



Department of Computer Science Academic Syllabus

Course Number: 151055
Course Name: Mini project in Introd. to Software Engineering

Mini-project 1 instructions

General instructions:

- For presenting this mini-project feature, it is mandatory to create at least one 3D model which includes at least 8 different bodies and at least 3 different light sources in different positions.
- It must be possible to turn the feature developed in the mini-project ON and OFF from unit test(s) code. In the unit tests, for each picture it is mandatory to run it with and without the feature and to show both resulting pictures and timing of their image rendering.
- All the features in this mini-projects create a cone or a pyramid of sample rays in addition to a main (basic) ray.
- Number of sample rays produced for each basic ray must be 50 or higher (for X/Y rectangle based method it will be $9 \times 9 = 81$).
- The basic ray must be included in the set of sample rays.
- The rays must be distributed evenly in the rays' cone/pyramid, therefore the target points used for producing the sample rays must cover the whole target area evenly.
- The students will choose rectangular, circle or ball area in accordance to specific feature and they must be able to explain their decision with appropriate reasoning.
- The students must make architectural decisions about code responsibilities (according to RDD) for their mini-project, and as a result location and way of implementation. Their solution must follow the design principles and avoid "smells" as learned in the course Introduction to Software Engineering. They must be able to explain their decisions with appropriate reasoning.
- For this course, the resulting color of a point (or color multiplier for a ray) will be equally weighed color from all the sample rays.
- Amount of sample rays and all other parameters will be stored in appropriate classes according to RDD decisions and they must be changeable by appropriate setters from the unit tests code. **It is strictly forbidden to use any hard-coded values.**

Super-sampling:

- It is clear that the sample rays are produced from camera location through points in a pixel
- What will be the method of calculating evenly distributed points in the target area?
- Where will the parameters be stored?





- Where will the sample rays be produced?
- How and where will the resulting color be calculated?

Soft Shadows:

- Will be the target area a ball or a circle or a square?
- The light sources (which ones?) will get radius or square edge size parameter
- If it is a circle or a square – will it have configurable "direction" (normal to its plane) or it will always be orthogonal to the basic shadow ray?
- What will be the method of calculating evenly distributed points in the target area?
- What will we get from the sample rays (color? Multiplier?) and how we will average the results?
- Where will the parameters be stored?
- Where will the sample rays be produced?
- How and where will the resulting color be calculated?

Depth of Field:

- It is clear that the sample rays are produced from a rectangle in view plane through a point in the focus plane
- Who is responsible for calculating the focus plane and view plane's source area?
- What are the parameters for focus plane and the view plane's source area parameters?
NB: take in account camera parameters like aperture, focus distance, etc.
- How will we avoid undesirable distortions of the picture (when calculating the target point)?
- What will be the method of calculating evenly distributed points in the source area?
- Where will each one of the parameters be stored?
- Where will the sample rays be produced?
- How and where will the resulting color be calculated?

Glossy Surface and Diffuse Glass:

- How will you ensure that the DRY principle is kept?
- Will we use "virtual" target area or angle generator in order to produce a **cone** of rays?
- If virtual target area approach chosen:
 - Will be the target area a ball or a circle or a square?
 - How will the "virtual" target area location and size be determined in order to ensure desirable glossiness/diffusion?
- What will be the method of calculating evenly distributed points in the target area?
- How will we ensure even distribution of the rays in the cone?
- How will we avoid sample rays going to other side (relatively to the basic ray) of plane tangent to a surface at a point?
- Where will the parameters be stored?
- Where will the sample rays be produced?
- How and where will the resulting color be calculated?

