Teaching Computer Graphics with Java

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Agenda

- Background
  - Computer Graphics I
  - Grading
  - Computer Graphics II
**Background (pre 2012)**

- Two main courses dedicated to teaching computer graphics offered at the Department:
  - Computer Graphics I: CS students, VI semester, obligatory and elective, B.Sc. Level
  - Computer Graphics II: CS students, VII semester, elective, M.Sc. Level
- CG1: covered 2D and 3D computer graphics
  - Lectures were focused on analytical geometry and linear algebra, exercises on Java 2D and JOGL APIs
- CG2: a wide range of topics, based on students’ research and seminar papers

**Reasons for change**

- As of school year 2011/2012, several important changes were introduced:
  - CG1 is now focused mainly on 2D
  - CG2 deals with 3D, and the teaching is based on lectures and exercises
  - Additional elective course is introduced (“Advanced concepts of computer graphics”)
- Main reasons:
  - One semester is not enough for a thorough understanding of both 2D and (especially) 3D concepts
  - A relatively high percentage of plagiarism in seminar papers 😐
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Computer Graphics I

- Main motivation: to create a practical and fun 2D computer graphics course
- The covered concepts include:
  - The basics of drawing
  - Fractals
  - Image filtering
  - Principles of animation
- In the end, the students are also given a short introduction to Open GL
The basics of drawing

- The Java painting process
- Window coordinate system
- Graphics and Graphics2D classes
- Drawing and filling simple geometry and text
- Loading and drawing images

Fractals

- Introduction to fractal geometry
- L-Systems
- Turtle graphics
Image filtering

- The RGB color model
- The concepts of image filtering
- Three filter categories: simple, displacement, convolution

Principles of animation

- Frame-based animation
- Time-based animation
- Double-buffering
- Geometry and image morphing
Projects

- During the semester, the students also work on two projects:
  - *JPaint*: a *MS Paint*-like application for drawing fractals and simple figures, and applying various filters on a canvas
  - *Shoot ‘em up*: implementation of a classical shooter game

- For each application, the students are given a *skeleton* implementation, as well as an accompanying documentation

- The main idea is for the students to have *two finished software products* at the end of the course, that they have built on their own

Introduction to Open GL

- In the end, students are given a short introduction to 3D graphics programming and Open GL / JOGL
- The purpose is to provide them a *hint* of the *Computer Graphics II* course
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Grading

- Two practical exams during the semester
  - 30 + 40 points

- Minimum passing score: 35
  - After the semester ends, there are two additional make-up exams

- The final (oral) exam: 30 points
Grades – school year 2011/2012

- 27 students enrolled the course
- As of August 2012:
  - 20 students (74%) passed the practical exams
  - 15 students (55%) passed the final exam
  - Average score: 7.73 (of 10 max)

Informal feedback

- The students’ informal feedback was highly positive
  - In previous official surveys, the average course grade has been ~ 9.5 (of 10 max)
- The majority of students were motivated to work on the assignments during the practical exercises as well as at home
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Computer Graphics II

- The upcoming CG2 course will include a number of introductory, as well as advanced 3D graphics programming topics:
  - 3D transformations
  - Texturing (incl. multi-texturing)
  - Lighting
  - Terrain rendering
  - Shaders
  - Ray tracing
- In the end, an existing Java-based 3D engine (e.g. Unity 3D) will be studied
Thank you for your attention!

- Questions? Suggestions?