# Problem Set 6 - Network Flow

Problem C

This question I was SO close to, but stuck on for like 3 days. It just took one key hint from a friend to finally get it, and boy was it satisfying. I think the way I initially got to my 90% solution was just playing around with network flow graphs on paper. I was pretty certain that the max flow would give us the final answer for this question.

My initial approach was to put all of the grid points as nodes on the left hand side, and then again, all the grid points as nodes on the right hand side. Every location that had oil on it would flow into its adjacent locations with oil - and thus, running the max flow would give us a bipartite matching that sets up scoops nicely. Or so I thought. Turns out with this method, I couldn't explicitly classify what was a start point and an endpoint, and let's say a location on the RHS was scooped up, there was nothing stopping me from using that location as a starting point for another scoop.

I then went down a rabbit hole of trying other things, like taking scoops as nodes on the flow network entirely, taking rows and columns as nodes on the flow network etc. etc. At the end of the day though, returning to my solution, all it took was a line from my friend who had completed the question - to "think of the grid like a chessboard", and it all clicked. The way to classify start points and end points was to just explicitly define alternating locations as start points.

If you think about it, since we're scooping from a node to its cardinally adjacent nodes, ALL scoops that exist on the grid would flow from a black node, to a white node, or vice versa, depending on how you set up the network. And thus, by setting up the bipartite matching like this, you don't lose any scoops at all, but make sure none are double counted. Genius…

If the purpose of these journals is to check that one has not cheated, attached below is one (of many) test diagrams I was playing with in order to find the answer.