M2 Data & Knowledge Course Descriptions

version 2017-04-15

First semester, first period:

Mandatory courses: 7 x 2.5 = 17.5 ECTS
1. Web Data Models (Silviu Maniu)
2. Semantic Web (Yue Ma)
3. Data Warehouses (Benoit Groz)
4. Machine Learning and Data Mining (Albert Bifet)
5. IoT Big Data Processing (Albert Bifet)
6. Novel Architectures for Big Data Analytics (Ioana Manolescu)
7. Introduction to Research and Business (Emmanuel Waller)

First semester, second period:

Mandatory course: 2.5 ECTS
1. Softskills seminar (Fabian Suchanek, all lecturers)

Optional courses: 6 out of the following, 6x2.5 = 15 ECTS
These courses are offered, but are canceled if too few students sign up or a lecturer resigns.
1. Knowledge Base Construction (Fabian Suchanek), opened to DataScale
2. Natural and Artificial Intelligence (Jean-Louis Dessalles)
3. Information Integration (Nathalie Pernelle; Fatiha Saïs)
4. Social and Uncertain Data Management (Silviu Maniu; Antoine Amarilli)
5. Dynamic Content Management (Nicoleta Preda), opened to DataScale
6. IoT Big Data Stream Mining (Albert Bifet, Jesse Read)
7. Managing Very Large Data and Knowledge in Bioinformatics (Sarah Cohen-Boulakia)
8. Image understanding (Isabelle Bloch)
9. Image mining and content-based retrieval (Antoine Manzanera)
10. Factorization-Based Data Analysis (Umut Simsekli)
11. Module liberté (any course at UPSay by approval)

Second semester:

6 month master thesis project: 25 ECTS
-OR-
6 month industrial internship: 25 ECTS

M2, S1P1: Mandatory Courses

UE: Web Data Models

Titre UE	Web Data Models
Responsable(s) (Etablissements)	Silviu Maniu (U Paris Sud)
Adresse(s) email	silviu.maniu@lri.fr
Autres intervenants et établissements	
Lieu principal d'enseignement	Plateau (Univ. Paris Sud)
ECTS	2.5
Nbr d'heures total	21
Cours	12
TD	3
TP	6
Objectifs	Recent years have seen a massive increase in the amount of data, in particular on the Web. This course is to expose students to current technology and research issues in connection with web data. More concretely, this module covers the basics of semistructured data models such as XML standard and RSS, JSON, schemas such as DTD, XML Schema, query languages such as XPath, XQuery, XSLT and more advanced topics such as static analysis, XML views, XQuery evaluation. *Intended outcome* This course gives the student a broad and detailed understanding of XML database technology as well as the Semantic Web. Its goal is also that student be able to identify the latest related research topics.
Prérequis	Relational databases (model and query languages) Programming skills (Java)
Grade (MCC)	<u>First Session:</u> 50% Projet (CC) + 50% Exam (G) Project: implementation of an XPath/XML algorithm (homework) Exam: exam containing exercises solved during practical classes and theoretical questions <u>Second session:</u> 100% Exam
Language	English

UE: Semantic Web

Titre UE	Semantic Web
Responsable(s) (Etablissements)	Yue Ma (Univ. Paris Sud)
Adresse(s) email	ma@lri.fr
Autres intervenants et établissements	
Lieu principal d'enseignement	Plateau (Univ. Paris Sud)
ECTS	2.5
Nbr d'heures total	21
Cours	10.5
TD	3.5
TP	7
Objectifs	Searching information over rich web resources becomes a necessity for a large number of advanced applications. However, there are several impediments to use traditional keyword based search in practice due to the semantic mismatch among different resources. The course will introduce an approach to handle this problem, so called Semantic Web technology. And then it will focus on the knowledge representation aspect of Semantic Web, starting with various representation formalisms (such as Description Logics) and their reasoning mechanisms, and ending with W3C Semantic Web standards such as RDF, OWL, and SPARQL. Intended outcome: This course provides students with a broad and detailed understanding of semantic technologies. It also serves as a basis for several optional courses of D&K program, such as Knowledge Base Construction, Natural and Artificial Intelligence, Information Integration.
Prérequis	Programming skills (Java), Propositional Logic (if possible)
Grade (MCC)	<u>First session:</u> 25% Project1 + 25% Project2 + 50 % Exam (J) Projects: implementation of a reasoning algorithm and reasoning with ontology Exam: written <u>Second session:</u> 50% Exam
Language	English

UE: IoT Big Data Processing

Titre UE	IoT Big Data Processing

Responsable(s) (Etablissements)	Albert Bifet (Télécom ParisTech)
Adresse(s) email	albert.bifet@telecom-paristech.fr
Autres intervenants et établissements	
Lieu principal d'enseignement	Télécom ParisTech
ECTS	2.5
Nbr d'heures total	21
Cours	12
TD	0
TP	9
Objectifs	This module will present concepts, architectures and algorithms for IoT big data processing and analytics, at a very large scale, in distributed settings. The following topics will be covered: ● Apache Spark ● Apache Flink ● Apache Beam/Google Cloud DataFlow ● Apache Storm ● Lambda and Kappa Architectures A strong focus will be given to labs in this class, so that students can gather enough experience with different existing systems, and understand their respective advantages. The architecture of all distributed computing systems will be discussed in detail during lectures.
	Databases, Algorithms & Data Structure, Java programming
Grade (MCC)	<u>First session:</u> 2/3 Exam +1/3 Labs (E) <u>Second session:</u> 100% Exam
Language	English

UE: Novel Architectures for Big Data Analytics

Titre UE	New Architectures for Big Data Analytics
Responsable(s) (Etablissements)	Ioana Manolescu (INRIA Saclay)
Adresse(s) email	ioana.manolescu@inria.fr
Autres intervenants et établissements	

Lieu principal d'enseignement	Plateau (Univ. Paris Sud)
ECTS	2.5
Nbr d'heures total	21
Cours	12
TD	0
TP	9

Objectifs	This module will present concepts, architectures and algorithms for data storage, management, and analysis, at a very large scale, especially in distributed settings. The following topics will be covered, each illustrated with a representative system, whose main features will be detailed during lectures:
	● Introduction to distributed systems (consistency, availability, and the CAP theorem; ACID vs BASE)
	● Massively distributed (cloud-based) filesystems (e.g., HDFS/GFS)
	● Distributed NoSQL databases:
	   ○ Dynamic Hash Tables (DHTs)
	   ○ Key-value stores
	   ○ "Big Table" - style systems
	   ○ Graph databases: Neo4J
	   ○ Distributed triple stores
	   ○ Document stores: MongoDB
	● Data analysis tools in the Amazon cloud
	A strong focus will be given to labs in this class, so that students can gather experience with different existing systems, and understand their respective advantages.

	Databases, Algorithms & Data Structure, Java programming
Grade (MCC)	<u>First session:</u> 0.6 * Exam + 0.4 * Labs (E) <u>Second session:</u> 0.6 * Exam + 0.4 * Lab
Language	English

UE: Data Warehouses

Titre UE	Data Warehouses
Responsable(s) (Etablissements)	Benoit Groz (U Paris Sud)
Adresse(s) email	benoit.groz@gmail.com
Autres intervenants et établissements	
Lieu principal	Plateau (U Paris Sud)

d'enseignement	
ECTS	2.5
Nbr d'heures total	21
Cours	10.5
TD	10.5
TP	5

Objectifs	This module will cover relational technologies dedicated to transform raw data from various sources into valuable information providing a global vision for business processes. More specifically, we will discuss
	● relational data warehouse architectures,
	● data modeling:
	  ○ conceptual (multi-dimensional modeling)
	  ○ and logical (star-schemas)
	● query languages and (relational) optimizations for analytical queries:
	  ○ OLAP-queries
	  ○ indexes
	  ○ partitioning
	  ○ views.
	● ETL processes (briefly)
	● column stores (briefly)

Prérequis	Relational databases (model and query languages)
Grade (MCC)	<u>First session:</u> 75% Exam +25% lab exam (SQL) (K) <u>Second session:</u> 100% re-exam.
Langue	English

UE: Machine Learning and Data Mining

Titre UE	Machine Learning and Data Mining
Responsable(s) (Etablissements)	Albert Bifet (Telecom ParisTech)
Adresse(s) email	albert.bifet@telecom-paristech.fr
Autres intervenants et établissements	
Lieu principal d'enseignement	Télécom ParisTech
ECTS	2.5

Nbr d'heures total	21
Cours	10.5
TD	10.5
TP	5
Objectifs	The objective of this course is to be a first course on machine learning and data mining algorithms from a practical and a theoretical point of view. This is an introductory course that will set the basis for the more advanced courses on the second period. Topics covered include: - classification - deep learning - clustering - frequent pattern mining - recommender systems
Prérequis	
Grade (MCC)	<u>First session:</u> 2/3 Exam +1/3 Labs (E) <u>Second session:</u> 100% Exam
Langue	English

M2, S1P2: Optional Courses

UE: Knowledge Base Construction

Titre UE	Knowledge Base Construction
Responsable(s) (Etablissements)	Fabian Suchanek (Télécom Paris Tech) [100%]
Adresse(s) email	fabian@suchanek.name
Autres intervenants et établissements	
Lieu principal d'enseignement	Télécom Paris Tech
ECTS	2.5
Nbr d'heures total	21
Cours	12
TD	0
TP	9
Objectifs	This module will teach students the basics of semantic information extraction. It will cover the concepts, methods, and algorithms to extract factual information from text in order to construct a coherent knowledge base. This includes some NLP (Part-of-Speech tagging, Dependency Parsing, etc.), and the techniques and concepts of entity disambiguation, instance extraction, the extraction from semi-structured sources (Wrapper Induction, Wikipedia-based approaches), the extraction from unstructured sources (e.g., by Pattern-based approaches), and the extraction by Soft Reasoning (Markov Logic, MAX SAT, etc.). We will also cover the design of extraction approaches in general (Evaluation, Iteration, etc.).
Prérequis	* Propositional & First Order Logic * Basics of the Web (HTTP, HTML, (Web forms), XML, ...) * Basics of the Semantic Web (knowledge representation, RDF, OWL,...) * Graph Theory * Java programming
Grade (MCC)	<u>First session:</u> 50% Labs + 50% Exam (C) <u>Second session:</u> 50% original labs + 50% re-exam
Language	English

UE: Social and Uncertain Data Management

Titre UE	Social and Uncertain Data Management
Responsable(s) (Etablissements)	Antoine Amarilli (Télécom ParisTech) [50%] Silviu Maniu (Paris-Sud) [50%]
Adresse(s) email	a3nm@a3nm.net; silviu.maniu@lri.fr
Autres intervenants et établissements	
Lieu principal d'enseignement	Télécom ParisTech
ECTS	2.5
Nbr d'heures total	21
Cours	18
TD	0
TP	3
Objectifs	The objective of this class is to present models for the representation of uncertain data, as well as algorithms and tools to process this data, while maintaining information about its uncertainty. Topics covered include: ● Sources of uncertain data ● Incomplete data models in closed-world assumptions: SQL NULLs and Codd tables, c-tables ● Data model for open-world data: consistent query answering, OBDA ● Possible world semantics ● Querying relational probabilistic databases: operators, lineage, hardness, practical implementations ● Social applications of uncertain data: probabilistic graphs, social influence, crowdsourcing Labs will feature the MayBMS probabilistic relational database engine.
Prérequis	Relational databases, Basics of probability theory, Propositional logic, Basics of Graph Theory
Grade (MCC)	First session: 50% Project + 50% Exam (variations of problems solved in class) (D); Second session: 100% Exam
Language	English

UE: Dynamic Content Management

Titre UE	Dynamic Content Management
Responsable(s) (Etablissements)	Nicoleta Preda (UVSQ)
Adresse(s) email	preda@prism.uvsq.fr
Autres intervenants et établissements	
Lieu principal d'enseignement	Télécom ParisTech
ECTS	2.5
Nbr d'heures total	21
Cours	12
TD	0
TP	9
Objectifs	This module will examine the management of dynamic data, for a variety of distributed Web applications. The course includes an introduction to standard tools for developing Web applications (REST/SOAP Web Services, XML/JSON, XSLT, BPEL), followed by an exploration of the problems that come from the dynamic nature of the data returned by Web services: wrapper construction, on-the-fly entity resolution, query evaluation using services with limited access patterns, workflow selection, verification/provenance of workflows. We will also cover the dynamic integration into RDF knowledge bases (Linked Open Data) of the data exported by digital libraries using Web service APIs.
Prérequis	Basics of the Web (HTTP, HTML, Web forms, XML), Basics of distributed and database systems.
Grade (MCC)	First session: 50% Report (of a paper) + 50% Project (implementation of an algorithm) Second session: 100% Exam

UE: Information Integration

Titre UE	Information Integration

Responsable(s) (Etablissements)	Nathalie Pernelle, U Paris Sud [40%] Fatiha Saïs, U Paris Sud [40%]
Adresse(s) email	pernelle@lri.fr, sais@lri.fr
Autres intervenants et établissements	AgroParisTech (Juliette Dibie-Barthélemy, Liliana Ibanescu) [20%]
Lieu principal d'enseignement	Paris Sud
ECTS	2.5
Nbr d'heures total	21
Cours	12
TD	9
TP	0
Objectifs	Nowadays, the Web of documents has evolved into a Web of Data connecting distributed and structured data (e.g., RDF, RDFa, MicroFormat) across the Web. To benefit of all the Web of data richness, it is important to establish whether two pieces of data refer to the same real world entity. In this module, we first survey well-known data integration architectures. Then, we present the data linking problem by giving a classification of the main existing approaches: supervised/unsupervised, local/global, knowledge-based and single/multi-ontologies. After that, we introduce the data fusion issue encountered when data connected by an identity link has to be integrated, which arises the problem of conflicting values. The main approaches, techniques and knowledge used to solve all these issues are explored. Intended outcome: This course gives the students an understanding of the difficulties encountered with regard to the design of an application when he has to decide that the "*Musée des Arts Premier*", located near "*Trocadero*" and the "*Musée du quai Branly*", located in "Paris's 7th arrondissement", refer to the same museum. It gives also an understanding of the criteria to choose a data linking approach in order to take into account characteristics related to the data and to the application. Finally, it introduces students to the data fusion issue, allowing to develop tools specifically adapted to the data and application domain.
Prérequis	Knowledge representation, RDF, OWL
Language	English
Grade (MCC)	<u>First session:</u> Project (report 50% + talk/demo 50%) <u>Second session:</u> exam

UE: Natural and Artificial Intelligence

Titre UE	Natural and Artificial Intelligence
Responsable(s) (Etablissements)	Jean-Louis Dessalles, Telecom ParisTech [100%]
Adresse(s) email	dessalles@telecom-paristech.fr
Autres intervenants et établissements	Fabian Suchanek, Telecom ParisTech
Lieu principal d'enseignement	Télécom ParisTech
ECTS	2.5
Nbr d'heures total	21
Cours	70%
TD	
TP	30%
Context	Bringing machines closer to human competence is a fascinating challenge. We can hardly anticipate all the technical consequences that competent machines will have in domains such as human-machine interaction, intelligent search engines, machine translation, robotics, pattern recognition, knowledge mining and learning, adaptive planning or personal assistance. This course addresses the issue of A.I. as a reverse-engineering problem: try to mimic, not only the performance, but also the processes, of natural intelligence. For example, a text-messaging app reading "The meeting is scheduled for tomorrow." anticipates future tense: "Will [you be there]?". It does so through mere statistical association between "tomorrow" and future tense. Could a machine *detect* that the message is about a future event, and then not only *deduce* that future tense is appropriate, but also retrieve the *reason* for attending the meeting? This course is best adapted to students who want to acquire more than skills in the domain of Artificial Intelligence.
Objectives	The course will present several models of human cognition that can lead to implementation. The objective is not only technical. It is an occasion to grasp the complexity and power of human intelligence, while drawing a line between capacities that can be implemented and those that remain challenging to reproduce.
Topics	- Symbolic machine learning - Cognitive knowledge representation - Introduction to Natural Language Processing (syntax, semantics, relevance) - Reasoning, complexity, simplicity - Emotions and computation

URL	More on http://teaching.dessalles.fr/NAI
Prérequis	Basic knowledge in Logic (propositional logic and predicate logic) and in logic programming.
Grade (MCC)	<u>First session:</u> 30% lab questions + 30% paper + 10% presentation + 30% quiz. <u>Second session:</u> 50% first session + 50% oral examination Answers to questions during lab sessions are recorded and read (30%). In addition, each student will choose a technical topic (typically a topic studied during lab sessions), perform a micro-research on that problem (typically go beyond the lab exercises) and write a 4-page paper (30%). Students will briefly present their work on the last day (10%). Students will also answer a small quiz on the last day (no documents). Students who would fail to pass this first round will have to prove that they master the main concepts taught in the course during an oral interview. The eventual note will be the mean of the first grade and this oral evaluation.

UE: IoT Big Data Stream Mining

Titre UE	IoT Big Data Stream Mining
Responsable(s) (Etablissements)	Albert Bifet (Télécom ParisTech) [50%] Jesse Read (Télécom ParisTech)[50%]
Adresse(s) email	albert.bifet@telecom-paristech.fr
Autres intervenants et établissements	
Lieu principal d'enseignement	Télécom ParisTech
ECTS	2.5
Nbr d'heures total	21
Cours	15
TD	0
TP	6
Objectifs	Data streams are everywhere, from F1 racing over electricity networks to social media feeds. Data stream mining or Real-Time Analytics relies on and develops new incremental algorithms that process streams under strict resource limitations. This course focuses on, as well as extends the methods implemented in open source tools as MOA and Apache SAMOA. Students will learn to how select and apply an appropriate method for a given data stream problem; they will learn how to design and implement such algorithms; and

	they will learn how to evaluate and compare different solutions.
Prérequis	
Syllabus	1. Introduction Slides 2. Introduction to Data Science Slides 3. Stream Algorithmics Slides – Lab 4. Concept drift Slides 5. Evaluation Slides 6. Classification Slides 7. Ensemble Methods Slides – Lab2 8. Clustering Slides
Language	English
Grade (MCC)	<u>First session:</u> 60% Exam + 30% Project + 10% Labs (I) <u>Second session:</u> 100% Exam

UE: Managing Very Large Data and Knowledge in Bioinformatics

Titre UE	Managing Very Large Data and Knowledge in Bioinformatics
Responsable(s) (Etablissements)	Sarah Cohen-Boulakia (Paris Sud)
Adresse(s) email	Sarah.Cohen_Boulakia@lri.fr
Autres intervenants et établissements	
Lieu principal d'enseignement	Paris Sud
ECTS	2.5
Nbr d'heures total	21
Cours	9
TD	6
TP	6
Objectifs	The course will cover problems of managing very large data and knowledge in the domain of Bioinformatics. This course is not a course on algorithms which are bio-inspired (like neural networks etc.) but it rather aims at introducing **data management techniques** used on **real biological data**.

	Topics include, but are not limited to: (1) data integration problems encountered by true users when using real biological databases (practice sessions), (2) methods and tools available to analyze such data in particular using scientific workflows, (2) storing and querying provenance of data obtained in scientific workflows, (3) mining workflow databases, (4) the use of Semantic Web and Metadata in Bioinformatics.
Prérequis	No prior knowledge in biology is necessary to follow this course.
Langue	English
Grade (MCC)	<u>First session:</u> Project (report 50% + talk/demo 50%) <u>Second session:</u> exam

UE:Module liberté

Titre UE	Module liberté
Responsable(s) (Etablissements)	Fabian M. Suchanek (Télécom ParisTech) [0%]
Adresse(s) email	fabian@suchanek.name
Autres intervenants et établissements	All
Lieu principal d'enseignement	Any participating institution
ECTS	2.5
Nbr d'heures total	21
Cours	14
TD	4
TP	3
Objectifs	The Data&Knowledge track acknowledges that new concepts and techniques will be developed over the coming years in the area of knowledge and data mangement. To ensure the timely coverage of these concepts, and also to welcome potential future lecturers into our track, we allow students to fill the credits of this module completely freely from the courses that are offered at UPSa. The condition is that the courses be thematically related to knowledge and data mangement. The organisers of the Data&Knowledge track will examine each proposed course upon request and decide whether to admit it as a possible choice for the students.
Prérequis	Depending on the chosen module
Language	English
Grade (MCC)	Depending on the choses module

UE: Image Understanding

Titre UE	Image understanding
Responsable(s) (Etablissements)	Isabelle Bloch (Télécom ParisTech)
Adresse(s) email	isabelle.bloch@telecom-paristech.fr
Autres intervenants et établissements	Henri Maître and Florence Tupin (Télécom ParisTech), Antoine Manzanera and David Filliat (ENSTA ParisTech), Céline Hudelot (Centrale-Supelec)
Lieu principal d'enseignement	Telecom ParisTech
ECTS	2.5
Nbr d'heures total	21
Cours	10.5
TD	10.5
TP	0
Objectifs	This course introduces structural approaches for image understanding, with examples in medical imaging, remote sensing, robotic vision, and video. The methods taught include knowledge-based approaches, graphs, spatial ontologies, information fusion, high level recognition.
Prérequis	
Language	English
Grade (MCC)	First session: 0.4*oral presentation of a paper + 0.6* written exam Second session: 0.4*oral presentation of a paper + 0.6* written exam

UE: Image mining and content-based retrieval

Titre UE	Image mining and content-based retrieval
Responsable(s) (Etablissements)	Antoine Manzanera (ENSTA ParisTech)

Adresse(s) email	Antoine Manzanera <antoine.manzanera@ensta-paristech.fr>
Autres intervenants et établissements	Henri Maître (Télécom-ParisTech), David Filliat (ENSTA-ParisTech)
Lieu principal d'enseignement	Orsay
ECTS	2.5
Nbr d'heures total	21
Cours	15
TD	6
TP	0
Objectifs	This course aims at providing students with knowledge and skills for image mining and content-based retrieval. This includes extraction of features from images, descriptors, classification and recognition methods (supervised and unsupervised), motion estimation, video segmentation, indexing, content-based retrieval in image and video databases.
Prérequis	
Language	English
Grade (MCC)	First session: 0.4*labs + 0.6*final exam Second session: 0.4*original labs + 0.6*final re-exam

UE: Factorization-Based Data Analysis

Titre UE	Factorization-Based Data Analysis
Responsable(s) (Etablissements)	Umut Simsekli (Telecom ParisTech)
Adresse(s) email	umut.simsekli@telecom-paristech.fr
Autres intervenants et établissements	
Lieu principal d'enseignement	Telecom ParisTech

ECTS	2.5
Nbr d'heures total	21
Cours	15
TD	6
TP	0
Objectifs	This course will give an introduction to matrix and tensor factorization models. These models provide a unifying view of a broad spectrum of techniques in machine learning, data mining, and signal processing. Thanks to their generic nature, these models have proven very successful in several application fields such as topic modeling (text processing), link prediction (recommendation systems, social media analysis), and audio/music signal analysis. The aim of this course is to establish the mathematical foundations of factorization-based approaches and to develop estimation algorithms that can scale up to modern data science problems. The course will be self-contained; however, the students are expected to have basic knowledge on linear algebra and machine learning/optimization. Basic probability theory and coding in Matlab and C/C++ would be a plus but not mandatory.
Prérequis	
Language	English
Grade (MCC)	First session: 0.4*labs + 0.6*final exam Second session: 0.4*original labs + 0.6*final re-exam

M2, S1P2: Mandatory Softskill Courses

UE: Softskills Seminar

Titre UE	Softskills seminar
Responsable(s) (Etablissements)	Fabian Suchanek, with all other lecturers
Adresse(s) email	fabian@suchanek.name
Autres intervenants et établissements	All
Lieu principal d'enseignement	Plateau
ECTS	2.5
Nbr d'heures total	21
Cours	3
TD	18
TP	0
Objectifs	In this module, students will get the opportunity to practice their English speaking skills as well as various soft-skills such as presentation techniques, team work, discussion or debating techniques. After introductory classes to these topics, students will prepare presentations (not necessarily limited to slideshows) on scientific papers, with the goal of explaining the scientific contributions to non-computer scientists in an understandable, accurate, but entertaining way.
Prérequis	None beyond the prerequisites of the program itself.
Language	English
Grade (MCC)	First session: 50% presentation + 33% report + 17% oral participation Second session: 50% presentation + 33% report + 17% original oral participation

UE: Introduction to research and business

Titre UE	Introduction to research and business
Responsable(s) (Etablissements)	Emmanuel Waller (Paris-Sud)
Adresse(s) email	Emmanuel.Waller@lri.fr

Autres intervenants et établissements	
Lieu principal d'enseignement	Orsay
ECTS	2.5
Nbr d'heures total	21
Cours	10.5
TD	10.5
TP	0
Objectifs	This module corresponds to the course "Formation à la recherche / à l'entreprise" of the French education system. It teaches general softskills in preparation for the master's thesis or the internship.
Prérequis	
Language	English
Grade (MCC)	<u>First session:</u> business plan oral presentation (50%), research paper oral presentation (40%) and written summary (10%) and weekly preparatory homework <u>Second session:</u> business plan oral presentation (50%), research paper oral presentation (40%) and written summary (10%)