CA313 Algorithms and Complexity

	First 6 Weeks	Last 6 Weeks
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Course webpage:

http://www.computing.dcu.ie/~away/CA313

Recommended Texts: *"Elements of the Theory of Computation"*, H.R. Lewis & C.H. Papadimitriou, Prentice Hall, 1998 (2nd edition), [511.3/LEW]

"Introduction to the Theory of Complexity", D.P. Bovet & P. Crescenzi, Prentice Hall, 1994 [511.3/BOV]

"The Theory of Computation", B.M. Moret, Addison-Wesley, 1998, [511.3/MOR]

"Models of Computation", J.E. Savage, Addison-Wesley, 1998, [004/SAV]

"The New Turing Omnibus", A.K. Dewdney, Freeman & Co., 1989, [004/DEW]

Schedule

Lectures

Day	Time	Location
Mon	14:00	QG22
Tues	13:00	QG22

Assessment

Component	Weight
In-Class Tests	20%
End-of-year exam	80%

The in-class tests will take no more than 45 mins and will be regularly scheduled throughout the semester.

The exam in January will consist of 3 questions (probably out of a choice of 4 or 5).

What is this Course about?

"Computer Science is no more about computers than astronomy is about telescopes." - Edsger W. Dijkstra

- Building on CA215 Languages and Computability, in this course we will develop a framework to classify a program as tractable or intractable.

- A tractable problem has a *'fast'* algorithm that solves **all** instances of the problem.

- An intractable problem can only be solved in the worst case by *brute force* search.

Polynomial vs. Exponential

Assume we have a (slow!) computer than carries out 1MIPS. What are the running times (in seconds, unless otherwise stated) for (hypothetical) algorithms of different size inputs n?

	10	20	30	40	50	60
n	.00001	.00002	.00003	.00004	.00005	.00006
n^2	.0001	.0004	.0009	.0016	.0025	.0036
n^3	.001	.008	.027	.064	.0125	.0216
2^n	.001	1.0	17.9 mins	12.7 days	35.7 years	366 centuries
3^n	.059	58 mins	6.5 years	3855 centuries	2×10^8 centuries	1.3×10^{13} centuries

Note that the age of the Universe is estimated as 14×10^9 years ...

Course Outline

1. Basic Introduction
   - Mathematical Prerequisites
   - Chomsky Hierarchy
   - Turing Machines
2. Complexity Measures
   - the Class P
   - the Class NP