

## Algorithm 7: ray - due on 11/12/2009 5:00PM

Name and Account:

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### Question 1

The high-level view of our ray tracer is exactly the same as for intersect, except for a few additions. Below is the high-level pseudocode for intersect. What needs to be changed/added to make this a full-fledged raytracer? Just specify what changes need to be made – no pseudocode please.

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#### Algorithm 1 RAY-TRACE(*Scene*, *Canvas*)

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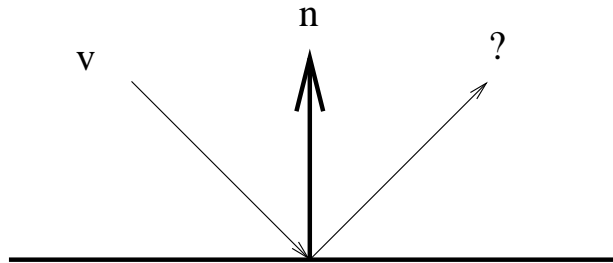
```
for point ∈ Canvas do
  cast a ray to find the nearest object
  if ray intersects an object then
    for each light that illuminates the point do
      Canvas[pt] = Canvas[pt] + color with only diffuse/ambient components
    end for
  else
    Canvas[pt] = background color
  end if
end for
```

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## Question 2

Given a vector  $\vec{v}$  and a surface normal  $\vec{n}$ , find the equation for the vector  $\vec{r}$  which is the reflection of  $\vec{v}$  about  $\vec{n}$  (i.e., in the equal and opposite direction). Write your equation in terms of vector operations. How do you compute the color contributed by the reflected ray? Give a brief description.



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## Question 3

Is raytracing a local or global illumination algorithm? Why?

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## Question 4

For what two cases will an object (or portions of an object) not be affected by a light source?

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## Question 5

Recall that we can think of texture mapping in two steps. First, mapping from the object to the unit square, and second, mapping from the unit square to the texture map. Let  $a$  and  $b$  be the  $x$  and  $y$  values in the unit square that a particular point on an object gets mapped to in the first step. (Note that  $a$  and  $b$  are calculated differently depending on the object.) From here, how do you find the coordinates  $(s, t)$  to look up in a texture map in terms of  $a, b, u, v, w$ , and  $h$ , where  $u$  and  $v$  are the number of repetitions in the  $x$  and  $y$  directions respectively,  $w$  is the texture width, and  $h$  is the texture height?

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## Question 6

How do you use the color from the texture map and the *blend* value in the lighting equation?

### Question 7

What is the Phong lighting model used for? What is the purpose of its exponent?

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### Extra Credit

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### Question 8

Compare and contrast radiosity and raytracing: what are the advantages and disadvantages to each? How might you combine the two?