CSE 287 Guide Study for First Midterm.doc

**CSE 287: Practical Learning Objectives**

The following is a list of practical instructional objectives for CSE 287. Each describes some action or task that students should be able to perform. Several include the conditions under which the action or task should be performed.

**Chapter One (Introduction)**

1. Describe or identify differences, strengths, and weaknesses of image-order and object-order rendering algorithms.

Image Order processing iterates over every single pixel to be rendered. Object order

Iterates over all the elements in the scene that need rendered. For lightly clustered pictures

With less objects, Object order is optimal because dead space is irrelevant. For heavily

Clustered pictures, or ones with few empty space, image order(Ray tracing) will prove more

effective .

**Chapter Two (Mathematics)**

1. Use the quadratic equation to find the roots (solutions) or a second order polynomial.

Memorize it first (-b + or - the square root of b squared minus 4ac all divided by 2a).

Then plug in the a, b, c values, represented in the form ax^2 + bx + c to determine

If we have 1, 2, or 0 solutions

1. Given the value of the “discriminant” in the quadratic equation, state the number of real solutions to the equation.

If the discriminant(the thing under the square root sign or b^2 - 4ac. Is..

0: We have 1 solution

>0: We have 2 solutions from the plus or minus component

<0: We have 0 real solutions, sqrts of negatives are imaginary.

1. Write code or “by hand” convert radian measures of angles to degrees and degrees to radians.

Radians = (Degrees \* pi) / 180

Degrees = (Radians \* 180) / pi

1. Given the cosine of an angle, use the arccosine to the find the angle.

Applying cos-1/arccos to the cos of an angle will give the desired angle.

Angle = acos(cos(angle));

1. Describe or identify the differences between scalar and vector quantities.

A scalar is a 1-part integer or double. Vectors exists in at least 2 dimensions.

I.E. 3.5 is a scalar, [1, 2.5, 3.0] is a vector

1. Use vector addition and subtraction to solve problems in computational geometry.

[x1, y1, z1] + [x2, y2, z2] = [x1 + x2, y1 + y2, z1 + z2]

[x1, y1, z1] - [x2, y2, z2] = [x1 - x2, y1 - y2, z1 - z2]

1. Use scalar multiplication to change the length of a vector and/or reverse its direction.

Applying a scalar of size x, will multiply the length of a vector by x.

Applying a negative scalar to a vector will reverse it's direction.

I.E. ||2 x vectorX|| = 2 x ||vectorX||

-1 \* vectorX is the opposite direction as vectorX

1. Given a vector, calculate its length/magnitude.

The length of a vector is listed on the formula sheet, but it’s equal to the square root of

All the components squared, summed.

I.E || [x, y, z] || = sqrt(x^2 + y^2 + z^2)

1. Given two points, calculate the distance between the points

Euclidean distance between two points is sqrt( (y2-y1)^2 + (x2-x1)^2 )

1. Given a vector, normalize it to unit length.

For a given vector, divide it by it’s length to normalize it.

1. Given a vector, find a new vector that points in the same direction and has a specified length.

A vector “a” is parallel to another vector b if there exists a scalar t such that

a = t \* b

To find one with a designated length, set t = desiredLength/(||a||)

1. Given two points, calculate a unit length vector that points from one point to the other.

To find a unit length vector that points from v1 to v2, subtract v2 - v1 and then normalize the vector.

1. Given two vectors, calculate the dot product of the vectors.

The two ways to calculate the dot product of vectors are:

1. x1 \* x2 + y1 \* y2 + z1 \* z2
2. ||a|| \* ||b|| cos (angle between the two)

1. Write an expression the represents the geometric interpretation of the dot product. State how this changes when the two vectors are unit length.

|a|| \* ||b|| cos (angle between the two) becomes just cos(angle).

1. Use the dot product and the arccosine function to find the angle between two vectors.

Angle = acos(a dot b/(||a|| \* ||b||)

1. Given the value of a dot product, state whether the vectors are parallel, perpendicular, less than ninety degrees, or more than ninety degrees apart.

If a dot b :

= 0: The vectors are perpendicular

> 0: The vectors are within 90 degrees of each other

< 0: The vectors are more than 90 degrees apart

1. Given two vectors, use the dot product to find the parallel and/or perpendicular components of one to the other.

A parallel component from one vector to another is commonly referred to as a projection.

To find the parallel component from of vector a on b(or the projection of a onto b)

(a dot b)/ (||b||) ^ 2 \* b

The perpendicular component is this but with an a minus at the beginning.

a - (a dot b)/ (||b||) ^ 2 \* b

1. Describe how the cross product is geometrically related to the multiplicands in the product.

Cross product gives us a vector that is perpendicular to the multiplicands.

1. Given two vectors, use the right-hand rule to correctly order the vectors so that their cross product points in a specified direction.

Point index at vector 1, middle at vector 2, check where your thumb is, on your right

hand.

1. Given three points that describe the corners of a parallelogram, use vector subtraction and the cross product to find the area of the parallelogram.

Given v1, v2, and v3 in counterclockwise order,

Area = ||(v1 - v2) cross (v3 - v2)||

1. Given three points that describe the corners of a triangle, use vector subtraction and the cross product to find the area of the triangle.

Given v1, v2, and v3 in counterclockwise order,

Area =0.5 \* ||(v1 - v2) cross (v3 - v2)||

1. Given the equation that implicitly describes a surface and the coordinates of a point, calculate a signed distance from the surface to the point.

Determine a point on the plane using the equation, draw a vector (destPoint - pointOnPlane)

and find it's length

1. Given three points on a plane, use them to calculate a unit length vector that is normal to the plane

With three points glm::norm(v1 - v2 cross v3 - v2)

1. Given three points on a plane, use them to create an implicit description of the plane.

The implicit equation for a plane is (p - a) \* n = 0.

Where

p = any point we want to check

a = a point on the plane

n is a normal vector perpendicular to the plane, calculated from

glm::norm(v1 - v2 cross v3 - v2)

1. Given two points on a line, use them to generate a parametric representation a line.

p(t) = p0 + t(p1 - p0)

Where p0 is the start point, and p1 is the end point

1. Given two points on a line, use them to generate a parametric representation a line in which the direction vector is unit length.

p(t) = p0 + t \* glm::normalize(p1 - p0)

Where p0 is the start point, and p1 is the end point

1. Given a parametric description of a line and value of the parameter, t, find the coordinates of that point on the line that is associated with the value of the parameter.

Plug t in for your parametric equation. The resultant vector will be the cartesian coordinate

Associated with that t value.

1. Given a parametric description of a line and the coordinates of a point, determine whether or not the point is on the line.

Break the equation into

x = p0 + t \* glm::normalize(p1 - p0)

y = p0 + t \* glm::normalize(p1 - p0)

z = p0 + t \* glm::normalize(p1 - p0)

Solve for t with the given point’s x value.

Solve for y and z using that t value.

If both points match, it is on the line, otherwise it is not.

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1. Given a parametric description of a line and the coordinates of a point on the line, find the value of the parameter, t, for that point.

Reverse of the previous process

**Chapter Three (Raster Displays)**

1. State what “pixel” is short for.

Picture Element

1. Give or identify a definition for “color depth.”

The number of bits used to represent the color of a single pixel

1. State the values for alpha that are normally associated with totally transparent surfaces and totally opaque surfaces.

Totally Transparent: Alpha = 0;

Totally Opaque: Alpha = 1;

1. Given the red, green, blue, and alpha components of two colors, use alpha blending to blend together the two colors.

Color = alpha \* (colorWeAreLayingDown) + (1 - alpha) \* colorAlreadyThere

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