

Knight Foundation School of Computing and Information Sciences

Course Title: Principles of Computer Graphics

Date: 3/10/2004

Course Number: CAP 4710

Number of Credits: 3

Subject Area: Computer Systems	Subject Area Coordinator: Leonardo Bobadilla email: bobadilla@cs.fiu.edu
Catalog Description: A first course in algorithms/techniques for image generation devices, geometric transformations/matrices, algorithms for hidden surfaces, ray tracing, advanced rendering. Programming with standard graphics interface. This course will have additional fees.	
Textbook: Computer Graphics with OpenGL, 3 rd Edition, Hearn and Baker, Prentice Hall (ISBN: 0130153907)	
References: Computer Graphics: Principles and Practice in C, 2 nd Edition, Foley, van Dam, Feiner, and Hughes, Addison-Wesley (ISBN: 0201848406)	
Prerequisites Courses: COP 3337 and MAC 2312	
Corequisites Courses: None	

Type: Elective for CS (Applications group).

Prerequisites Topics:

- Array, stack, and queue data structures
- Recursive functions
- Differentiation and integration

Course Outcomes:

1. Be familiar with drawing primitive objects (lines, circles, polygons) on a display
2. Be exposed to graphical input and output devices
3. Master two dimensional modeling and 2-D transformations
4. Be familiar with master-instance structure
5. Master three dimensional modeling and 3-D transformations
6. Be familiar with projection of 3-D objects on a 2-D plane
7. Master clipping, fill, and rendering techniques
8. Be exposed to color and shading models

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Outline

Topic	Number of Lecture Hours	Outcome
<ul style="list-style-type: none"> • Introduction <ul style="list-style-type: none"> ○ Raster and vector graphics systems ○ Video display devices ○ Physical and logical input devices ○ Issues in graphical systems development ○ Coordinate representation 	6	2,4
<ul style="list-style-type: none"> • Drawing primitives <ul style="list-style-type: none"> ○ Line drawing algorithms ○ Circle and ellipse generation ○ Fill-area primitives, scan-line polygon-fill ○ OpenGL API ○ Character font outline & bitmap 	6	1
<ul style="list-style-type: none"> • Geometric transformations <ul style="list-style-type: none"> ○ Two dimensional transformations ○ Inverse transformations ○ Three dimensional transformations ○ Object-relational model 	6	3,5
<ul style="list-style-type: none"> • Viewing <ul style="list-style-type: none"> ○ Viewing pipeline ○ Normalization and viewing transformation ○ 2-D clipping algorithms ○ Projections: parallel and perspective ○ 3-D object representations ○ 3-D clipping techniques 	9	6,7
<ul style="list-style-type: none"> • Advanced graphics <ul style="list-style-type: none"> ○ Hidden-surface removal methods ○ Ray-tracing algorithm ○ Texture mapping ○ Color models: RGB, YIQ, CMY, HSV,HLS 	9	8

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Course Outcomes Emphasized in Laboratory Projects / Assignments

	Outcome	Number of Weeks
1	Drawing primitive graphical objects Outcome: 1	2
2	Two dimensional transformations Outcomes: 3	3
3	Design of a 2-D graphical system with master-instance Outcomes: 3,4,7	4

Oral and Written Communication:

No significant coverage

Social and Ethical Implications of Computing Topics

No significant coverage

Assessment Plan for the Course & how Data in the Course are used to assess Program Outcomes

Student and Instructor Course Outcome Surveys are administered at the conclusion of each offering, and are evaluated as described in the School's Assessment Plan:
<https://abet.cs.fiu.edu/csassessment/>

Approximate number of credit hours devoted to fundamental CS topics

Topic	Core Hours	Advanced Hours
Algorithms:		1.5
Software Design:		
Computer Organization and Architecture:		0.5
Data Structures:	0.5	
Concepts of Programming Languages		

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Theoretical Contents

Topic	Class time
Matrix theory	0.5

Problem Analysis Experiences

1. Mapping among several coordinate systems

Solution Design Experiences

1. Graphical transformations
2. Design of a simple graphical system

The Coverage of Knowledge Units within Computer Science Body of Knowledge¹

Knowledge Unit	Topic	Lecture Hours
<u>GV1</u>	Hierarchy of graphics software, using OpenGL API, simple color models (RGB, HSB, CMYK), homogeneous coordinates, affine transformations (scaling, rotation, translation), viewing transformation, clipping	6
<u>GV2</u>	Raster and vector graphics systems, video display devices, physical and logical input devices, issues in graphical systems development	3
<u>GV5</u>	Line generation algorithms (Bresenham), font generation: outline vs. bitmap, light-source and material properties, rendering of a polygonal surface, introduction to ray tracing, sampling techniques & anti-aliasing	9

¹See https://www.acm.org/binaries/content/assets/education/cs2013_web_final.pdf for a description of Computer Science Knowledge units