

Name: _____ Student ID: _____

You have three (3) hours to complete the exam: 8:30am to 11:30am.

Nobody will be allowed to leave in the first half hour.

Write your answers in the spaces provided.

This is worth 40% of your final mark. The value of each question is indicated next to it.

No aids (books, notes, calculators, mobile phones, PDA's, music players, other electronic devices, etc.) are permitted.

Check that you have all 8 pages.

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1) How does a photorealistic renderer take into account persistence of vision? (give some detail about the rendering algorithm) [2%]

2) How does layering relate to the keyframe approach to animation? [1%]

3) If motion blur is so important for the realistic rendering of animation, why should it be avoided in motion capture? [1%]

4) What is a Hermite spline compared to a regular spline? Why are they useful for motion curves? [2%]

5) Compare quadratic B-splines, cubic B-splines, and cubic Hermite splines in terms of smoothness and interpolation. [1%]

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- 6) What does breaking the smoothness of a motion curve refer to, and why is it useful? [1%]
- 7) What is retiming, how is it done, and why is it useful? [2%]
- 8) How many degrees of freedom does the root link of a 3D Forwards Kinematic skeleton normally have? What is a good representation from the standpoint of interpolating between arbitrary poses? [2%]
- 9) What is Inverse Kinematics? [1%]

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10) How can you set up IK as an optimization problem? Why is this useful? [2%]

11) Write down the Steepest Descent algorithm with line search for minimizing $f(\theta)$, where θ is a vector of parameters to the scalar function f . [2%]

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12) How do you add computer-generated models to a real photograph? (hint: lights, camera, action)
[3%]

13) Why is the alpha channel important even for opaque objects? [1%]

14) Describe the steps of the REYES algorithm. [2%]

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15) What is the benefit of a displacement shader over just modeling highly detailed geometry? [1%]

16) How could you use particle systems to model flesh? [1%]

17) What is an implicit surface, and why are they useful? [1%]

18) What is the difference between Forward Euler and Symplectic Euler? Why is it important? [2%]

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19) How do you detect if a moving particle collides with a stationary sphere during a time step? [2%]

20) For a sand effect in Spiderman 3, hundreds of thousands of grains of sand were modeled as spherical particles; how could you speed up collision detection between all of these grains? [2%]

21) Suppose a collision has been detected between a particle and a stationary plane. How do you modify the particle's new position and velocity to account for a perfectly elastic and frictionless collision? [2%]

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- 22) What is an advantage of orthogonal matrices over quaternions for representing rotations? [1%]
- 23) Describe a problem with skinning using linear blend weights. [1%]
- 24) What are the sources of footskate in motion capture data? [2%]
- 25) Sketch and label a move tree for a character that can walk (in a straight line) and stand still. [2%]