

Computer Graphics and Computational Geometry

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Plan

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The pedagogical team

- $EP = \{$
Lucian GHIRVU,
Eugen Nicolae CROITORU,
Mihai-Andrei COSTANDACHE,
Elena ROTARU,
Oriana ONICIUC
 $\}$

The pedagogical team

- Course instructors
 - Lucian GHIRVU
 - Courses 1-7
 - Eugen Nicolae CROITORU
 - Courses 8-11

Syllabus

1. Introduction in Computer Graphics.

2. 2D Raster Graphics.

- Approximation of simple, mathematical primitives: lines, circles, ellipses, polygons and filling the inside of a bounded planar surface (rectangles, convex or concave polygons).
- Clipping primitives against an upright clip rectangle.
- Antialiasing.

Syllabus

3. Geometrical transformations.

- 2D, 3D geometrical transformations.
- Matrix representations of geometrical transformations.
- Homogeneous coordinates.
- Geometrical transformations composition.

Syllabus

4. Viewing in 3D.

- Planar geometric projections.
 - Mathematical description.
 - Implementation.

5. Achromatic and colored light.

- Achromatic light.
- Colored light.

Tematica cursului

6. Derivation and integration in simulation.
7. Position integration. Building a simulator.
8. GPU-accelerated drawing. VBOs.
9. The modern GPU rendering pipeline.
Shaders.
10. Advanced modeling techniques: fractals,
animation.
11. OpenGL library.

Tematica cursului

6. Representing curves and surfaces.

- Polygon mesh surfaces.
- Cubic parametric curves.
- Bicubic surfaces.

7. Solid modeling (CG).

8. Visible-surface determination.

9. Illumination and shading models.

Resources

- Webpage
 - courses, labs, etc.

www.info.uaic.ro/~ghirvu/gpc/
www.info.uaic.ro/~ghirvu/gpc-en/
- Discord Server
 - labs
 - course announcements
 - Webex, Zoom conferences
- Cisco Webex Meetings
 - course main platform
- Zoom
- Youtube
- E-mail (?)
 - Google forms and Discord

Resources

- E-mail
 - If the e-mail @info.uaic.ro is not available
 - We will communicate using Discord and a Google form (specified using Discord)
 - The communication protocol (for private messages)
 - » Write a message using the Google form
 - » Write a message in the dedicated chat from the Discord server mentioning that I have your message in the Google form
 - If your message is public then write it in the dedicated chat of the Discord server

Grading

| Evaluation method | Assignments | Written test |
|------------------------------|---|---|
| Classic (current evaluation) | Assignment solving, sending solutions, presentation, oral examination (online?) | Optional (but could be cancelled). The decision will be notified in due course. |
| Online | Ditto but the presentation and oral examination will take place online | Optional but could be cancelled or replaced with a combination of written test, grid test and oral examination. The precise manner of examination will be notified in due course. |

Grading

- **EVP** – Ongoing grading (in RO “evaluare pe parcurs”)
 - During the teaching weeks and **NOT** in the 3 exam sessions or in the overdue session
 - there could be exceptions (due to lack of time for evaluating)

Grading

- What is it graded?
 - the lab homework (assignments): **only** during the semester and **no** during (overdue) sessions
 - (optional) course knowledge: an optional written test (optional = passing it is not mandatory in order to pass the discipline) during the last course
 - If, from some objective reason (e.g., national holiday, need for bigger halls to accommodate multiple half-years etc.) the written test could be scheduled at a date that will be announced in advance on the course web page
 - scores
 - **PL** score after lab grading
 - **PC** score after written test evaluation that will be transformed into the **CC** coefficient

Grading

- Computing **PL**
 - 7 lab assignments (homeworks)
 - each assignment is composed from at least one problem
 - each problem of the assignments 1 to 7 is graded with a **score between 0 and 4** (+ bonuses for original solving)
 - the scores of the assignments are the arithmetic means of the scores of the problems of the assignments
 - $PL = S / 7$
 - S is the sum of the scores of the assignments

Grading

- Computing **PC**
 - In principle, PC is computed in a similar way as PL: it is the arithmetic mean of written test topics' scores, each topic being scored between 0 and 4.
 - Any change to this formula will be explicitly mentioned on the written test's sheets.
 - Transforming into the **CC** coefficient
 - If the student did not pass CG then the value of CC is 0 (zero)
 - Otherwise, if the student passed CG then $CC = 1 + PC / (\text{maximum score that can be obtained by solving all the topics of the written test})$ so $1 \leq CC \leq 2$.
 - if the written test is canceled then $CC = 1$

Grading

- Passing CG
 - A student **pass** Computer Graphics if **PL \geq 1.6**
 - exception: frauds during the written test
 - Otherwise, a student **do not pass** Computer Graphics

Grading

- Passing CG/ Not passing CG
 - A student **pass** Computer Graphics if **PL ≥ 1.6**
 - exception: fraction during the written test
 - Otherwise, a student does not pass Computer Graphics
 - Or, otherwise stated, the sum of the scores of the assignments
$$S = 7 * PL$$
$$\geq 7 * 1.6 = 11.20.$$

Grading

- Attendance bonuses
 - Laboratory attendance
 - no such bonuses are awarded
 - Course attendance bonus (called BC)
 - it is awarded only if **the student passed CG** and the following conditions are met simultaneously
 - the student is actually present
 - the student is answering an online quiz (related to the notions from that course) at the end of class
 - **there will be an advance notification (at the course or by e-mail, Discord) if there will be a quiz next week**
 - BC will be added to PT (see next slides)
 - $0 \leq BC \leq 0.25$
 - it is an intention, other rules / clarifications may appear

Grading

- Total score **PT**

$$\mathbf{PT = CC \times PL + BC}$$

Grading

- Final grades
 - The final grade of a student that **did not pass** CG is **4**
 - The final grade of a student that **passed** CG is one of the following grades:
5,6,7,8,9,10

Grading

- Final grades: 5,6,7,8,9,10
 - if the number of students that passed CG is > 50 then the grading will be done according to ECTS (FII Council decision from 19/01/2009) and final score PT
 - final grade 10 : the first 5%
 - if we return to the classic method of evaluation and the written test is not cancelled
 - » one must also meet the condition $CC \geq 1.125$
 - » if $CC < 1.125$ then final grade is 9
 - final grade 9 : the next 10% PTs
 - final grade 8 : the next 20% PTs
 - final grade 7 : the next 30% PTs
 - final grade 6 : the next 25% PTs
 - final grade 5 : the next 10% PTs
 - if the number of students that passed CG is ≤ 50
 - final grade =
if $(3 + PT \geq 10)$
then 10
else if $(4.6 \leq 3 + PT < 5)$
then 5
else $[3 + PT + 0.5]$

Grading

- For any issues regarding the evaluation during the lab hours students will consult that instructor from the EP that did evaluate them

Grading

- The case of the students that passed some components of the course (assignments, the lab or the written test) but did not pass CG
 - do not assume that the validation of these results is somehow mandatory and/or automatic
 - send a request to L.Ghirvu until the week 1,2 specifying your full name, the academic year when you obtained these results, and the results

Grading

- If you passed CG and your grade should be recorded again this year
 - send a request to L.Ghirvu until the week 4 specifying your full name, the academic year when you passed CG, and the grade
 - attach an image of the document from the secretariat of the Faculty

Laboratory organization

- Teamwork
 - It is not mandatory.
 - A team has at most 2 members. It is established definitively at the first common assignment solving and presentation.
 - By belonging to a team its 2 members **agree to solve together and present together** the assignments
 - It is not mandatory that team members should receive same scores for an assignment!
 - Team separation
 - In the case of a team separation the 2 members can no more belong to other teams.
 - The team separation occurs when at least a team member decides this and communicates this to EP

Laboratory organization

- Teamwork
 - Eventual litigations occurred during and after a team separation will be solved with the **minimum** involvement of EP
 - If a problem was solved together but, from various reasons, the team can not convene for its presentation, then a team member that would like to present the problem will send a notification e-mail to the team and EP. After that, EP will decide on the date of the presentation and also could decide on the team separation.
 - If a student is simultaneously member of multiple teams he/she commits fraud.

Laboratory organization

- In order to receive a score/grade, any solution of a problem must be evaluated by EP. A solved but not evaluated problem will receive the score 0 (zero).

Laboratory organization

- The evaluation of problems / assignments
 - (Mandatory) A presentation before EP during lab hours
 - Sometimes, EP can ask questions, verify the students' advance in solving the assignments, etc. But this does not constitute a presentation!
 - During the presentations, EP could also evaluate the students' level of mastery of corresponding course knowledge.
 - After the end of the evaluation the instructor will communicate the score to the team (although for some assignments/problems the scores will be communicated after the evaluation of all the other assignments)
 - the students should record themselves their scores in order to avoid some errors when all the scores will be displayed
 - it is strongly recommended to check the accuracy of the scores in each version of the results file that will be available on the course web page

Laboratory organization

- The evaluation of problems / assignments
 - (Optional, With an advance notice) Tests during lab or course hours regarding one or more problems of one or more lab assignments. The tests could include new but similar problems.
 - Without documentation and possibly without computers/laptops etc.
 - The test will be noticed **in advance**; in this case the attendance is **mandatory** (with the exception of medical exemptions, in this case the test will be given at a future date).
 - The way in which the test result affects PL will be specified at the date of the test: this result could diminish PL and possibly change the (not) passing status of the student.
 - In the case of online evaluation, the tests will be carried out similarly to the optional written test

Laboratory organization

- The assignments have deadlines
 - Deadlines' exceeding involves penalties or even interdiction to present the assignment solution to EP (in the case of a large number of days). The decision of yes/no for interdiction lays entirely with EP but it will be uniform for all the students in this situation.
 - **The penalty** will be proportionally with the number of days past the deadline and does not affect PL for computing the passing status but only for computing the final grade.

Laboratory organization

- For some problems, specified by EP or mentioned in the course Web page, the students will send their solutions according to some format (see next slides) to EP.
- Regardless your group/instructor, use the following Google form
<https://forms.gle/rgNkiPZojHAmxekL6>

Laboratory organization

- In order to avoid crowded presentations
 - If, during a lab, a presentation is postponed because of lack of time then those students will be registered by EP and will take precedence at the next lab
 - The students belonging to the group specified at the timetable take precedence
 - All the other attending students (within the lab time limit)
 - In the weeks in which a new assignment is proposed, its presentation will be done at the beginning of the laboratory, before the evaluation of the assignments
 - Exception: sometimes there is a small overlap of the group that had previously been in the lab with the CG group; in this case we begin with the evaluation (for about 5-10 minutes)
 - Usually, an assignment presentation could take an hour

Laboratory organization

- If you would like to give a presentation but you notice or EP communicates you that there is no more available time for evaluation, do not leave laboratory before register with EP! You could be penalized or you could even not be evaluated!
- In the case of an assignment sent by e-mail: even if you sent it before its deadline, don't postpone its presentation!

Laboratory organization

- The assignments are solved using C/C++ in Microsoft Visual Studio (≥ 2010) or Bloodshed Dev-C++, etc.
- Each problem solution will have an unique source file (.cpp, .c) and an unique executable file
- At the beginning of a source file there will be the data structures used (struct, class, etc.), then function definitions, the global variables, the GLUT call-back functions and, at the end, the main function.

Laboratory organization

- Sending solutions to EP
 - Please comply with the indications for the assignment from the course Web page

Laboratory organization

- Sending solutions to EP
 - File name
 - Let's suppose that the team members are Vasile IONESCU and George VASILESCU and the team solved the problems 1 and 3 of the assignment 5
 - They will call the file(s):
 - "t05p01 ionescuvasile vasilescugeorge.cpp"
 - "t05p03 ionescuvasile vasilescugeorge.cpp"
 - "t05 ionescuvasile vasilescugeorge.cpp"
 - Don't send other files (object files, executables, etc.)

Laboratory organization

- Sending solutions to EP
 - By e-mail: your subject should be like
 - In function of the attached file
 - “[gpc] t05p01 ionescuvasile vasilescugeorge.cpp”
 - “[gpc] t05p03 ionescuvasile vasilescugeorge.cpp”
 - “[gpc] t05 ionescuvasile vasilescugeorge.cpp”

Laboratory organization

- Sending solutions to EP
 - The names of the team members should appear in the name of the solutio(s) file
 - If the name of a student does not appear clearly anywhere then the student could not claim that he/she sent the solution

Written test organization

- The students participation is optional, the outcome of the test does not affect the passing status of the students
- In principle, during the written test, the students **do not have access to any kind of documentation**, or laptops, phones, electronic devices etc.; if the written test will be online students will need a laptop, internet connection, etc.
- During the last course of the semester
 - On objective reasons (e.g., national holiday, need for bigger halls to accommodate multiple half-years etc.) the written test could be scheduled at a date that will be announced in advance
- Duration: 1 hour ca.

Written test organization

- There may be additional details on the course page and these will take precedence over those in this file
- The written test will start at a certain time X (even though it could be given in several series)

Written test organization

- If you want to take the written test you must register yourself
 - You may register through a Google form whose address will be communicated in due time.
 - Based on this form, a series planning will be obtained and you will be assigned to some Y series (and thus you do not need to come at X but at Y).
 - You only have priority in the series in which you were assigned
 - You could come directly at the X hour (and then you will be assigned in some series - it may be series X or $X + 1$, etc. - and also you will have priority only in that series)

Written test organization

- If you want to take the written test
 - Establishing priority in series
 - In the case when there are no more places available for students who have registered in this series
 - The EP will remove from the room (randomly or by an ad-hoc established method) all (or some) students that have not registered with this series
 - In extreme / objective cases (room malfunctions, problems with the room allocation that require moving to another room, etc.): if $i < j$ then the students registered in the $X + i$ series have priority over those in the $X + j$ series and the precedent paragraph is applied

Written test organization

- In each series, with the exception of the last one, the available seats will be fully occupied
- A Y series is the last one if there are no students scheduled in the $Y + 1$ series and the number of available seats in the hall is \geq the number of students present at the beginning of the Y series
- The written test ends with the last series!
- (Strong) Recommendation
 - Do not come directly for the $X + k$ series ($k \geq 1$). It is possible that the $X + k - 1$ series was the last one.
- As far as possible, the Z series will begin the written test at Z hour (there may be small delays due to the collection of the written tests from the previous series, the seat occupation, etc.).
- If you come (unregistered) in a Y series and there are no more places available, do not leave the room without registering with the EP!
- Above Y, Z, ... (but not X) are generic series

Written test organization

- Types of topics
 - The topics could be
 - theoretical notions from the course
 - similar problems to those of lab assignments

Fraud

- Copying solution of some problems either at laboratory, either at the written test (fraud detection could happen later!),
- Being a member of multiple lab teams,
- Using electronic devices during the written test or any other tests,
- Exchange of any kind of information during the written test or any other tests,
- The file sent for evaluation includes lines of code for solving problems from previous years but which are not in the current lab syllabus,
- Using documentation (or unauthorised documentation if using documentation is allowed) during the written test or any other tests
- In the case of online assessment, the requirements that the student should be alone in the room and not have other applications open (except those required for the online assessment) or other devices (laptop, tablet, phone, etc.) that are not necessary for the assessment are not respected.
- etc.

Fraud

- Measures against it
 - Losing **all** achieved bonuses
 - PL / PC penalties
 - Including 0 (zero) score (or even <0 in the PC case)
 - Removing from the hall
 - Dean report for faculty expulsion

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