Clearly print your name as it appears on Canvas:

Your netid:

Game design and development
Practice quiz 3

Question 1 Score:

Suppose you run the following loop:

```
for (float i=0.0; i<100000000.0; i=i+1.0)
   do something
```

Yes, we know this is a stupid thing to do. Don't worry about that. But suppose you run it and it never terminates no longer how long you run it. Explain why. Assume standard IEEE floating point with a 24 bit mantissa.

Question 2 Score:

Your friend decides that SQT (Scale + Quaternion + Translation) representations are too much work and they write their animation system to represent joint poses using raw matrices. They then linearly interpolate the matrices between keyframes. Their characters appear to bend and deform horribly when they move. Explain why.

Question 3 Score:

Your friend was building a game and wanted to have two characters hold hands. So he attached their hands using an invisible, zero-length spring and set its stiffness to 10^8. The characters exploded. Explain why.

Question 4

Suppose you have a data structure to represent a bounding sphere for collision detection:

```
class BoundingSphere {
   public Vector3 Center;
   public float Radius;
}
```

Write a procedure: bool Intersects(BoundingSphere a, BoundingSphere b), that returns true when the two spheres intersect. (Note: pseudocode is fine for this; don't worry about the details of C# syntax if you don't want to). Assume that you have available subroutines for whatever linear algebra you want to do (dot products, cross products, distance between vectors, matrix multiplication, etc.)

Question 5 Score:

Suppose you need to make a balloon that pumps up and pops. When a method Go() is called, the balloon starts growing, so that after 1 second, it's twice as big as the original, after 2 seconds, it's 3 times as big as the original, after 3 seconds, it's 4 times as big, etc. Write the code for a component class Balloon that contains Go() and Update() methods to make the balloon grow for 10 seconds and then destroy itself. You may add whatever fields to the class you like.

Question 7

Suppose q_0 is a quaternion representing some rotation about the X axis by some angle, θ_X, and q_1 is a quaternion representing a rotation around the Y axis by some angle θ_Y. Give the expressions for the quaternions representing:

1. The rotation around X followed by the rotation around Y?
2. The rotation around Y followed by the rotation around X?
3. The rotation around X by an angle $\theta_X/2$?
4. The rotation halfway between q_0 and q_1. That is, suppose an object starts out at the rotation represented by q_0 and smoothly rotates to the rotation represented by q_1. What is the rotation it is in when it is halfway from one to the other?