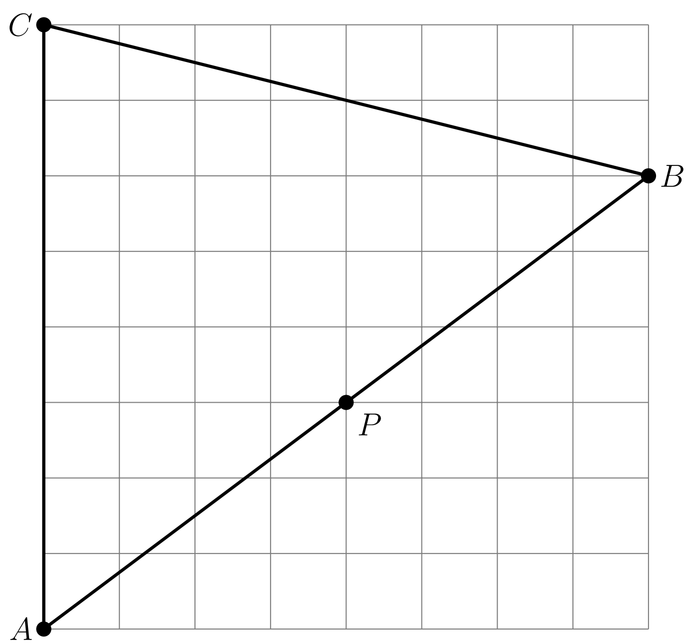
CS 130, Midterm

Name: ______________________________________ ID: _________________

Read the entire exam before beginning. **Manage your time carefully.** This exam has 34 points; you need 30 to get full credit. Additional points are extra credit. 34 points $\rightarrow$ 2.3 min/point. 30 points $\rightarrow$ 2.7 min/point.

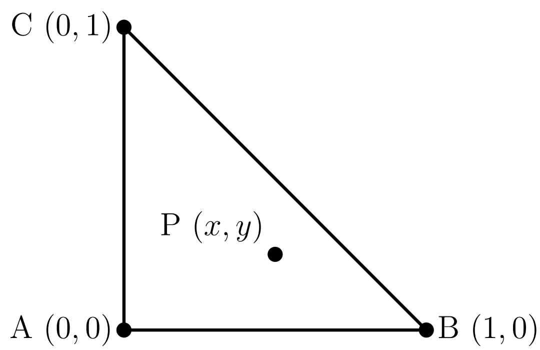
Problem 1 (2 points)

Compute the barycentric weights of the point P.



Problem 2 (2 points)

Find the barycentric weights for the point P in the triangle below.



Problem 3 (2 points)

A raytracing scene has a yellow-colored sphere illuminated by a magenta-colored light. What color will the sphere appear in the image?

Problem 4 (2 points)

Give reasonable RGB values for (1) blue, (2) dark blue, and (3) light blue.

Problem 5 (2 points)

When viewed from 20 cm away, the whiteboard appears white. When viewed from a distance of 20 m away, the whiteboard appears to be approximately the same color and brightness. In the second case, the observer is standing 100 times farther away. Why does the whiteboard not appear 10,000 times dimmer (essentially completely black)?

Problem 6 (3 points)

Given two vectors $\vec{u}$ and $\vec{w}$, how do we determine whether the vectors are parallel? You may assume 3D.

Problem 7 (5 points)

Compute the normal direction for the implicit surface $f(x, y) = 2x^2y^2 - 5xy^2 + 2$ at the point $(2, -1)$. You do not need to simplify your answer.

Problem 8 (2 points)

The equation $2z = x^2 + y^2$ represents a paraboloid. Compute *all* of the intersection *locations* between this paraboloid and the ray with endpoint $\mathbf{e} = \langle 0, -1, 3\rangle$ and direction $\mathbf{u} = \langle \frac{1}{3}, -\frac{2}{3}, \frac{2}{3}\rangle$.

Problem 9 (2 points)

The equation $2z = x^2 + y^2$ represents a paraboloid. Given a point (x, y, z) that is on the paraboloid, compute the normal direction at that location.

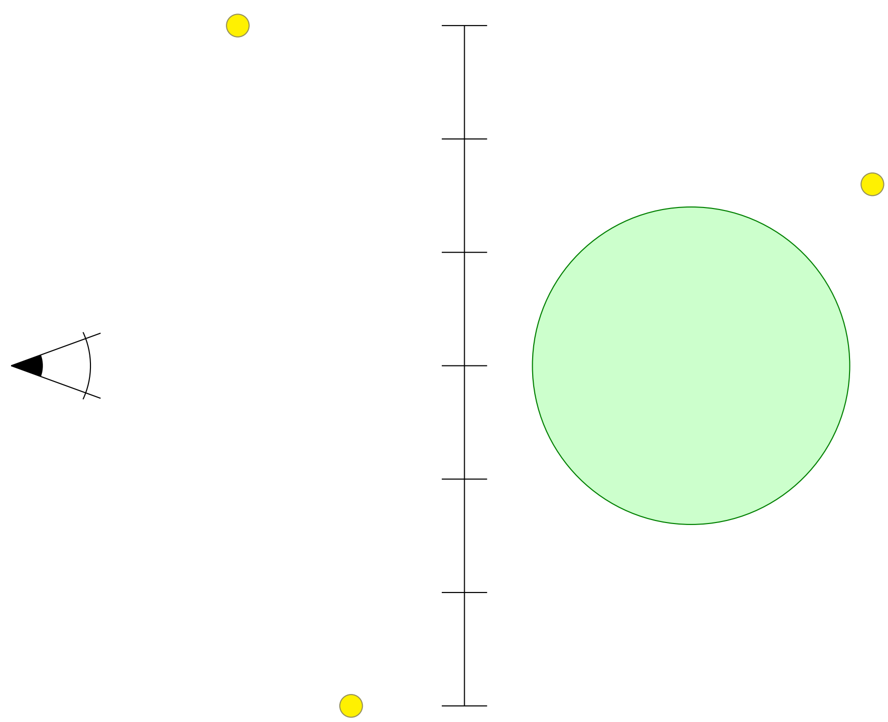
Problem 10 (2 points)

Let $\mathbf{z} = \mathbf{e} + t\mathbf{u}$, where $\mathbf{z}, \mathbf{e}, \mathbf{u}$ are vectors and are given to you. You may assume that $\mathbf{u}$ has been correctly normalized. Find t. *Be careful.*

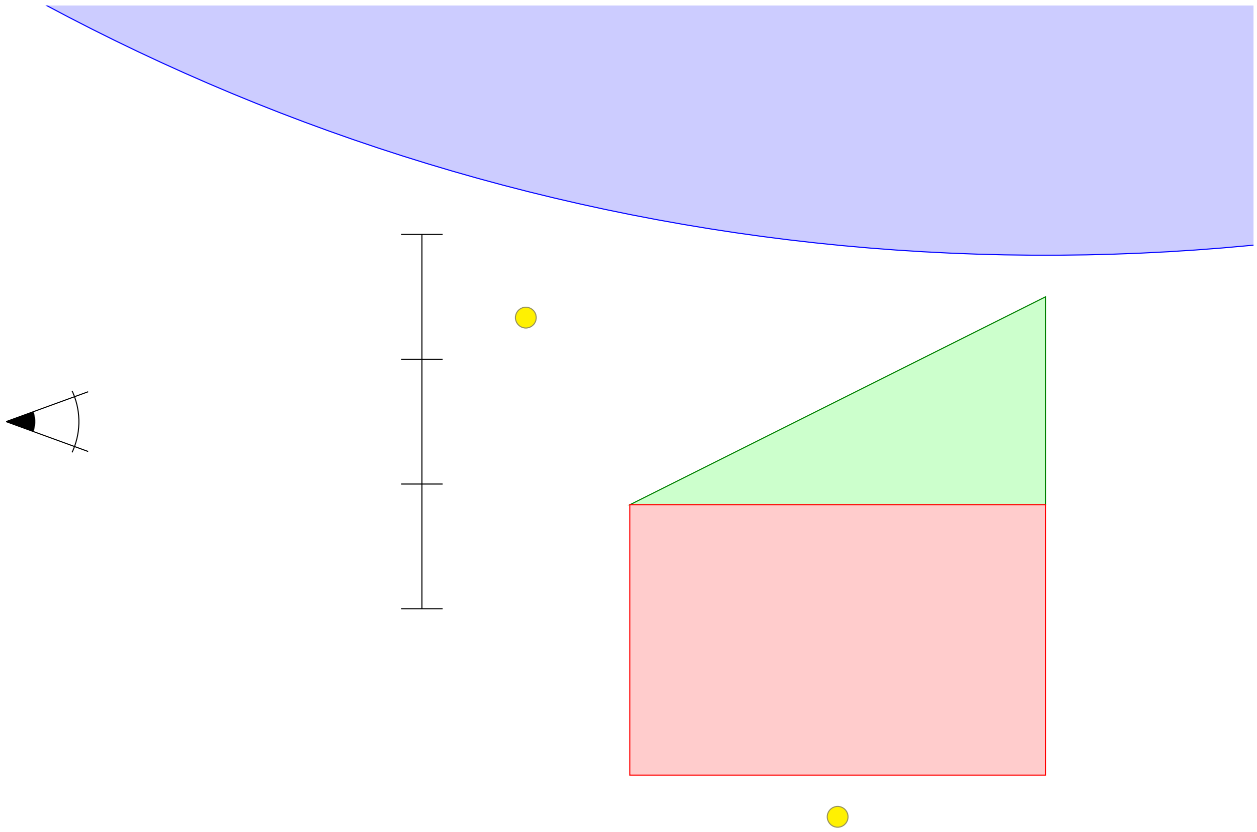
In the raytracing problems below, green objects are wood, red objects are reflective, and blue objects are transparent. The scenes are in 2D with a 1D image. yellow circles are point lights; the ray tracer supports shadows. Draw all of the rays that would be cast while raytracing each scene. Use a maximum recursion depth of 6. (Don't worry about precisely what counts as depth 6; I just care that recursion is being performed correctly when necessary and that important rays are not missing. There are no more than 25 rays in the "exact" solution.)

Problem 11 (4 points)

Note that this image has six pixels.



Problem 12 (4 points)



Problem 13 (2 points)

Why does a bump-mapped sphere cast a shadow that does not look bumpy?