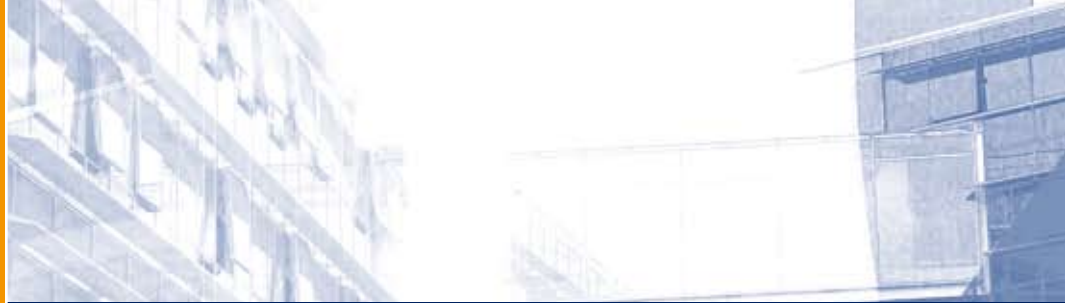


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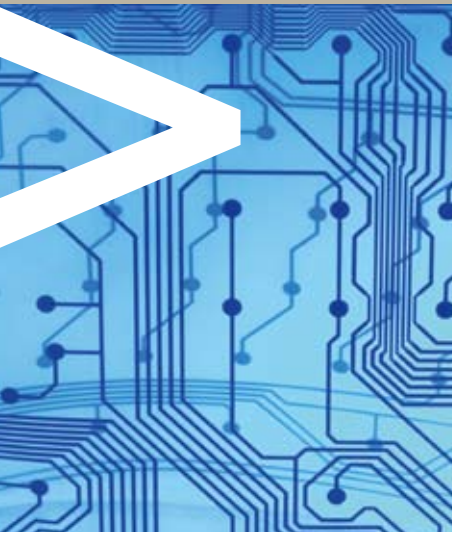
GIPAD

**Computer Science
for Decision Support**



ECOLE DES MINES DE NANTES

The GIPAD option



Decision making processes in business are becoming increasingly complex. There is so much data involved and the human and financial issues are so important that information technology has become a strategic tool. Decision support systems that manage and report data are already common in business. Today powerful new analytical and optimization methods automatically extract knowledge from data. The GIPAD option trains engineers who can design and implement intelligent decision support systems, from data processing to decision analysis.

> Career Opportunities

Intelligent decision support systems are crucial in both manufacturing and service sectors such as transportation, telecommunications, fabrication, finance, health care, energy and electronics.

Decision support systems development can be done in-house, when businesses handle sensitive strategic information, or can be outsourced.

GIPAD engineers can join:

- **IT R&D units of major companies**
- **Software publishers**
- **General or specialized IT consulting firms**

> Jobs for Tomorrow and the Future

Decision support jobs involve two main activities – analyzing client requirements and designing and implementing the IT solution – that are performed in the context of team projects.

Typically, GIPAD engineers start out as design and development engineers, and then quickly move into expert jobs such as analysts, consultants or research engineers with a technical specialty (optimization and operations research, data mining, business intelligence). Decision support has a wide range of applications, so engineers can also focus on a specific domain (finance, logistics).



Sophie Demassey,
Program Head.

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“Thanks to the general training they receive in the program, GIPAD engineers can work in the wide range of domains where intelligent decision-support systems are used. Moreover, in this option they acquire cutting-edge scientific and technical skills both in analysis and development, and are operational at all stages of the decision-support process.”



> The Program

At the end of the common core, during which the students consolidate what they have learned and acquire the fundamentals of the new technologies, the first year of specialization focuses on artificial intelligence, operations research, software engineering and IT project management.

During the second year of specialization, the students acquire more advanced skills in these areas, by using them in an application context. These techniques will then be placed in perspective in the global decision-making process.

■ The scientific and technical curriculum is built around this process:

- Upstream, the activities specific to performance management (*business intelligence*): Data collection, integration and warehousing; processing and analysis (interactive visualization and data mining)
- Downstream, the activities specific to process management (*scheduling, configuration*) that produce and assess the effectiveness of decisions: Combinatorial optimization (operations research and constraint programming)

■ Students also learn how to manage IT projects in business:

- software technologies: architectures, quality, testing, human-computer interaction
- social and management sciences: business organizations and change management

■ Finally, all of the knowledge is put to use in the option project:

- team project to develop a software solution for a specific industrial optimization problem, from the functional analysis of the problem through to delivery of the product.

INTELLIGENT DECISION-SUPPORT SYSTEMS

Understanding the decision-making process

Characterizing and modeling a decision-making problem

Characterizing and applying solution techniques

Combinatorial optimization

Data mining and Business Intelligence

INFORMATION TECHNOLOGY PROJECT MANAGEMENT

Organizing and managing a project

Modeling and designing software architecture

Developing, integrating, testing

Documenting, writing, presenting

Science and technology watch

BUSINESS AND MANAGEMENT

Understanding customer requirements

Analyzing the impact of change and innovation

Working in an international context

> Beyond Borders

Because it is a global issue, decision support offers numerous career opportunities abroad. Constraint programming, which was developed in France, has spread throughout the world in the past ten years. Double degree programs have been set up with several partner institutions, including Ecole Polytechnique de Montréal, Georgia Tech (Atlanta), Universidad de los Andes (Bogotá) and Shanghai Jiao Tong University.



> Double degrees



“Real IT engineers”

Étienne Gaudin, director of e-lab,
the IT research group at Bouygues

“We took on two students for their graduate project at e-lab, which works for all the Bouygues companies. Starting with a specific problem, each one had to propose a solution that was also a generic software product. Jean-Sébastien Brunner worked on a search engine to explore a database on Bouygues Construction experts. Guillaume Lutton designed and evaluated algorithms for scheduling subcontractors (plumbers, electricians, painters) at construction sites. The solution was never really defined at the start. They had to explore different avenues, implement them, compare the results, refine, correct, optimize performance, and finally package the entire solution to create reusable products. They were both real IT engineers who were able to develop and propose solutions, and implement and use test protocols. They were able to work independently and make valuable proposals. But above all, beyond their project management skills, which all schools rightly emphasize, they were extremely good at their core technical competencies, which are often neglected.”

> Research

Intelligent decision support raises new challenges for which cutting-edge scientific techniques are developed at research labs throughout the world. Because of the applicative nature of the field and its considerable impact, academics and businesses work together to further research in intelligent decision-support tools.

The GIPAD option is supported by the Constraints research group (<http://www.emn.fr/x-info/ppc/>). This group is affiliated to LINA (UMR CNRS 6241) and is one of the most important in the field, with strong industrial links.

Opportunities exist for students to pursue a research orientation (MSc/PhD) in optimization.



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