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Worksheet 23: Work with either ONE or TWO other students to complete this worksheet. You must work with at least one other student on this assignment, and should submit one paper. Be sure to describe your key idea at a high level.

1. Develop an efficient algorithm to determine if two line segments intersect. Given line segments L and M, return TRUE if the segments intersect, and FALSE if they do not (6 points)

KEY IDEA: To first create a helper function to determine whether a point lies on a specific line segment given. This is to make sure that there are actual line segments between the points. This will end up returning a true or false as a check. Then another helper function will be used to find where all these points are orientated within the different line segments. This will be used to see which way line segments are going, as well as giving an idea which line segments overlap. After these 2 helper functions are created then the function to check for intersections will happen. This uses the orientation helper function to create different orientation variables that will be checked against the points that need to be checked. The other helper function will be used to check whether these points are on the line segment that is being tested. If the points checked are on the line segment then it will return true, this will then check the other orientations and will also return true if the points line up with them. If the points checked are on the line segment then it will return true, this will then check the other orientations and will also return true if the points line up with them. If none of these points pass then it returns false.

Algorithm SegmentsIntersect(L, M):

Input: Two lines segments L and M, containing 2 points each

Output: TRUE if L and M intersect, FALSE if they do not

PROCESS:

```
o1 ← orientation(L.p1, L.p2, M.p1)
o2 ← orientation(L.p1, L.p2, M.p2)
o3 ← orientation(M.p1, M.p2, L.p1)
o4 ← orientation(M.p1, M.p2, L.p2)

if o1 != o2 AND o3 != o4:
    return true

if o1 = 0 AND onSegment(L.P1, M.P1, L.P2)
    return true

if o2 = 0 AND onSegment(L.P1, M.P2, L.P2)
    return true;

if o3 = 0 AND onSegment(L.P2, L.P1, M.P2)
    return true;

if o4 = 0 AND onSegment(M.P1, L.P1, M.P2)
    return true;

return false
```

Orientation(P1,P2,P3):

```
int val = (P2.y - P1.y) * (P3.x - P2.x) - (P2.x - P1.x) * (P3.y - P2.y);
if val = 0
    return 0
if val > 0
    return 1
else
    return 2
```

onSegment(P1, P2, P3):

```
if (P2.x <= Math.max(P1.x, P3.x) AND P2.x >= Math.min(P1.x, P3.x) AND
    P2.y <= Math.max(P1.y, P3.y) AND P2.y >= Math.min(P1.y, P3.y)) :
    return true;

return false
```