloquium 2001, Barcelona Oct., Proceedings of the Colloquium, Volume 1. LESCA, H. CARON, M-L (1995) - Strategic intelligence : creating a

collective intelligence within the company. Revue Française de Gestion, Sept. - Oct. , pp. 58-68. LESCA, H RAYMOND, L. (1993)

- Experimentation of an expert system for the evaluation of Business Intelligence in SMEs. International SME Review, vol.6 n°1 p.49-65. (Quebec, Canada) Website http://www.veille-strategique.org

Semester : 6 SI courses
Basic teaching unit : UEF1 Subject : Mobile Applications
Credits : 5
Coefficient : 3

Teaching objectives : the purpose of this subject is to provide the student with knowledge in application development and computer system in mobile environments. With the arrival of smartphones, mobile applications are omnipresent whether you are a customer (BtoC), supplier (BtoB) or employee (BtoE). The aim of this course is also to learn programming on Android, its development platform and the specificities of embedded development on *smartphones*.

Recommended prior knowledge : Have good knowledge of Java, JavaScript and XML.

Content of the material :

Chapter 01 : Mobile Apps

1. Introduction
2. Mobile operating systems:
3. Types of mobile applications

Chapter 02 : Android Platform

1. Presentation of the Android platform
2. The fundamental components of an Android application
3. The Android SDK
4. Installation and configuration of tools
5. Create Android emulator
6. The first Android app

Chapter 03 : Activities and Resources

1. Introduction
2. concept of economic activity
3. Lifecycle of an activity
4.
5. Resource organisation
6. ResourceUtilization
   - Strings
   - The drawables
   - Styles
   - Animations

Chapter 04 : Graphical Interfaces and Widgets

1. Creation of graphical interfaces
2. Manage events on widgets

Chapter 05 : Menus and Dialogs

1. App Menu Management
   a) Options menu
   b) Contextual menus
   2. Dialogboxes

Chapter 06 : AndroidManifest.xml and communication between components

1. The AndroidManifest.xml file
2. Communication between components
   a) Explicit intents

b) Implicit intents
c) The resolution of implicit intents

Chapter 07 : Databases with SQLite **Chapter 08 :**

Development of a simple application

Evaluation mode:Examination (60%) , continuous monitoring (40%)

References:

- Create apps for Android - OpenClassrooms
  https://openclassrooms.com/courses/creez-des-applications-pour-android
- Android Development - Jean-Francois Lalande
  http://www.univ-orleans.fr/lifo/Members/Jean-Francois.Lalande/enseignement/android/cours-android.pdf

Semester 6 : Computer systems
Fundamental Teaching Unit (FTU)
Subject : Computer Security
Credit : 5
Coeffecient : 3
Teaching goals : This subject allows students to acquire skills to ensure the security and proper functioning of computer systems.
Prerequisites : Algorithmics, Programming techniques
Subject content :
Chapter 1 : Introduction to Computer Security

1.1 Definitions: Security, Dependability, ...
1.2 Main IT Security concepts : vulnerability, - threat, - countermeasure, risk, ...
1.3 IT security objectives : Confidentiality, Integrity, Availability, Non-repudiation, Authentication, ...
1.4 IT threats :
- What is an attack?
- Definitions: Virus - Worm - Trojan Horse - Spyware
- Origin of attacks
- Who can be targeted?
- Stages of an attack
- The different taxonomies of attacks
- The different types of attacks: - Network attacks - System attacks - Password attacks - Website attack - Application attack. - Ways to launch an attack

1.5 Defense methods : - Anti-virus, - Firewalls, - Private networks, - Intrusion detection, etc...

Chapter 2 : Introduction to Cryptography

2.1 Vocabulary and definitions : - Cryptology, - Cryptography, Cryptogram, - Cryptanalysis, etc...
2.2 History of cryptography
2.3 Classical Cryptography : - Substitution algorithm: Caesar cipher, VIGENERE cipher.
- Transposition algorithm: the Assyrian technique.
2.4 Modern Cryptography : - Symmetric cryptography: Principles, DES and AES algorithms
- Asymmetric Cryptography: Principles, RSA Algorithm
2.5 Hash Functions : - Principles - MD5 and SHA-1 algorithms.
2.6 The digital signature
2.7 Digital certificates
2.8 Certification authorities and PKI

Evaluation mode : Exam (60%), CC (40%)
References

- Laurent Bloch , Christophe Wolfhugel , Ary Kokos ,Gérôme Billois , Arnaud Soullié , Alexandre Anzala-
- Yamajako , Thomas Debize, Sécurité informatique pour les DSI, RSSI et administrateurs, éditions Eyrolles , 5° édition, Collection Blanche, 2016.
- Jean-François Pillou, Jean-Philippe Bay, Tout sur la sécurité informatique, DUNOD, 4° ÉDITION, 2016.
- Gilles Dubertret, L'univers secret de la cryptographie, Vuibert, 2015.
- Damien Vergnaud, Exercices et problèmes de cryptographie ,*Collection : Sciences Sup, Dunod*, 2015

Semester 6 : Computer systems
Fundamental Teaching Unit (FTU)
Subject : Artificial Intelligence
Credit : 5
Coeffecient : 3
Teaching goals : The main objective of this subject is to allow a student to know the fundamental concepts of AI. It consists of allowing more interests to the contribution of AI in problems resolution, which is actually based on reasoning approaches rather than classical computational techniques.
Prerequisites : Mathematical logic, Algorithmics
Subject content :

Chapter 1 : Beginning of AI

1.1 History : Beginning of AI, AI and types of problems, Difference between AI and classical computational techniques
1.2 Turing test
1.3 AI applications

Chapter 2 : Expert systems

2.1 Definition and role
2.2 Expert system architecture

Chapter 3 : Expert system functioning

3.1 Knowledge and Knowledge representation formalisms
3.2 Production rules-based systems
3.3 Inference engine functioning

Chapter 4 : Expert system developping appraoch

4.1 Expert system developping process
4.2 Examples of expert systems : Dendral, Mycin, Prospector

Evaluation mode : Exam (60%), CC (40%)
References :

- Manuel d'intelligence artificielle, Louis Frécon and Okba Kazar, Edition PPUR, ISBN : 978-2-88074-819-7, 2009
- Ganascia, Jean-Gabriel. L'intelligence artificielle, Flammarion, 1993
- Bratko, Programmation en Prolog pour l'intelligence artificielle, 2001
- J.M. Alliot et T.Schiex, Intelligence Artificielle et Informatique Theorique, Cepadues Editions, 1993.
- N. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann, 1998.
- S. Russell, P. Norvig, Artificial Intelligence: A Modern Approach, 2nd edition, 2002

Semester : 6 SI courses

Basic teaching unit : UEF2 Subject : Semi-structured data
Credits : 5
Coefficient : 3

Teaching objectives: the objective of this subject and to allow the student to become familiar with unstructured data structures to be exploited in web-oriented applications.

Recommended prerequisite knowledge : programming language

Content of the material :

1. **Context and issues**
   - 1.1. Database Reminders
   - 1.2. Multimedia & Document
   - 1.3. Hypermedia, Internet and Web
   - 1.4. Problem of this course
2. **Multimedia documents and hyper-documents**
   - 2.1. The documents
     - 2.1.1. Introduction
     - 2.1.2. Modeling of specific documents
     - 2.1.3. Modeling of document classes
   - 2.2. Hyper documents
   - 2.3. Multimedia content
3. Core :
   - 3.1. Introduction to XML
   - 3.2. Basic XML structure
   - 3.3. Nominal domains
   - 3.4. XML Schemas
4. **Galaxie XML**
   - 4.1. Paths: XPATH
     - 4.1.1. Principles
     - 4.1.2. the
     - 4.1.3. Filters
     - 4.1.4 Predicates
   - 4.2. XSL stylesheets and treatments
   - 4.3. XML applications : RDF, SVG, ...
   - 4.4. Treatment: Dom and SAX
   - 4.5. Pointers: XPOINTER
   - 4.6. The links: XLINK
5. **XML BDs and semi-structured BDs**
   - 5.1. Semi-structured data and XML
   - 5.2. Query languages
   - 5.3. XML databases
6. **XQUERY and comics**
   - 6. 1. XML and semi-structured data
     - 6.1.1. Semi-structureddatabases
     - 6.1.2. Query languages
     - 6.1.3. .xml

6. 2. XQUERY
   6.2.1. XQuery Syntax
      6. 2.1.1. XQuery Expressions
      6.2.1.2. Functions and operations
   6.2.2. Uses and examples of functions

Evaluation mode: Examination (60%) , continuous monitoring (40%)

References

- CHAUDHRI Akmal, RASHID Awais, ZICARI Roberto " XML Data Management- Native XML and XML Enabled Database Systems " , ADDISON WESLEY , 2003 , ISBN 020184452 4, 641 pages
- Michard A., "XML : language and application", EYROLLES, 2001, 499 pages , ISBN: 2-212-09206-7
- GARDARIN Georges." Object and Relational Databases ", EYROLLES, 2001

Semester : 6 SI courses

Methodological teaching unit Subject :
Project
Credits : 6
Coefficient : 3

Teaching objectives: the objective of this subject is to entrust a group of students with the care to analyze, design and implement a computer application. **Recommended**

Prior Knowledge : IS License Curriculum **Content :**

The Bachelor 's degree project focuses on one or more themes addressed in the SI Bachelor 's degree curriculum. He is supervised by a teacher from the department.
It can be carried out in a company (internship) or at the department level.

Assessment:

The assessment will be carried out by an examination board composed of three (03) teachers: the president, the examiner and the supervisor.
The Review will cover 72 countries.

- -The dissertation (or internship report) : 07 points.
- -The software : 07 points.
- - Answers to questions : 06 points

The final mark is equal to the average of the marks awarded by each of the members of the examination board.
There is no defense. The consultation focuses on the manuscript and the software (design and created by
The dissertation (or internship report) contains the bulk of the work and should not exceed 30 pages.

Evaluation : report (35%) + Software (35%) + Responses (30%)

Methodological teaching unit Subject :
scientific writing
Credits (2)
Coefficient : 1

Teaching objectives: learn scientific writing techniques to enable the student how to publish the results of their research.

Recommended prior knowledge : knowledge of scientific work

Content of the material :

Introduction
Before Writing

a. Organization of ideas and drafting plan
b. Prepare the way of writing
c. Choose your layout tools
d. Version control systems

Bibliographic references **23**

a. Get References '
b. Build bibliography
c. Avoid plagiarism

Redaction

a. Structure
b. Content
c. Style
d. Overview

Evaluation mode: continuous monitoring (100%)

References :

- BRUYERE, V. How to write well. Lecture ; for undergraduate students in computer science, University of Mons-Hainaut, 2006.
- VALDURIEZ, P. Some Hints to Improve Writing of Technical Papers. Systems Engineering of Information 2, 3 (1994), 371–375.

Semester : 6 SI courses

Transversal Teaching Unit (TU) Subject :
Creating and developing a startup **Credits :**
2
Coefficient : 1

Teaching objectives: this course aims to give the student and help him to structure, start or develop his entrepreneurial project. The aim of the course is also to develop in the student the " Learn to Do Business " mechanism. The objective is also to develop the student's entrepreneurial creativity by highlighting their idea through " business model " type projects. The module is based on four points which are :

- Motivate the student to create a startup and provide them with the means to embark on the business model sector.
- Mastering tools for formalizing and implementing a startup project
- Transforming good business model creation ideas
- Adapt the student to the startup ecosystem and culture.

Recommended prior knowledge : programming language, business concept

Content of the material :

Chapter I : Entrepreneurial Profile & Motivations

I.1 The creation of a European
I.2 The Contractor's Posture
I.3 How to find an idea
I.4 The startup ecosystem
I.5 Launching alone or with others
I.6 Growth and sales
I.7 Errors, failures and best practices

From idea to market

II.1 Customer development and product development
II.2 The construction to the formalization of an economic model
II.3 Pitch Anything: An Innovative Method for Presenting, Persuading, and Winning the Deal

Chapter III : From Market to Growth

III.1 Growth hacking or the cult of growth
III.2 Fundraising and valuation
III.3 Crowdfunding : marketing and financial leverage

Chapter IV : Administration and management

IV.1 The starter pack : legal / social / tax / VAT
IV.2 Tools to manage, develop and communicate your business
IV.3 Market access & sales • Business development • Web marketing • Performance management
IV.4 Business Intelligence

Assessment mode: Examination (100%)

- Robert Papin, La création d 'entreprise, Création, reprise, développement, 16e édition -
- *Collection : Hors collection, Dunod,* 2015.
- Eric Ries, Lean Startup : Embrace Continuous Innovation, Publisher : PEARSON, 2015.
- Vincent Ydé, Creating your company : from project to reality , Publisher : VUIBERT, 2009.