DH 2323 - Project Specification (for A grade)

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Our goal is to try to improve the performance of a basic raytracer as much as possible in order to try to simulate real-time rendering. We have created a list of optimizations that we will consider applying:

- Implement raytracing on a GPU for parallel performance
- Optimize the intersection finding algorithm
  - pre-calculation for faster ray-triangle intersections [1]
  - preprocessing with *kd*-trees to avoid unnecessary tests[2][3]
    - surface area heuristic for construction in $\mathcal{O}(n \log n)$
  - first-hit optimization for early termination of shadow ray checks
  - implement intersection tests for other graphical primitives

References

[1] Doug Baldwin and Michael Weber, *Fast Ray-Triangle Intersections by Coordinate Transformation*, Journal of Computer Graphics Techniques (JCGT), vol. 5, no. 3, 39-49, 2016 http://jcgt.org/published/0005/03/03/

[2] Ingo Wald and Vlastimil Havran RT06 Conference, Sept. 2006 http://dcgi.felk.cvut.cz/home/havran/ARTICLES/ingo06rtKdtree.pdf

[3] M. Vinkler, V. Havran, J. Bittner *Performance Comparison of Bounding Volume Hierarchies and Kd-trees for GPU Ray Tracing", in Computer Graphics Forum* DOI: 10.1111/cgf.12776, Volume 8, Issue 35, pages 68-79 https://onlinelibrary.wiley.com/doi/epdf/10.1111/cgf.12776