Tutorial 1
CS3241 Computer Graphics (AY22/23)

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Question 1

To be able to display **realistic** images, our display devices need to be able to produce every frequency in the visible light spectrum.

True or false? Why? What are the advantages and disadvantages?

Three-Color Theory

To be **realistic to human**

$\Rightarrow$ To be compatible with human visual system (L01, slide 35)

- Rods: Monochromatic
- **Cones**: Color sensitive to wavelengths
  - Long $\approx$ red
  - Medium $\approx$ green
  - Short $\approx$ blue

Proportion of the three gives us the sensation of different colors.

Cones sensitivity

Additive color

Question 2

Each pixel in a frame-buffer has 8 bits for each of the R, G and B channels. How many different colors can each pixel represent? Is this enough? On some systems, each pixel has only 8 bits (for all R, G, and B combined). How would you allocate the bits to the R, G and B primaries?

8-bit representation of color

Question 3

Referring to Lecture 1 Slide 26. If an imaginary image plane is d unit distance in front of the pinhole camera, what are the coordinates of the projection (on the imaginary image plane) of the 3D point (x, y, z)?

Question 4

Why do we need a primitive assembly stage in the rendering pipeline architecture?

Question 5

What does the rasterization stage (rasterizer) do in the rendering pipeline architecture? Describe what it does to a triangle that is supposed to be filled, and the three vertices have different color. Assume smooth shading is turned on.

Question 6

What is hidden-surface removal? When is it not necessary?

Question 7

Which of the two following program fragments is more efficient? Why? Can the same optimization be done for the case of `GL_POLYGON`?

Question 8

OpenGL supports the GL_TRIANGLES primitive type. Why do you think that OpenGL also supports GL_TRIANGLE_FAN and GL_TRIANGLE_STRIP?

Question 9

Devise a test to check whether a polygon in 3D space is planar.

Question 10

Devise a test to check whether a polygon on the x-y plane is convex.