Métodos de Apoio à Decisão
Assignment 3: *Examination Scheduling Problem*

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In this assignment, questions will be based on the following statement. At the time of submission, during the practical classes dedicated to that purpose, there will be a set of questions in Codex*, with the lab's computers configured as in previous classes. The AMPL textbook and the slides for this course will be available for reference.*

You can use the AMPL extensions for constraint programming and/or support for logical constraints. References on constraint programming in AMPL will also be available on the course unit's pages.

Exercise 1

After completing your course, together with some colleagues, you decided to create a company called EXbytes, with the objective of providing optimization services for academic activities, aiming to attract the main Portuguese universities as clients. One of the problems you will manage is exam scheduling, which frequently leaves students dissatisfied due to having exams on consecutive days, or even on the same day.

The main data for this problem consists of a list of students, for each of whom the set of subjects/exams they intend to take is provided, as in the following example.

```
Student Exams
  1     1 2 3 4 5
  2     1 4 5
  3     1 4 5 6
  4     1 4 3 5 7
  5     2 4 6 7
  6     3
  7     2 4 5 7
  8     1 2 4 5 6 7
  9     2 3 4 5
 10     6 7
```

Exercise 1.1: Consider the problem of avoiding overlaps (two or more exams on the same day/period). For this data, determine the minimum number of periods that allows for a schedule without overlaps.

(Suggestion: write a model that, for a given number of periods, determines whether or not it is possible to create a schedule without overlaps; through trial and error, identify its minimum value.)

Exercise 2

The model from the previous exercise left some students dissatisfied, because even though they didn't have overlapping exams, they had several exams on consecutive days. Create a model that determines, for each student, the shortest interval (i.e., the smallest distance) between successive exams. Consider, in this exercise, that the number of available days/periods is given (for example, 10 periods).

Exercise 2.1: Determine the solution that maximizes the sum, for all students, of the distance between the closest exams for each student. (If a student has only one exam, consider this value to be zero.)

Exercise 2.2: Determine the solution that maximizes the minimum value, among all students with more than one exam, of the distance between their closest exams. (If a student has only one exam, consider this value to be infinity.)