

# Practice Examination

CSC140 Foundations of Computer Science

11 February 2016

Let  $(x_0, y_0)$ ,  $(x_1, y_1)$ , and  $(x_2, y_2)$  be the Cartesian coordinates of the three vertices of a triangle.

Let  $(x, y)$  be the Cartesian coordinates of a point that could be inside or outside of the triangle. The barycentric coordinates  $(\alpha, \beta, \gamma)$  of that point are:

$$\alpha = \frac{(y_1 - y_0)x + (x_0 - x_1)y + y_0x_1 - x_0y_1}{(y_1 - y_0)x_2 + (x_0 - x_1)y_2 + y_0x_1 - x_0y_1}$$

$$\beta = \frac{(y_2 - y_1)x + (x_1 - x_2)y + y_1x_2 - x_1y_2}{(y_2 - y_1)x_0 + (x_1 - x_2)y_0 + y_1x_2 - x_1y_2}$$

$$\begin{aligned}\gamma &= \frac{(y_0 - y_2)x + (x_2 - x_0)y + y_2x_0 - x_2y_0}{(y_0 - y_2)x_1 + (x_2 - x_0)y_1 + y_2x_0 - x_2y_0} \\ &= 1.0 - \alpha - \beta\end{aligned}$$

A point  $(x, y)$  is inside the triangle if  $0 \leq \alpha \leq 1$  and  $0 \leq \beta \leq 1$  and  $0 \leq \gamma \leq 1$ .

Write a program that prints **true** if a point  $(x, y)$  is inside a triangle whose vertices are  $(x_0, y_0)$ ,  $(x_1, y_1)$ , and  $(x_2, y_2)$ , and prints **false** if the point is outside the triangle.

Include a `main()` method and at least one other method in your program. Include code that defines the vertices of a triangle plus a fourth point. Include code that tests if the point is inside the triangle and reports the result of the test.

Annotate your program with Javadoc comments. Include in these comments information about authorship, version, and the license under which you are

releasing the software. Include also a hyperlink to an article that explains more fully how to determine if a point lies inside of a triangle.