POLITÉCNICA

UNIVERSIDAD POLITÉCNICA DE MADRID

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History of Algorithms: An e-learning free election subjet, in a classical university

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Overview

- Introduction
- Designing the subject
- Results of the experience
- Conclusions

E-learning in traditional universities

- E-learning: education through communication networks.
- On-line support to the classroom teaching or distance courses.
- *OGLET(Oferta Global de Libre Elección por Telenseñanza)*, Universidad Politécnica de Madrid: More than 130 e-learning or b-learning subjects.
- *Institutional distance learning Platform* (UPM).

The Subject: History of Algorithms

- Born in 2007, as a face to face subject, in a specific title of *Expert on Algorithms*.
- 2009-2010: *OGLET* (e-learning) with 3 ECTS and 30 places.
- 2010-2011: 20 places.
- A free election subject conducted on-line for engineering students of UPM.

Why this subject?

- The subject is about the invention and analysis of algorithms.
- Although algorithms are independent of Informatics, their study becomes more relevant from the mid-twentieth century in relation to the development and use of computers.
- The ability to invent and improve algorithms is a specific competence of any engineer.
- The study of the history of a discipline fosters a deeper understanding of their techniques.
- Algorithms are a "heritage" of humankind.

Designing the subject

- Competences and learning outcomes.
- Learning activities.
- Schedule.
- Assessment.
- Quality protocol.

There are good books and documentation about HA. But we did not find similar courses at other universities

Competences

- Specific: Initiation to algorithmic techniques, based on their historical precedents.
- Generic: Self-learning.
  Use of technology.
  Information Management.
  Critical thinking.
  Writing scientific papers.

General learning outcomes

1. Understand the concept of algorithm and analyze various algorithms from a historical perspective.
2. Understand the idea of algorithmic process and know the circunstances that led to the birth of computability.
3. Know how certain problems have been addressed from different points of view, combining known techniques and new algorithms.

Course contents: Four Modules

1. Algorithms before computers.
2. The birth of the computability. The limits of what can be computed.
3. From Algorithms to Programs.
4. Improved efficiency: Different algorithms for the same problem.

On–line Methodology

Time:

3 ECTS = 75- 80 hours of student work

Activities:

- Displaying presentations
- Reading documentation
- Looking for algorithms
- Replying on-line questionnaires
- Developping projects (written reports, presentations,…)
- Writing in the Forum

Material:

A "**Tutorial**" for each module, with different files.

Plataforma Moodle

Material de cada tema

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Tema 1.- Algoritmos previos a la aparición del computador

- Foro de consulta y Debate. Tema 1
- Página de la profesora
- Guía de aprendizaje del Tema 1
- Planificación y fechas de entrega de las actividades del Tema 1
- Presentación Tema 1 (para verla)
- Presentación Tema 1 (para imprimirla)
- Entrega del Trabajo 1: Sistemas de Numeración
- Entrega del Trabajo 2: Cálculo Mecánico
- Entrega del Trabajo 3: Resolución de problemas con solución algorítmica
- Lista de problemas para el Trabajo 3
- Cuestionario de objetivos básicos número 1
- Cuestionario de objetivos básicos número 2
- Cuestionario Final Tema1

Directed projects

TD 1.1	Old numbering systems
TD 1.2	Mechanization of calculation
TD 1.3	Problems with algorithmic solution
TD 2.1	Turing Test
TD 2.2	Turing machine
TD 2.3	Contributions and limitations of ENIAC
TD 3.1	Biographies
TD 3.2	A programming language
TD 4.1	Enigma machine
TD 4.2	Historical overview of sorting and searching algorithms
TD 4.3	Problems P and NP
TD 4.4	Algorithms and quantum cryptography

Descripción de la tarea TD 1.1: Sistema de numeración

Tarea	Elaborar una memoria sobre un sistema antiguo de numeración, a elegir entre: Babilónico, Egipcio, Ático, Jónico, Maya y el antiguo sistema Chino.
Tiempo estimado	4 horas
Plazo de entrega	Finaliza 8 de Marzo a las 23 horas
Forma de entrega	Documento Word (máximo 4 páginas)
Contenido de la memoria	1.Contexto histórico. 2.Descripción detallada del sistema elegido, con ejemplos (ejemplos obligatorios: escribir 1524 y el número formado con los tres últimos dígitos del DNI del autor). 3.Formulación de los algoritmos para sumar y multiplicar en el sistema elegido (ejemplo obligatorio multiplicar por 25 el número formado por los tres primeros dígitos no nulos del DNI del autor). 4.Referencias utilizadas y tiempo empleado.
Valoración	**5% de la nota final de la asignatura**

Questionaires

- BQ: **Basic Questionnaires** (Formative assessment activity) Each questionary has 20 questions (T/F). Each question is randomly chosen from two or three questions about the same goal. Feedback is provided. Each student can do two trials.
- FT: **Final Evaluation Test** conducted at the end of each module. All students simultaneously connected. Unique attempt, 10 questions, with three options in twenty minutes.

The assessment model

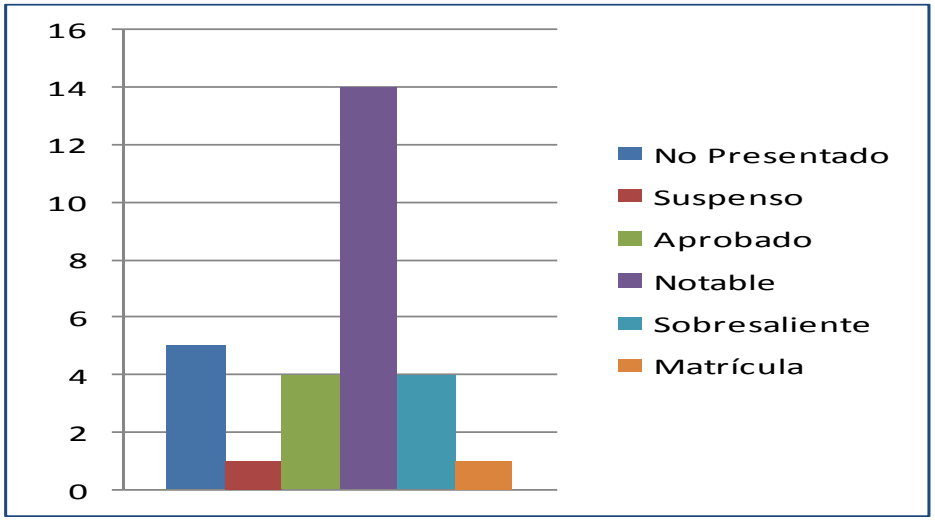
Formative and summative assessment

- Projects 58% (4% - 9% each project)
- CB 14% (2% each questionaire)
- CFT 20% (5% each questinaire)
- Forum 8% (2% each module)

To pass, it must obtain at least 5 points, with marks exceeding minimal values in some activities.

Alternative: Traditional examination

Students' grades 2009-10



Satisfaction (2009-10) 1--5

	T. 1	T. 2	T. 3	T. 4
Topics	4.2	4.0	4.1	4.2
Material	4.0	3.6	3.6	3.9
Presentation	4.1	4.1	4.0	4.0
Projects	3.9	3.9	4.2	3.9
Questionaires	4.2	4.0	4.1	4.0
Assessment	4.2	4.4	4.4	4.4

On-line Assessment

- Free election subjects are good for experimenting with a pattern of on-line assessment.
- We have not included authentication procedures.
- Students must do many activities, each one with a little weight in the final grade.
- Milestones are good for student discipline.
- Some issues: Plagiarism, delays, ...
- We have included different items for each student in many activities.
- For working, students use "our material" and "Google material".

Knowing that students use Google…

Inappropriate question	A more appropriate question
He lived in the XIX century a) Leibniz b) Babbage c) Turing	To factor a number N of 20 digits, with the successive divisions algorithm, the number of divisions in the worst case is: a) Less or equal than to 20 b) Less than 10^{10} c) There is no guarantee that the number of divisions required is finite

For CB no matter.

For the CFT should you have to do some reasoning.

Conclusions

- Satisfactory experience.
- An adequate "big picture".
- A lot of work for teachers.
- With good students, work is very motivating.

Thank you very much for your attention!!!

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