

# Quaternions

CS 4620 Lecture 9

# Recall Rotation Matrices

- Pure rotation about the origin
- Rotation about an arbitrary point

# Interpolating Rotations

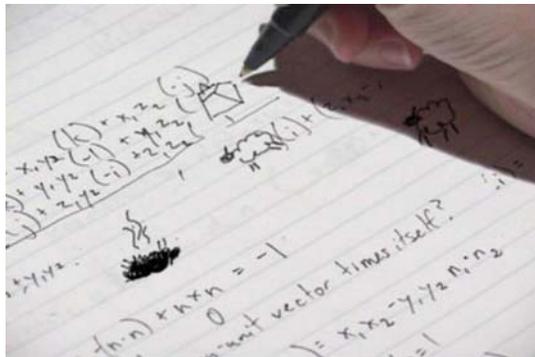
- Recall linear interpolation:  
 $lerp(x,y,a) = (1-a)x + ay$
- Interpolating rotations is slightly tricky:
  - Linear interpolation of rotation matrices does not produce rotation matrices, e.g., result is not orthogonal matrix
    - » Could project using polar decomposition, but there's a simpler way...
  - Euler angles (and axis-angle representations) can be ambiguous to interpolate due to nonunique representation (and gimbal lock)
- Quaternions are a good representation rotations that also simplifies interpolation
  - Interpolate using spherical linear interpolation,  $slerp(x,y,a)$

# Blackboard

(Please share notes with sick students)

- Quaternions (Ref: Buss, XII.3)
  - axis & angle
  - scalar and vector part
  - $q$  and  $-q$
  - $i, j$  and  $k$ ; generalizations of complex numbers, and commutation
  - addition is commutative and associative
  - norm, conjugate, inverse
  - multiplication
  - representing and evaluating rotations
  - examples
  - quaternion-matrix conversions
- Interpolation of quaternions
  - $slerp(x,y,a)$ ; derivation
  - $slerp(x,y,a)$  vs  $slerp(x,-y,a)$

## Epilogue: "Attack of the Note Sheep"



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