Algorithms for Computer Games

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Course syllabus

- credits: 2 cu
- prerequisites
  - fundamentals of algorithms and data structures (see Cormen et al., *Introduction to Algorithms*)
  - knowledge in programming (e.g., with Java)
- assessment
  - examination only (no exercises)
  - voluntary exercises can be arranged

Lectures

- Tuesdays and Wednesday, Auditorium, 2–4 p.m.
- September 9 – October 29
- exceptions
  - October 8 (Wednesday) lecture is held in Etäluokka
  - no lectures on week 42 (Oct. 14 & Oct. 15)
- total: 14 lectures (28 hours)

Examinations 1(3)

- examination dates (to be confirmed)
  1. November 24, 2003
  2. January 2004
  3. March 2004
- check the exact times and places at **http://www.it.utu.fi/opetus/tentit/**
- remember to enroll!

Examinations 2(3)

- if you are *not* a student of University of Turku, you must register to receive the credits
- further instructions are available at **http://www.tucs.fi/Education/ Information/regcredits.php**

Examinations 3(3)

- questions
  - based on both lectures and lecture notes
  - four questions, à 8 points
  - to pass the examination, at least 16 points (50%) are required
  - questions are in English, but you can answer in English or in Finnish

Web page

http://staff.cs.utu.fi/staff/jouni.smed/a4cg/

- news and announcements
- slides, code examples, additional material
- corrections to the lecture notes

Lecture notes

- J. Smed & H. Hakonen: *Algorithms for Computer Games*, 2003
- paper copies are distributed in the lectures
- no electronic version! (don't even ask)
- errata can be found in the course web page

Let's play a game: Bonus on grades

- find typos, mistakes, error, bugs, blunders
- suggest improvements
- first one to send gets point(s); check the existing errata!
  - if a tie or undecided, all get points.
  - the lecturer decides, what is rewarded. no appeals!
- student with most points gets 0.5 bonus on the grade
  - if a tie, all the best ones get 0.5 bonus.
- the next best three get 0.25 bonus on the grade
  - if a tie, all among the best three get 0.25 bonus.

Scoring

1 – a typo, a grammatical error or a mistake in spelling (please suggest a correction)

2 – a typo in equation or code

4 – a bug in code (unless intentional) or an improvement (unless unintentional)

8 – a serious flaw in the text or a serious improvement

16 – a flaw too serious to be fixed or a fix too serious to be flawed

Scoring (cont'd)

32 – a novel solution method

…

256 – a suggestion that can be relayed to D.E. Knuth

…

65536 – a ground breaking discovery

…

4294967296 – a total dismission of the course as a complete waste of time and paper (please elaborate)

How to submit erratum

- email to **jouni.smed@cs.utu.fi**
- use the subject prefix 'a4cg'
- give page and line numbers
  - negative line number indicates numbering from the bottom up
- list the errors and the possible corrections
- remember to include your full name and student number

  The small print: The submitted corrections can be used freely in the subsequent editions without further notice.

  (If you can read this, you don't need new glasses.)

Academic sources

- journals
  - *Journal of Intelligent Games & Simulation*
  - *Journal of Game Development* (forthcoming)
- conferences
  - Computers & Games (CG)
  - NetGames
  - Game-On Conference on Simulation and AI in Computer Games (GAME-ON)
  - Application and Development of Computer Games (ADCOG)

Practitioners' sources

- books
  - *Game Programming Gems* series (three volumes)
  - *AI Game Programming Wisdom* series (volume two forthcoming)
- journals
  - *Game Developer*
  - *Gamasutra*, **http://www.gamasutra.com**
- conferences
  - Game Developers Conference (GDC)

Intention

- to provide a glance into the world of computer games as seen from the perspective of a computer scientist

Contents

§1 Introduction
§2 Random Numbers
§3 Game Trees
§4 Path Finding
§5 Decision-Making
§6 Cheating Prevention
§7 Code Tweaking

§1 Introduction

- definitions
  - play?
  - game?
  - computer game?
- anatomy of computer games
- sought-after features
- outline of the course
  - notions & notations

Definition for 'play'

'[Play] is an activity which proceeds within certain limits of time and space, in a visible order, according to rules freely accepted, and outside the sphere of necessity or material utility. The play-mood is one of rapture and enthusiasm, and is sacred or festive in accordance with the occasion. A feeling of exaltation and tension accompanies the action, mirth and relaxation follow.'

— Johan Huizinga, *Homo Ludens*
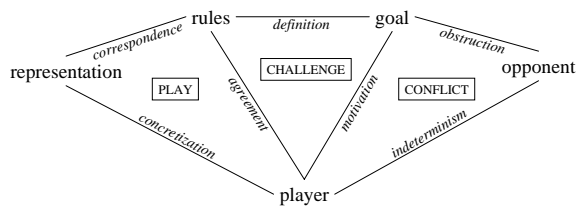
Definition for 'game'

'a universal form of recreation generally including any activity engaged in for diversion or amusement and often establishing a situation that involves a contest or rivalry'
— *Encyclopædia Britannica*

'Etymology: Middle English, from Old English *gamen;* akin to Old High German *gaman* amusement'
— *Merriam-Webster Dictionary*

Components of a game

- players: willing to participate for enjoyment, diversion or amusement
- rules: define limits of the game
- goals: gives a sense of purpose
- opponents: give arise to contest and rivalry
- representation: concretizes the game

Components, relationships and aspects of a game

rules — *definition* — goal

correspondence — *obstruction*

representation — CHALLENGE — opponent

PLAY — CONFLICT

agreement — *motivation*

concretization — *indeterminism*

player

In the beginning...

"If, when walking down the halls of MIT, you should happen to hear strange cries of 'No! No! Turn! Fire! ARRRGGGHHH!!,' do not be alarmed. Another western is not being filmed—MIT students and others are merely participating in a new sport, SPACEWAR!"

D. J. Edwards & J. M. Graetz, "PDP-1 Plays at Spacewar", *Decuscope*, 1(1):2–4, April 1962

Top 20 game publishers 1(3)

	Publisher	Revenue (G$)
1.	Electronic Arts	2.48
2.	Sony Computer Entertainment	2.18
3.	Nintendo	2.13
4.	Activision	.86
5.	Vivendi Universal	.83
6.	Take Two	.79
7.	Atari	.76

Top 20 game publishers 2(3)

	Publisher	Revenue (G$)
8.	Konami	.74
9.	Microsoft Game Studios	.61
10.	Sega	.56
11.	Square Enix	.53
12.	Ubi Soft	.49
13.	THQ	.48
14.	Capcom	.41

Top 20 game publishers 3(3)

	Publisher	Revenue (G$)
15.	Bandai	.37
16.	Namco	.36
17.	Acclaim	.27
18.	Koei	.22
19.	Eidos	.20
20.	Midway	.19

(source: *Game Developer*, Sep. 2003)

Articles containing 'computer game' according to Inspec database
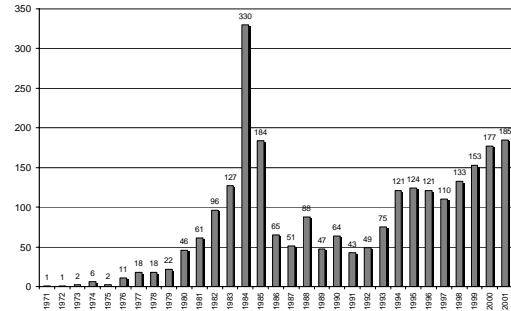
Definition for 'computer game'

- a game that is carried out with the help of a computer program
- roles
  - coordinating the game process
  - illustrating the situation
  - participating as a player

Model-View-Controller