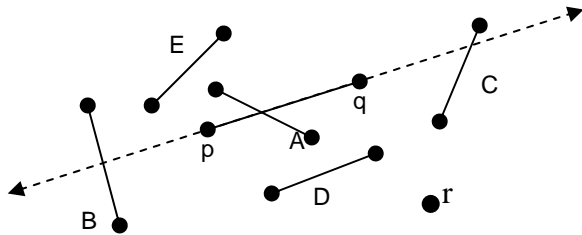


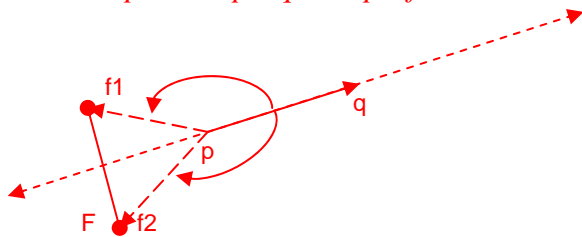
CS 410/586: Quiz 8, 26 May 2009 Name: \_\_\_\_\_ **KEY** \_\_\_\_\_

No books or notes. Work individually.



Question 8A (5 points): Describe a method to decide if a line segment  $S$  crosses the infinite **line** defined by two points  $p$  and  $q$ . In the figure above, segments  $A$ ,  $B$  and  $C$  cross the  $p$ - $q$  line. (You can assume that no three endpoints involved are co-linear.) Try to avoid division.

*Suppose we are checking a segment  $S = f_1$ — $f_2$  against  $L = p$ — $q$ . Then  $S$  must intersect the infinite line through  $L$  if  $f_1$  and  $f_2$  lie on different sides of that line. (Note that neither can be on the  $L$ -line, because that would make 3 co-linear points.) That condition can be tested by seeing if the cross product of  $p$ — $q$  (with  $p$  translated to the origin) with  $p$ — $f_1$  has the opposite sign from the cross product  $p$ — $q$  with  $p$ — $f_2$ .*



Question 8B (5 points): Consider a segment  $S$  that does **not** cross the  $p$ - $q$  line. Describe a method to decide if  $S$  is on the same side of the  $p$ - $q$  line as a point  $r$ . In the figure above, segment  $D$  is on the same side of the  $p$ - $q$  line as point  $r$ , but segment  $E$  is not. (You can assume that no three points involved are co-linear.) Try to avoid division.

*Given that  $S$  does not intersect the  $p$ — $q$  line, then it suffices to check if the line segment from one end of  $S$  to  $r$  crosses the  $p$ — $q$  line or not. Let  $S = f_1$ — $f_2$ . Use the method in 8A to test if the segment  $f_1$ — $r$  intersects the  $p$ — $q$  line. If not, then  $S$  and  $r$  are on the same side of that line; if so, then they are on opposite sides.*