Software Developer (C++) Project:

A core component of Cesium is working with large geospatial datasets. As a 3D software developer with us you'll be involved in rendering them accurately and efficiently, but also in building analytics tools for deriving useful information. For this project, we'd like you to create a program that finds the surface distance of a path on terrain.

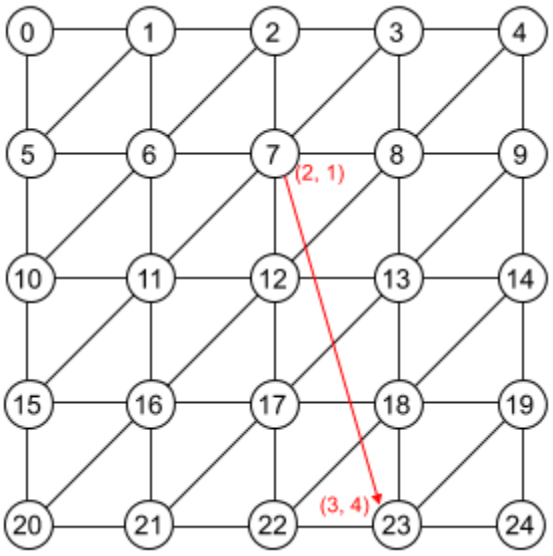
Please complete this project using C++. The final deliverable will be the code and instructions for running the program.

The project should be completed in three hours. If you wish to work on the project after the allotted time, that is fine too, but please clearly separate the work done in the first three hours from the work done after, e.g. as a git commit or a copy of the project.

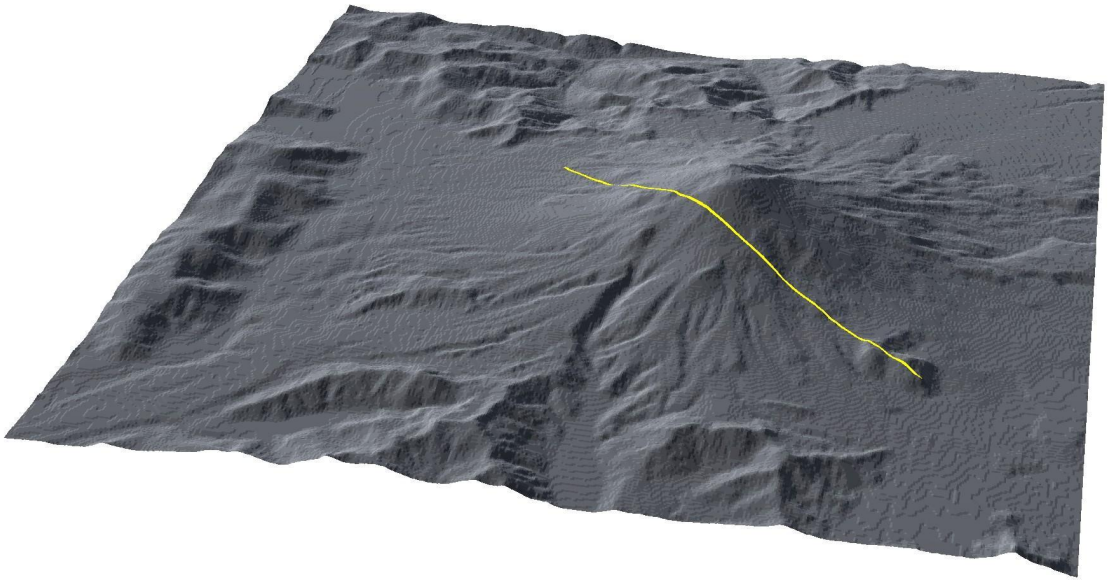
Feel free to google any questions, and also to reach out to Sean (sean@cesium.com) with any questions before you start and as you go.

Requirements:

- Download st-helens.zip (attached with the email)
- The folder contains four files:
    - Height map of Mount St. Helens pre-eruption
        - .data (raw heights)
        - .png (reference image)
    - Height map of Mount St. Helens post-eruption
        - .data (raw heights)
        - .png (reference image)
- The .data file contains the raw binary height map data. Each image is 512x512 pixels, row-major, with the first pixel at the top-left corner. Each pixel is a single unsigned 8-bit height value. The heightmap has a spatial resolution of 30 meters per pixel and 11 meters per height value.
    - E.g. If a pixel has a height value of 2 and its neighbor has a height value of 4, their horizontal distance is 30 meters and their vertical distance is 22 meters.
- Write a function that computes the surface distance from point A to point B, where points are specified in pixel coordinates (x, y) and surface distance is returned in meters. Unlike point-to-point distance, surface distance should take into account the topology of the terrain surface as if you were actually walking along it. For the purposes of this project, the terrain surface should be treated as a triangular grid derived from the height map (see image below).
- Compute surface distance for both the pre- and post-eruption height maps and print the difference in surface distance.



Example triangle grid of a 5x5 height map. Numbered dots are the indices in the binary data. The red arrow shows the surface distance calculation from point (2,1) to point (3,4).



Example path visualized on 3D terrain. The path follows the terrain surface with a constant heading.

Once you send us your project, after review (if moving forward), the next step will be a Google Hangout for you to talk through your thinking, approach, any problems you ran into, and anything else with Sean and potentially another developer on our team.

Good luck!