資訊網路與多媒體研究所

100. 9. 29

資格考試科目：計算機圖形

Computer Graphics Ph.D. Qualifying Exam, September 2011

1. (20%) (a) The Phong illumination model can be summarized by the following equation:

$$I = k_e + k_a I_a + \sum_i \left[I_{l_i} \left(k_d (\mathbf{N} \cdot \mathbf{L}_i)_+ + k_s (\mathbf{V} \cdot \mathbf{R}_i)_+^{n_s} \right) \min \left(1, \frac{1}{a_0 + a_1 d_i + a_2 d_i^2} \right) \right]$$

   Draw a diagram to explain the main variables in the above formulation. What effects do the terms of the above formulation intend to model? (b) Describe how to shade a triangle using flat shading, Gouraud shading and Phong shading. Discuss their visual differences.

2. (20%) Please describe a method of generating shadows for point light sources in local shading.

3. (20%) $\mathbf{A}$ and $\mathbf{B}$ are 3×3 rotation matrices. Let $\mathbf{C}$ be a matrix created by a convex linear combination of them ($\mathbf{C} = \alpha\mathbf{A} + (1 - \alpha)\mathbf{B}$). Under what circumstances will $\mathbf{C}$ be a rotation matrix?

4. (20%) What is the average value of the function xyz in the unit cube $(x, y, z) \in [0, 1]^3$?

5. (20%) Kinect is a motion sensing input device released by Microsoft. Briefly describe how it works, give a couple of its potential applications and describe how Kinect can be used in these applications.