**Computer Vision 2016 Spring HW#2 theory**

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**Q1.**

(1) Let the albedo of this Lambertian surface is each light source’s intensity is equal as and surface normal is

Then, because of properties of Lambertian surface, for all viewing directions, radiance of surface from first source and radiance of surface from second source are like this.

Now, let’s think about radiance of surface from single “effective” source.

By above equality, we can regard the “effective” source as a light source having intensity of and direction .

Therefore, the “effective” direction is .

(2) With different intensity , radiances are changed like below.

Now, let’s think about “effective” source’s direction and intensity .

Like (1), we can get this equality.

Therefore, “effective” direction is .

(There are two unknowns ( but there is just one equation, so I couldn’t get both unknowns respectively.)

**Q2.**

Let’s think about 3D coordinate system with origin at the sphere’s center and with x and y axes oriented with the image axes.

At a point (u, v, z) on this sphere’s surface, because of the definition of sphere and Pythagorean theorem.

Therefore, the normal vector formula for (u,v) is .