This is a written assignment. You are free to write out your answers by hand on paper, or use word processing technology if you are comfortable doing so. Either way, the answers should be zipped up and uploaded to handin by the deadline. Pay attention to the time of day on handin for the due date.

Problem 1

Using the following geometry:

- An infinite plane that includes the point $\vec{P} = (0, 0, 10)$ and has the normal $\hat{n}_S = (0, 0, 1)$.
- A sphere that has the center $\vec{P} = (0, 0, 0)$ and radius $R = 2$.

Show the value of the visibility $V$ of each of them from the point $(0, 0, -10)$ with the following ray directions into the point:

1. $\hat{n}_i = (0, 0, -1)$
2. $\hat{n}_i = (0, 1/\sqrt{2}, -1/\sqrt{2})$
3. $\hat{n}_i = (0, 0, 1)$

Problem 2

Which of the following formulae is a valid for of Lambertian reflectivity, given a surface normal $\hat{n}_S$, incoming direction $\hat{n}_i$, and outgoing direction $\hat{n}_o$:

1. $|\hat{n}_S \cdot \hat{n}_o|$
2. $|\hat{n}_S \cdot \hat{n}_i|$
3. $1/\sqrt{2}$
4. $|\hat{n}_S \cdot (\hat{n}_i - \hat{n}_o)| / \sqrt{2 - 2\hat{n}_i \cdot \hat{n}_o}$
Problem 3

An Axis-Aligned Bounding Box (AABB) has the Lower Left Corner (LLC) \((-1.3, 4.5, 0)\) and Upper Right Corner (URC) \((1.3, 100, 0, 0.5)\). Is the point \((0, 4.3, 0.25)\) inside or outside of the box?

Problem 4 (6050 students only)

Using the AABB above, and the AABB defined by the LLC \((0, 4.3, 0.25)\) and URC \((2.7, 7.6, 8)\), provide the LLC and URC for the AABB that is the Union of these two AABBs, and the LLC, URC for the AABB that is the Intersection of these two AABBs.