The University of Georgia

Department of Computer Science

Course Information Sheet

CSCI 4810

Computer Graphics

Brief Course Description (50-words or less)	Principles of two-dimensional and three-dimensional interactive raster graphics. Principles of scan conversion algorithms for two- dimensional and three-dimensional graphics primitives; data structures and modeling techniques for raster graphics; interaction, visual realism, animation and user interface design; ray tracing, illumination, shading, data storage/retrieval, software engineering and parallel computing for graphics.
Extended Course Description / Comments	This course emphasizes on fundamental principles of computer graphics. The coursework begins with introduction of hardware and software systems which are crucial for generating graphics. Students are encouraged to discuss how computer graphic systems generally works. The next part focuses on the representation of basic geometrical components including lines, curves and basic shapes. Students will work on modelling these components by analysing their attributes. The subsequent phase begins with an emphasis on two-dimensional transformation modelling, which involves translation, rotation, scaling and matrix operations. It describes the graphic pipeline procedures that involve viewing, normalization and clipping algorithms. Students will be given programming tasks to modify previous algorithms to generate a specific graphic output. Following two-dimensional modelling, the coursework continues with the basic transformation operations in three-dimensional and the working of the coordinate system in different phases of the image rendering process. Concepts of three-dimensional viewing and different projections are discussed with practical illustrations about boundary representations. After familiarizing with the fundamentals of computer graphics, the final phase focuses on key concepts of animation, shading and illumination models, visible surface detection methods, different color models, ray tracing methods, and information visualization.
Pre-Requisites and/or Co-Requisites	CSCI 1302: Software Development
Required, Elective or Selected Elective	Selected Elective Course
Approved Textbooks (if more than one listed, the textbook used is up to the instructor's discretion)	N/A

Specific Learning Outcomes (Performance Indicators)

This course presents a survey of topics in computer graphics most relevant to students studying computer science. At the end of the semester, all students will be able to do the following:

1. Basic knowledge of graphics display devices.
2. Knowledge of the best Graphics input/output devices to use for different applications.
3. Implement various line-drawing algorithms (Line Scan-conversion algorithms).
4. Design and implement line attributes (dotted, dashed. Thick, anti- aliased lines, …)
5. Develop functions for drawing circles and other related graphics primitives.
6. Implement Color Look-up Tables and applications (including animation).
7. Implement various Area-Filling Algorithms.
8. Use the matrix representation of two-dimensional geometric transformations.
9. Develop more complex transformations using the basic 2D matrix transformations (ie, the concept of concatenation).
10. Build various Windowing and Clipping algorithms.
11. Implement Window-to-Viewport transformations.
12. Basic knowledge of image processing and computer vision.
13. Use graphics and image data structures.
14. Basic knowledge of Graphics Processing Units (GPUs).
15. Solid knowledge of three-dimensional graphics.
16. Develop and implement various 3D transformations.
17. Implement 3D perspective projection and clipping.
18. Knowledge of Parallel Projection for displaying 3D objects.
19. Basic knowledge of visualization techniques.
20. Basic knowledge of advanced shading techniques and methods.

Relationship Between Student Outcomes and Learning Outcomes

CSCI 4810 contributes to student outcomes a and i.

Major Topics Covered (Approximate Course Hours) 3 credit hours = 37.5 contact hours 4 credit hours = 50 contact hours Note: Exams count as a major topic covered	Graphics display devices (2 hours) Graphics input/output devices (2 hours) Line-drawing algorithms (Line Scan-conversion algorithms) (5 hours) Line attributes (dotted, dashed. Thick, anti-aliased lines, …) (2 hours) Circle generating algorithms and other related shapes (3 hours) Color and Color Look-up Tables and applications (2 hours) Area-Filling Algorithms (2 hours) Matrix representation of 2D transformations (2 hours) Construction of more complex transformations using the basic 2D matrix transformations (ie, the concept of concatenation) (3 hours) Windowing and Clipping algorithms (2 hours) Window-to-Viewport transformations (2 hours) Introduction to image processing and computer vision (3 hours) Graphics and image data structures (2 hours) Graphics Processing Units (GPUs) and parallel processing (3 hours) Introduction to 3D graphics (2 hours) Various 3D transformations (2 hours) 3D Coordinate Systems (world-coordinate system, eye-coordinate system, clipping coordinate system, screen coordinate system) (2 hours) 3D perspective projection and clipping (3 hours) P arallel Projection for displaying 3D objects (2 hour) Various visualization techniques and algorithms (2 hours) Advanced shading techniques and methods (2 hours)
Course Master	Dr. Hamid Arabnia