Intersections

October 28, 2022

Consider a set of triangles in 3D space. Each triangle is defined by the coordinates of its vertices. The input triangles are given in the file `triangles.txt`, where each line corresponds to a different triangle (the first line would be "triangle #1" and so on). The line is formatted as follows:

```
[[x_1, y_1, z_1], [x_2, y_2, z_2], [x_3, y_3, z_3]]
```

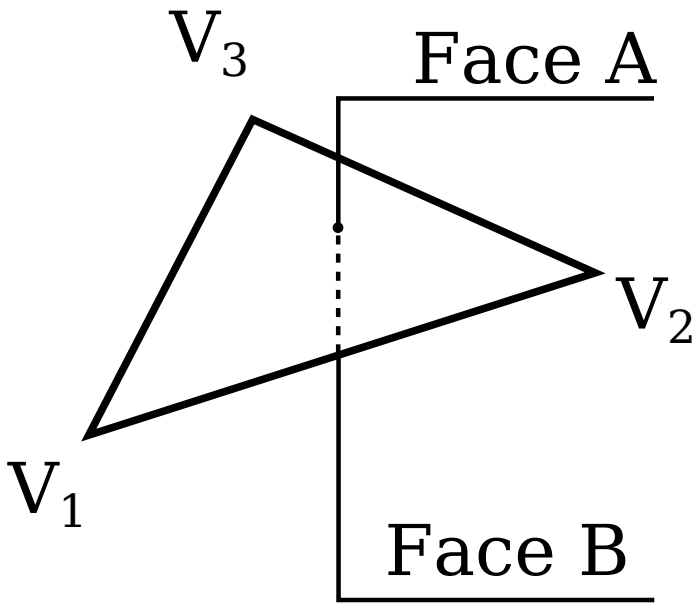
where `[x_1, y_1, z_1]` represent the coordinates of the first vertex of the triangle and analogously for the second and third vertex.

Similarly, the `directions.txt` file contains a list of normal vectors. Each normal represents the direction of a line crossing the origin.

Goal: make a script that reads both files and then computes, for each line, whether it intersects any of the triangles or not. It should produce a file named `results.txt`. That file should contain, in the n-th line, the string `-------`, if there is no intersection between the n-th line and any of the triangles. Otherwise, it should contain a line of the form

```
idx, [x_p, y_p, z_p], A/B
```

- The index `idx` of the triangle that first intersects the line coming from infinity in the direction of the normal.
- The intersection point, `[x_p, y_p, z_p]`
- The character `A` or `B`, depending on which side of the triangle is "seen" by the line as it approaches the triangle. See the figure for the explanation of which side is which (i.e. if you're seeing face A, then the vertices v_1, v_2, and v_3 appear in counterclockwise fashion).


V3
Face A
V2
V1
Face B