1. NTSC signal is interlaced, which means that each frame is displayed as two fields: first, all even lines and than all odd lines. One field is displayed every 1/60th of a second; any given line is displayed only every 1/30th of a second. Suppose your computer-generated video contains a thin horizontal line moving from the top to the bottom of the screen, and you would like to convert it to NTSC format. Assuming that your images are generated at correct NTSC resolution, a simple-minded approach (just pick every even line for one field and every odd line for an even field) will result in aliasing. Explain what kind of aliasing artifact you will expect and propose a method that would eliminate it.

2. Suppose you have a 3D scene with three people in it; all three are standing on a horizontal plane at the same level and have approximately the same height h. Their positions form an equilateral triangle with sides a. Assume that one of the triangle vertices is at (0,0), and the triangle axis of symmetry is on the positive x axis. Describe the parametric family of 3x4 matrices in homogeneous coordinates transforming world-space coordinates to normalized device coordinates (i.e. square $[-1,1] \times [-1,1]$ for which

- the head of the closest person is in the center;
- the height of the closest person is 1/3 of the height of image;
- the height of the person at maximum distance from the camera is 1/6 of the screen height;
- the horizon is 2/3 of the way from the bottom of the image; the the image fills the screen, i.e. the two people who are further away are at opposite edges of the image.

3. State the rendering equation for environments containing only opaque surfaces in vacuum and define all the quantities involved and the units used to measure these quantities. How this equation has to be changed if some of the objects are transparent, but all objects are homogeneous inside and do not attenuate light? How the equation should be changed to account for exponential attenuation of light in fog or other homogeneous attenuating medium?

4. Compare tensor-product B-splines and subdivision surfaces. What are the main advantages of subdivision? What are the disadvantages? Describe two examples of applications: one application for which subdivision surfaces are more suitable and another for which B-spline patches are more suitable.

5. Explain how inverse kinematics works. Provide examples of situations when forward kinematics has advantages over inverse kinematics and the other way around.