Assignment 1:
Exploring OpenGL Programming

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1 INTRODUCTION

1.1 Ray-Triangle Intersection

Complete the implementation of the ray-triangle intersection function `TriangleIntersect` in `src/accel.cpp`.

1.2 Ray-AABB Intersection

Complete the AABB (Axis-Aligned Bounding Box) intersection in the function `AABB::intersect` in the file `src/accel.cpp`.

1.3 BVH Construction

Implement BVH Construction.

1.4 Direct Illumination Integrator

Implement the IntersectionTestIntegrator class.

1.5 Integrate with Refractive Materials

Add support for refractive materials in the IntersectionTestIntegrator class.

2 IMPLEMENTATION DETAILS

2.1 Ray-Triangle Intersection

Through the calculation of the intersection point of the ray and the triangle plane in the triangle coordinate system, determine whether the point is inside the triangle.

2.2 Ray-AABB Intersection

Calculate the intersection time of the ray and the three pairs of parallel planes of the AABB. If the ray intersects the AABB, return true. Otherwise, return false.

2.3 BVH Construction

Build the BVH tree using the median split method.

2.4 Direct Illumination Integrator

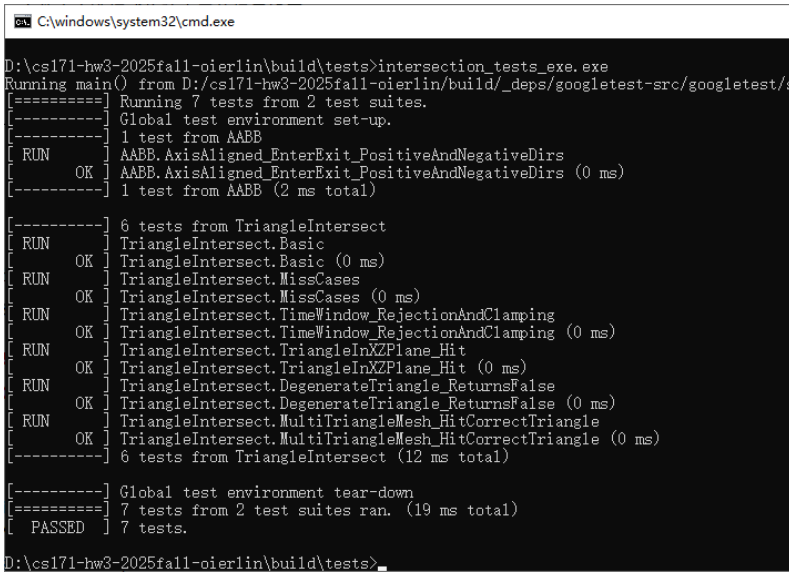
For every pixel it spawns one camera ray per sample; the ray is traced until it hits either an ideal-diffuse or a perfect-refraction surface. Specular refractions are followed recursively by sampling the BSDF and spawning a new ray, while diffuse surfaces terminate the path. Once a diffuse hit is found, direct illumination from the single point light is computed: a shadow ray is cast toward the light position and, if unoccluded, the reflected radiance is estimated with a simple Lambertian model—albedo from `bsdf->evaluate` multiplied by the clamped cosine between the surface normal and the light direction. All other surface types are ignored, so only direct lighting on ideal-diffuse surfaces contributes to the final pixel color.

2.5 Integrate with Refractive Materials

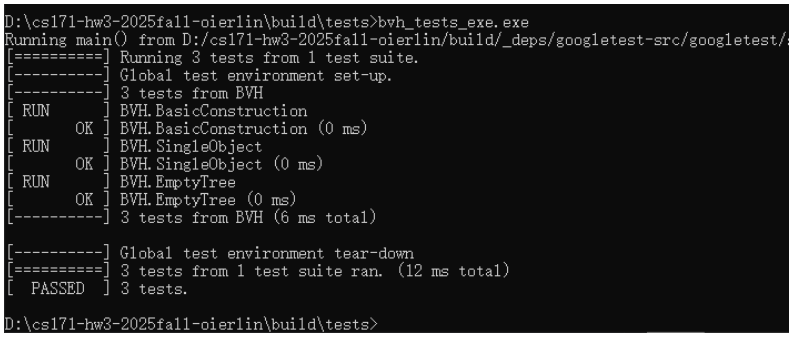
Judge whether it is a total reflection to call refraction or reflection.

3 RESULTS

3.1 Ray-Triangle Intersection & Ray-AABB Intersection



3.2 BVH Intersection



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3.3 Final