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| <SM601I> - <Graph Theory> | | | | | | | | |
| **Année** | 2019-2020 | | **Semestre** | | S6 | | **Coef/ECTS** | 2/5 |
| **Parcours** | Sciences | | | | | | **Langue** | Anglais |
| **Enseignant(s)** | KASSEL, Helen; VELIKSON, Boris | | | | | | | |
| **Volume horaire** | **CM** | 10,75 | **TD** | 10,75 | **PRJ** | 7 |  |  |
| **Évaluation** | **DE** | 0,6 | **PRJ** | 0,4 |  |  |  |  |

### Résumé

Modeling by graphs is a powerful tool used in many domains and in an enormous number of daily used applications, like searching for an itinerary in Paris underground, searching for best routes in “Via Michelin”… This course aims at allowing the students to learn how it is possible to model various problems in terms of graphs. It contains a theoretical study of the bases of Graph Theory as well as a study of major algorithms used in various applications: searching for shortest paths (Dijkstra, Bellman, and Floyd algorithms), scheduling algorithms (MPM), minimum spanning trees (Kruskall and Prim methods).

### Learning Outcomes

By the end of the course, the students will be capable to:

* Model with the aid of graphs logical/mathematical/practical problems
* Explain concepts seen in the course (paths, circuits, degrees, predecessors, successors, multivalued function, inverse multivalued function…)
* Represent a graph by its adjacency matrix / incidence matrix / adjacency list.
* Explain the functioning of algorithms seen in the course and exercise sessions: Roy-Warshall, Dijkstra, Bellman, search for the rank, Floyd, scheduling algorithm, Prim, Kruskal, and apply those algorithms to concrete examples.
* Develop a project based on one of those algorithms.

### Plan

* Introduction to the terminology used in Graph Theory (vertices, directed and undirected edges, circuits, multivalued function …)
* Various representations of graphs
* Search for the presence of cycles
* Search for shortest paths
* Scheduling graphs and calendars
* Trees and Spanning Trees of minimum weight minimum

### Grading

A final exam (1h45) and a project grade

### Prerequisites

Algorithmics – Programming in any imperative language

### Keywords

Directed graphs, undirected graphs, paths, cycles, degrees, adjacency matrix, connectivity, ranks, , circuits, degrees, adjacency matrices, Breadth First Search, Depth First Search, Dijkstra’s algorithm, Bellman’s algorithm, Floyd’s algorithm, Kruskal’s algorithm, Prim’s algorithm, scheduling

### Course Materials

Lecture course (PDF or PPT), Exercise sessions, software: a functioning CodeBlocks for C/C++ with conio.h and windows.h libraries, Java Eclipse, Anaconda

### Bibliography (in French)

* Christine FROIDEVAUX, Marie-Claude GAUDEL, Michèle SORIA, *TYPES DE DONNEES ET ALGORITHMES*, EDISCIENCE international
* AHO, HOPCROFT & ULLMAN, *Data Structures et Algorithms*, Addison-Wesley
* AHO, HOPCROFT & ULLMAN, *The design and Analysis of Computer Algorithms*, Addison-Wesley
* BERGE, *Graphes*, Gauthier-Villars
* GONDRAN & MINOUX, *Graphes et algorithmes*, Eyrolles
* LACOMME, *Algorithmes de graphes*, Eyrolles

### Langue d’enseignement

English

### Divers