PA3 Report

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1. Algorithm
   (1) Compare the number of pins of each net, and start routing from net with most pins.
   (2) Routing with BFS：

   We use two 1000*1000 matrices. One is used to record the position of blockages and the route of nets. Once a grid is blocked by a blockage or a net, we assign it a negative value, which means it cannot be occupied by other nets. The other matrix is used to record the distances of BFS, which is necessary for tracing back.

   Firstly, select the leftmost pin as source, using BFS algorithm to search for the nearest pin. After finding the nearest pin, trace back to record the route of this segment of net. Then, set the pin just found as the new source and keep looking for other pins with BFS until all pins of the net are connected. While progressing BFS, we should avoid any blockage and any other net. (grids with negative value) Finally, set all grids along the route of the net blocked so that it won't intersect any other net.

   (3) Trace back

   By choosing an adjacent grid while decreasing one unit of distance at a time recursively, we can find a route back to the source.

2. Complexity

   the number of pins (p)
   the number of blockages (b)
   the number of netlists (n)

   (1) Read input：$\Theta(p+b+n)$
   Record the position of each pin, each blockage and each netlist.
   (2) Set the grid matrices：$\Theta(m^2)$,m=1000
   Initialize each grid and set the blockage.
   (3) Routing：$(p-n)* O(m^2)$
   Connect a segment of net by BFS(between pin to pin) within a 1000*1000 grid matrix is $O(m^2)$.
   $(p_1-1)+(p_2-1)+(p_3-1)+\ldots+(p_n-1)=(p_1+p_2+p_3+\ldots+p_n)-n=(p-n)$ times of BFS
   (4) Trace back：$\Theta(p-n)$
   (5) Total complexity=$(p-n)* O(m^2)$