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Module Descriptor

Mathematics for Graphics and Statistics (Computing and Mathematics)

Mathematics for Graphics and Statistics (A13551)

Short Title: Maths for Graphics and Stats
Department: Computing and Mathematics
Credits: 5 **Level:** Introductory

Description of Module / Aims

The module applies matrix algebra to 2D and 3D transformations - including translations, scaling, shearing, rotation and perspective. It also introduces the student to descriptive statistics with an emphasis on visually presenting data in an appropriate and informative way using traditional statistical constructs. The practical element of this module applies matrix and vector algebra to computer graphics and also, obtains visual representations of data using software.

Programmes

		stage/semester/status
MATH-0029	BSc (Hons) in Creative Computing (WD_KCRCO_B)	2 / 3 / M
MATH-0029	BSc in Multimedia Applications Development (WD_KMULA_D)	2 / 3 / M

Indicative Content

- Matrix algebra: Multiplication; Transformations - translations, scaling, shearing, rotation and perspective
- Reference frames: Cartesian and homogeneous coordinates; Right handed and left handed 3D reference frames
- 2D and 3D geometric entities: Polygons and polyhedrons
- Vector algebra: Dot product; Cross product; Hidden face problem; Illumination problem
- Introduction to statistics: Types of variables (scale, nominal, ordinal); Descriptive and inferential statistics; Population and sample; Probability and non-probability sampling
- Descriptive statistics: Statistics measuring centre (mean, median, mode) and spread (standard deviation, quantiles); Charts for categorical and scale data – basic (histograms, pie charts etc.) and advanced (clustered/stacked charts etc.)

Learning Outcomes

On successful completion of this module, a student will be able to:

1. Describe a 2D polygon or a 3D polyhedron in terms of its faces and vertices.
2. Determine and apply the transformation matrices which perform translation, shearing, scaling, rotation and perspective in 2D or 3D space.
3. Compute vector algebra expressions and apply Painter's algorithm to the hidden face and illumination problems in 3D rendering.
4. Define the terminology and discuss the concepts of introductory statistics.
5. Construct an animation of a simple 3D object in a suitable software environment.
6. Select and construct statistical charts that convey pertinent information in a dataset.

Learning and Teaching Methods

- The mathematical constructs underpinning computer graphics are presented in lectures and reinforced in tutorials. The algorithms are then implemented in weekly practical sessions. The statistical material is similarly presented with the theory in the class room and the practice in the labs with appropriate statistical software.

Learning Modes

Learning Type	F/T Hours	P/T Hours
Lecture	36	
Tutorial	12	
Practical	12	
Independent Learning	75	

Assessment Methods

	Weighting	Outcomes Assessed
Final Written Examination	60%	1,2,3,4
Continuous Assessment	40%	
Assignment	30%	5
Assignment	10%	6

Assessment Criteria

<40%: Unable to perform basic mathematical calculations in matrix and vector algebra and statistics.

40%–49%: Able to perform some mathematical calculations and practical implementation in matrix and vector algebra and statistics.

50%–59%: Able to perform a range of mathematical calculations and practical implementation in matrix and vector algebra and statistics.

60%–69%: As above. And demonstrate a basic competence with some of the advanced techniques in matrix and vector algebra and statistics.

70%–100%: As above. And demonstrate excellence competence with the advanced techniques in matrix and vector algebra and statistics.

Supplementary Material(s)

- "Statsoft Electronic Statistics Textbook." http://www.statsoft.com/Textbook
- Tufte, E.R. *The visual display of quantitative information.* 2. Connecticut: Graphics Press, 2001.
- Vince, J. *Mathematics for Computer Graphics.* London: Springer, 2014.

Requested Resources

- Room Type: Computer Lab