

Monitoring Students Performances in French Institutes of Technology using the ScoDoc Software

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Abstract—French University-based Institutes of Technology (IUT¹) are a major player in France's superior educational system. IUTs provide technical university education, preparing students to careers in the industry and services. The main diploma is called DUT, *Diplôme Universitaire de Technologie* [2].

Designed to train mid-level technical staff in 2 years, IUT programmes also allow graduated students to pursue their studies with a more advanced degree, such as a *licence professionnelle* [4].

IUT students have very different profiles: most of them are coming from high school (with scientific or technical majors), but a significant proportion come from foreign countries (mainly Africa), or from other university tracks.

Assessment of IUT students relies on continuous evaluation: there are in principle no terminal exams, but series of tests, monitoring the acquisition of competences. At the IUT de Villetaneuse (Université Paris 13 - Sorbonne-Paris-Cité), we started more than ten years ago to design a dedicated information system to gather all available information concerning our students: personal data, results at all tests and exams, assiduity, orientation decision. This system, implemented in the open-source free software ScoDoc (<https://trac.lipn.univ-paris13.fr/projects/scodoc>) monitors the progression of all students and raises alarms when some special pedagogical action should be taken. It is widely distributed and used in other French universities, and is well-suited to handle the complex national regulations for semesters validation in IUTs.

Prevention of student difficulties requires action from the pedagogical team: it could be as simple as talking to an individual student to discuss his personal situation, or as complex as detecting an homogeneous group of students sharing similar problems and proposing them an ad-hoc remediation plan (such as tutoring, personalised learning plan, or ad-hoc learning module).

ScoDoc software system is intended for being used by the pedagogical team as well as by the students. Indeed, students can access their marks summary at all times, and be informed of new marks as soon as they are entered in the system. They thus can monitor their performances and ask advice from the teachers for a better progress.

Teachers can be assigned different roles according to their responsibilities in the organisation of studies. All of them can enter notes on a student in order for the pedagogical team to easily track past difficulties. Those involved in a specific course can enter their marks concerning this course, while the head of studies for a particular year or semester can also prepare

summaries for the class of students they are in charge of. This is not only necessary for the validation of semesters, but also at any time to have a synthetic view of the class performance, pointing out difficulties in some subjects or of a group within the class.

This paper is organised in three parts: first, we present the French IUT system and describe its peculiarities, insisting on the evaluation of the students. In section 2, the main features of the ScoDoc software are briefly presented. In section 3, we discuss how ScoDoc can be used to prevent student difficulties. Finally, in section 4, we discuss some future perspectives, such as the integration of more sophisticated predictive analytics technologies to enhance the relevance and accuracy of student real-time characterisation.

I. CONTEXT

The 113 French University Institutes of Technology (IUT — *Institut Universitaire de Technologie*) provide technical education spanning over four semesters of studies (DUT — *Diplôme Universitaire de Technologie*), as well as technical bachelor with two additional semesters (*Licence Professionnelle*). They are organised in teaching departments covering 23 different subjects ranging from humanities to sciences.

A. Main studies characteristics

These institutes differ from traditional university curricula in several ways:

- they offer a national diploma delivered according to a *national programme of studies* that is periodically revisited;
- students admission is subject to a *selection* according to their performance in high school;
- *attendance* to lectures, exercise courses and hands-on sessions is *mandatory*;
- 1,600 to 1,800 hours of *classwork* are delivered to students, with a particular focus on *practical sessions*;
- *examinations* take place all year long (as opposed to final exams), therefore there is no second session proper;
- beside regular lecturing and examination, students have to perform a *10-weeks internship* within a professional environment.

¹<http://www.campusfrance.org/en/page/short-programs>

B. Success conditions

The success to a semester is subject to rather complex and strict *conditions stated in a national decree*. For a better understanding of these conditions, it is necessary to describe the structure of a semester curriculum.

During each semester, *modules* constitute the basic unit for courses. Their length is typically 30 hours, but can also be 45 or 60 hours. The *periodic examinations* can take different forms: standard written exam, marked practicals' reports, oral presentation, etc.

The *number of exams*, of marked sessions, or any evaluation of students, as well as their respective weight, are subject to the appreciation of the teaching staff in charge of the module.

Modules are grouped within *Teaching Units* (UE — *Unité d'Enseignement*), which are generally consistent large-grain areas. For example, in the Networks and Telecommunications departments, it is general knowledge (mathematics, English, etc.) and technical proficiencies (electronics, informatics, etc.) Each module has a weight within its own teaching unit.

In order to pass, a student should obtain a global weighted mean of marks (given out of 20 in France) greater than 10, and each of the weighted means for the teaching units should be greater than 8. When these conditions are not met, the semester can still be validated *by compensation* with either the previous or the next semester: the global mean of both semesters must then be greater than 10 while the requirements for each individual teaching unit must still be satisfied. Note that a semester can be used to compensate either the previous one, or the following one, but not both.

Otherwise, the end of semester jury can decide the students performed sufficiently well for the semester to be granted. In any other case, it is failed, and only two fails over the complete curriculum are admitted. The jury can also decide immediately the student should be re-oriented to another kind of studies.

If a student has to take again a semester, all teaching units above 10 are still considered valid and the corresponding credits defined by the *European Credit Transfer System* (ECTS) are capitalised. Therefore, the student can either keep his marks in these units or decide to take them again, in which case the best mean is taken into account.

Since attending all kinds of courses is mandatory, the jury can decide an often absent student fails to meet this requirement and not grant the semester, or more often postpone the decision until appropriate behaviour, even if the marks are sufficient.

II. SCODOC FUNCTIONALITIES

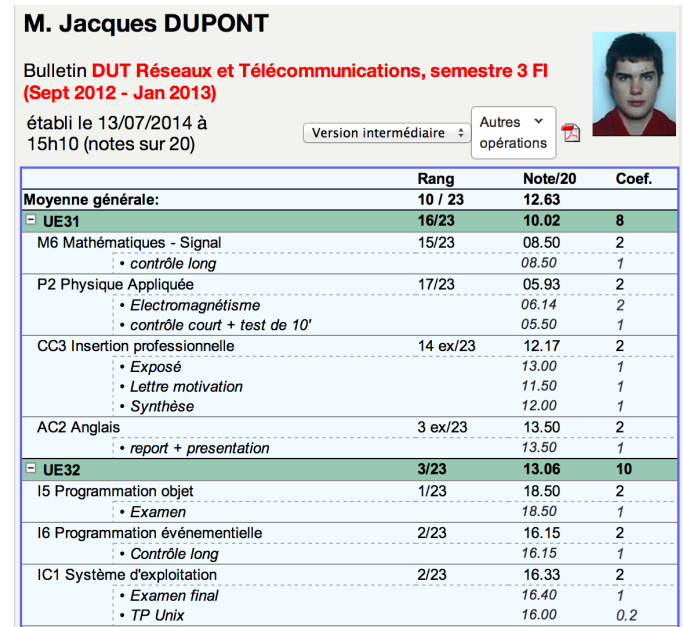
We started, at the IUT de Villetaneuse, more than 10 years ago, to design an adapted information system [5]. It is now distributed as the free software ScoDoc². It is now used by more than 100 departments in 32 IUTs. The code is written in Python and the data stored in a relational SQL database (postgresql). ScoDoc is designed to work as a standalone Web server, and can be integrated with other components of

the institutional information system through Web services. In this section, we briefly describe the main functions of the software from the users' point of view, without entering in the implementation details.

A. Easy access for all

ScoDoc allows for easing the work of all actors in the academic system, i.e. the administrative staff, the teachers, but also the students, by providing an easy to use web access.

The web interface allows for online access to everybody from everywhere, i.e. not only at the university but also at home or abroad, which is extremely convenient for teachers to enter the marks anytime. Similarly, students access their transcripts from home and can see any new mark as soon as it is entered in the system (Fig. 1).



	Rang	Note/20	Coef.
Moyenne générale:	10 / 23	12.63	
UE31	16/23	10.02	8
M6 Mathématiques - Signal	15/23	08.50	2
• contrôle long		08.50	1
P2 Physique Appliquée	17/23	05.93	2
• Electromagnétisme		06.14	2
• contrôle court + test de 10'		05.50	1
CC3 Insertion professionnelle	14 ex/23	12.17	2
• Exposé		13.00	1
• Lettre motivation		11.50	1
• Synthèse		12.00	1
AC2 Anglais	3 ex/23	13.50	2
• report + presentation		13.50	1
UE32	3/23	13.06	10
I5 Programmation objet	1/23	18.50	2
• Examen		18.50	1
I6 Programmation événementielle	2/23	16.15	2
• Contrôle long		16.15	1
IC1 Système d'exploitation	2/23	16.33	2
• Examen final		16.40	1
• TP Unix		16.00	0.2

Fig. 1. Example: part of marks transcript published on the student's Web space.

B. Users and authorisations

Such web access requires *enforced security*, in particular to avoid any tempering. To ensure this, users connect with a username and password, and their account is declared as part of a group with the appropriate right level. Thus, students can only access their own transcript, standard teachers can modify the data for the courses they are in charge of and read all information, while head of studies access the full year they are concerned, and the head of department all data.

In order to further enhance the security and at the same time improve the students' experience, their access is usually granted through a separate Website: the transcript publication and related access control is delegated to the University's Web portal. This portal is easy to interface with ScoDoc through Web services. Students thus connect to only one place to get access to all related services (timetables, marks, bibliographies, miscellaneous information published on the University's Intranet).

²<https://trac.lipn.univ-paris13.fr/projects/scodoc>

C. Handling several curricula

As several curricula are delivered, ScoDoc stores the list of all modules in all semesters with their coefficient. This description can be updated by the head of department, in particular when the national programme changes. Such a list is presented in Fig. 2, where we can also see, for each module, the number of students registered and the name of the teacher responsible.

UE	Code	Module	Coef.	Inscrits	Responsable
UE31	M6	Mathématiques - Signal	2.0	23	larcher
UE31	P2	Physique Appliquée	2.0	23	boucheffa
UE31	CC3	Insertion professionnelle	2.0	23	vervel
UE31	AC2	Anglais	2.0	23	lambe
UE32	I5	Programmation objet	2.0	23	evangelista
UE32	I6	Programmation événementielle	2.0	23	kanawati
UE32	IC1	Système d'exploitation	2.0	23	Viennet E.
UE32	E4	Systèmes bouclés	4.0	23	chakaroun
UE33	TR1	Modulations	2.0	23	peychet
UE33	TR2	Technologies de l'Internet	4.0	23	coti
UE33	TR3R	Réseaux étendus (Réseaux)	3.5	23	senoussaoui
UE3S	CISCO3	CISCO	1.0	3	lafont
			28.5		

Fig. 2. Example: description of a semester.

When a new semester starts, the concerned head of studies creates a copy of the programme, specifying for each module which teacher is responsible. He registers the students in the system (this step is synchronised with the tool for registration at the university).

D. Lists and groups of students

The head of studies also splits the set of students into smaller groups for exercise courses and practical sessions. These groups can then be used by teachers to monitor the attendance at their courses and track absences of students.

ScoDoc facilitates knowing new students by providing lists with photos, as shown in Fig. 3.

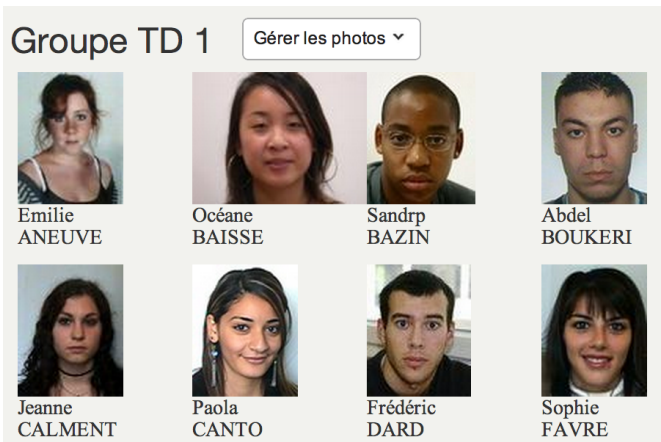


Fig. 3. Example: list of students with photos.

E. Absence to courses

An *absent* student can have a valid reason for not attending (e.g. he was sick). In such cases, students must provide

evidence (e.g. doctor's certificate). Then the secretary notes the absence was justified. This allows for making the difference between admitted and not admitted absences.

F. Managing exams in a module

Finally, a teacher responsible for a module can register exams, creating the corresponding empty sheet, with its coefficient within the module, the list of other teachers participating (so as to allow them to enter their marks), the total number of points of the examination (which is then presented as out of 20 in all documents). This last feature is particularly convenient in particular if the exam is too long, and totalises a lot of points. It is then possible to fine-tune the set of marks only by changing the number of points associated with the examination. Fig. 4 presents the summary of information for a module comprising a single exam.

Module M6 Mathematics for Signal Processing

Responsable: Martin F. (martin) [modifier](#) Bonaparte N. [modifier les enseignants](#)

Semestre: 3 **Coef dans le semestre:** 2.0

Formation: DUT Réseaux et Télécommunications

Inscrits: 23 étudiants
règle de calcul standard ([changer](#))
[Absences](#)

1 évaluations : Afficher les groupes de TD [Voir toutes les notes](#)

[Créer nouvelle évaluation](#) [Trier par date](#)

Le 16/10/2012 de 13h30 à 16h30 **Intermediary exam** (dernière modif le 22/10/2012 à 14h04)

	Durée	Coef.	Notes	Abs	N	Moyenne (prise en compte)
actions	3h	1	23 / 23	1	0	09.83 / 20
						Groupe A 08.23 (11 notes)
						Groupe B 11.29 (12 notes)

[Créer nouvelle évaluation](#) [Trier par date](#) [Gérer les inscriptions à ce module](#)

Fig. 4. Description of a module, with one evaluation (exam).

III. MONITORING STUDENTS WITH SCODOC

ScoDoc provides facilities to track how:


- students performances meet requirements (Fig. 5);
- tracking of complete cursus, including admission data (Fig. 6);
- behaviour (comments on students' files) (Fig. 6);
- marks are distributed for an individual student (Fig. 8) or for the whole class (Fig. 5);
- students are registered in specific groups (Fig. 7);
- students comply with assiduity requirements (Fig. 9);
- students' cohorts perform in the cursus (Fig. 10).

ScoDoc gives a synthetic view of the results of all students, as shown in Fig. 5. Marks in green denote that the general mean or the corresponding Teaching Unit requirements are satisfied, while those in red are below the threshold for the semester.

16	DUCLOS Ge.	A	10.92	11.35	08.50	13.09
17	BISMUTH Pa.	A	10.54	10.68	07.86	13.23
18	BERLU Si.	B	10.49	11.94	07.86	12.04
19	LUSSON Om.	A	10.31	09.38	09.76	11.66
20	POTIES Ma.	B	09.93	09.46	09.34	10.94
21	SAMPAN Ba.	B	08.71	07.88	07.29	10.90
22	GISCARD Va.	B	08.67	07.21	07.05	11.60
23	PLOT Ni.	A	07.62	06.38	06.04	10.32
	Min			06.38	06.04	10.32
	Max			15.40	14.90	15.78
	Movenness		11.58	10.99	10.39	13.25

Fig. 5. Table with weighted means in the Teaching Units.

Staff has access to detailed data concerning each student (see Fig. 6). It shows personal contact addresses, the different semesters that have already been attended and the corresponding results, admission information (type and year of Baccalaureate). Moreover, teachers and administrative staff can add annotations, such as specific situations or behavioural issues.

Eudiant ▼


M. Paul BISMUTH (ancien)

paul.bismuth@example.com

Situation : ancien élève
Né le : 06/01/1990
Adresse : 4, rue du Tonneau 75001 Paris [modifier adresse](#)
Tél.: 01 02 03 04 05

Parcours		Semestre	Etat	Abs
1	Sept 2011	DUT Réseaux et Télécommunications, semestre 1 FI 2011 - 2013	ADM	
2	Jan 2012	DUT Réseaux et Télécommunications, semestre 2 FI 2012	ADM	
3	Sept 2012	DUT Réseaux et Télécommunications, semestre 3 FI 2012- 2013	ADJ	UE31 UE32 UE33
	Jan 2013	groupe A Scolarité ▼	10.54	16 10.68 07.86 13.23
4	Jan 2013	DUT Réseaux et Télécommunications, semestre 4 FI 2013	ADM	UE41 UE42 UE43
	Jul 2013	groupe B 📱	11.39	12 10.73 10.83 13.20

Informations admission
 Bac SCIENTIFIQUE (SVT M) obtenu en 2009

Fichiers associés
[ajouter un fichier](#)

Annotations
 Le 13/07/2014 par **Le juge** (admin) :
 Téléphone mis sur écoute.

Fig. 6. Page showing the most important personal information about a student.

A radar graph (Fig. 8) displays a synthetic view of a student's weighted means in all modules. The teachers can thus easily detect students' strengths and weaknesses, and recommend them specific actions. Among these actions, tutoring is set for small groups of students. Hence, only part of the students (those really in need of such support) are registered to the tutoring scheme (Fig. 7).

Similarly, the table in Fig. 5 can be unfolded to display all individual modules. At the bottom of the table, the means, maximal and minimal marks obtained by students provide teachers with feedback on how the class performed for a particular course.

As attending courses is mandatory, teachers and staff can easily access students' absence calendar, as shown in Fig. 9. Absences are registered by half-day (morning and afternoon). Those displayed in pink have been excused, while those in red have not.

Etudiants sans groupe (15) <ul style="list-style-type: none"> M. Ismail BALAHEN (\$4) M. Mostapha BOUDJRAF M. Sofiane BOUHAZA M. Bastien CHARLES M. Mehmet DEMIR M. Mamadou Oury DIALLO M. Moussa DIARRA M. Georges DUCLOS M. Faouzi ESSAKAKI M. Elhadji Mamadou KHARMA M. Alexis LOISON M. Abderrahman MEJD Mme Diaw NIANG M. Basil SAMPAN M. Ahmad SHEKH OMAR 	Groupe Math+ (3) <ul style="list-style-type: none"> M. Silvio BERLU M. Paul BISMUTH M. Kevin DACALOR Groupe Informatique (4) <ul style="list-style-type: none"> M. Jacques DUPONT M. Valéry GISCARD M. Omar LUSSON M. Nicolas PLOT Groupe Anglais (2) <ul style="list-style-type: none"> M. Boubacar DABO M. Marc POTIES
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Fig. 7. Registration of students to groups dedicated to specific tutoring activities.

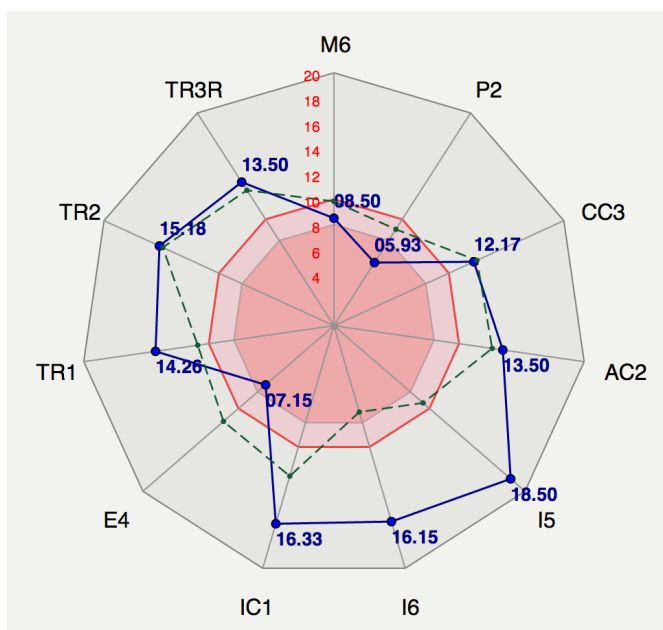


Fig. 8. Synthetic representation of a student weighted means in all modules.

Finally, ScoDoc provides tools for cohorts analysis. The graph in Fig. 10 summarises the paths of a set of students (a cohort) who all entered at the same time in a course. This data can be exploited to detect anomalies or assess the efficiency of options proposed to the students.

The example in the figure shows that out of 45 students that entered semester 1 of the academic year 2010–2011, 40 continued in semester 2, while 5 did quit these studies (Dem in the figure standing for *Démissionnaire*). Out of the 40 students in semester 2, 9 failed and started from semester 1 again, 8 passed in semester 3, 3 continued as apprentices in semester 3 (i.e. were working part time while continuing their studies) and 3 did quit. The other 17 were not authorised to continue or take the courses again.

This graph is very informative. It tells the situation of students all entering at the same time (so there are more students in the class, adding those that entered the previous year and have to take the semester again). It also shows that the group of apprentices contains very few students that are successful during their first year (we propose this type of

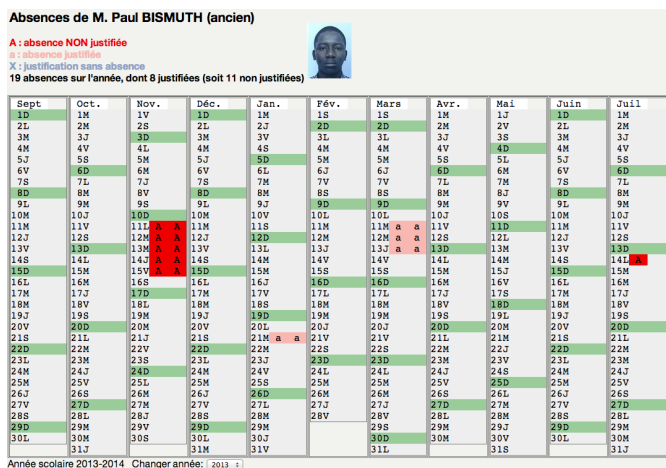


Fig. 9. Calendar showing absences of a student.

curriculum only for the second year). It thus constitutes a good means for students facing personal difficulties (in particular financial ones) to carry on studies and obtain a diploma.

IV. DISCUSSION

The current system is intensively used by all teachers, as it responds to the need to have a single place gathering all the data about the students' schooling. It handles a database with a growing amount of interesting data about our students. These data can be analysed to obtain useful information at multiple levels:

- 1) at the individual student level, it helps to spot learning difficulties or weak subjects in real time, and allows both the student and the teachers to react quickly (e.g. by proposing additional courses, tutoring, or by helping him/her to better organise his/her homework).
- 2) at the curriculum level, the analysis of the information from several institutions and/or across several consecutive years can help to identify problems in the syllabus: recurrent blocking points in some modules, for instance. This can be invaluable when revising the national curriculum to keep it up-to-date w.r.t. new technologies and industry demands.
- 3) the data could also be used to build a predictive analysis system: one important objective is to help anticipate individual student's difficulties by processing their current data. This could be done applying a machine learning approach: a statistical model [3] is built by considering how the former students performed. The input of this model is a vectorised representation of the personal student's data (age, gender, income level, kind of scholarship, secondary education, and so on³) together with all marks collected in our system. The predicted output can be, for instance, the probability to validate the next semester. Another objective could be to classify the students using unsupervised clustering [1]: such approaches allow for grouping together students with similar

profiles, or following similar paths in the pedagogical system, or even students who did face the same kind of difficulties.

In order to be used in foreign countries, the ScoDoc software system should also be internationalised (translation of the messages) and extended to handle different kinds of curricula.

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³French regulations do not allow us to collect and use data on ethnic/cultural origins.

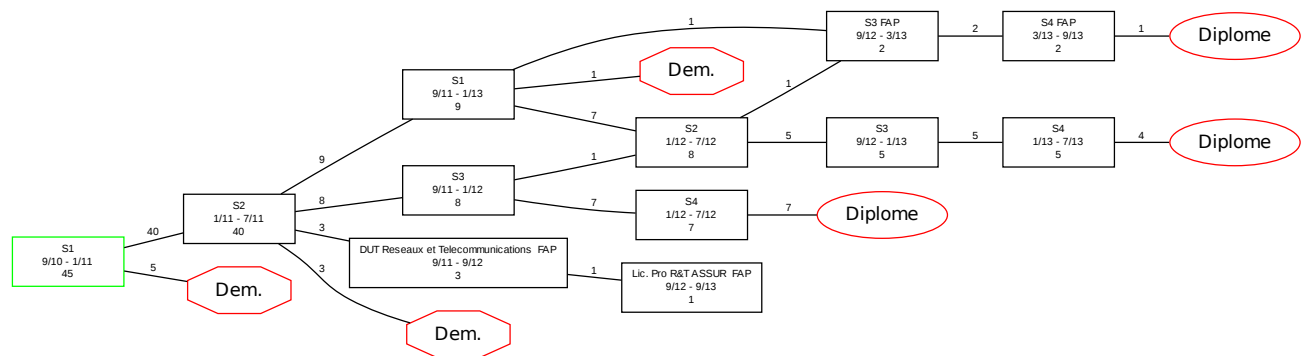


Fig. 10. Cohort analysis.