Computer Programming: Skills & Concepts (CP1)
Case Study 2

Aris Efthymiou

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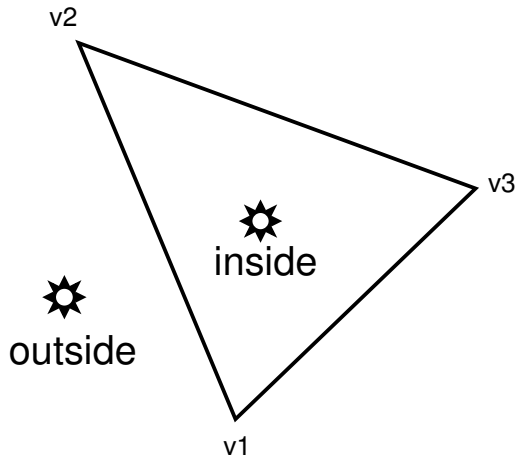
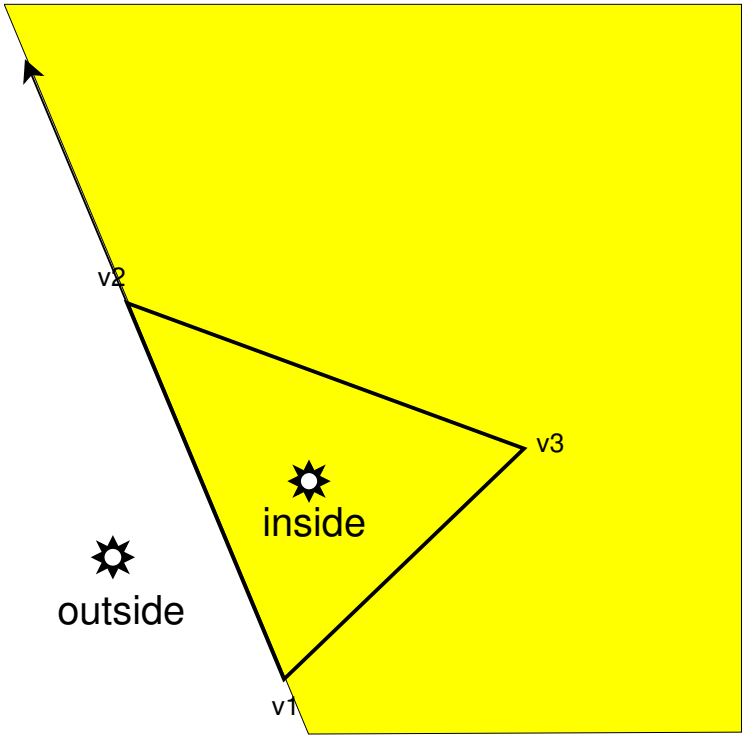
School of informatics

Task

- draw a triangle
- check if a point is inside the triangle or outside



Checking for *inside*



triangle.c

```
#include <stdlib.h>
#include <stdio.h>
#include "descartes.h"

/*
 * This program checks whether a point p lies inside a triangle
 * whose vertices are v1, v2, v3..
 */
```

```
int CrossProduct(point_t q, point_t p1, point_t p2)
/* Calculates cross product of (p1->p), (p1->p2) */
{
  int x  = XCoord(q),  y = YCoord(q),
      x1 = XCoord(p1), y1 = YCoord(p1),
      x2 = XCoord(p2), y2 = YCoord(p2);

  return (x2 - x1)*(y - y1) - (y2 - y1)*(x - x1);
}
```

```
int SameSide(point_t q1, point_t q2, point_t p1, point_t p2)
/* Calculates whether q1, q2 are on the same side of line (p1, p2) */
{
  int cp1, cp2;

  cp1 = CrossProduct(q1, p1, p2);
  cp2 = CrossProduct(q2, p1, p2);
  /* If one is on the (p1,p2) line, its cp is 0.
     We assume this is considered in the triangle.
   */
  return (cp1*cp2) >= 0;
}
```

```
int main(void)
{
  point_t v1, v2, v3, p;

  OpenGraphics();
  v1 = GetPoint();
  v2 = GetPoint();
  DrawLineSeg(LineSeg(v1, v2));
  v3 = GetPoint();
  DrawLineSeg(LineSeg(v2, v3));
  DrawLineSeg(LineSeg(v3, v1));
```

```
  p = GetPoint();
  while (XCoord(p) >=0 ) {
    if (SameSide(p, v3, v1, v2) && ... && SameSide(p, v2, v3, v1)) {
      printf("That point lies in the interior of the triangle\n");
    } else {
      printf("That point lies in the exterior of the triangle\n");
    }
    p = GetPoint();
  }
  CloseGraphics();
  return EXIT_SUCCESS;
}
```