1. Simulation, use union-find data structure to maintain the connected components. For each connected component, maintain a linked list containing its boundary. Each grid cell will be visited at most $O(1)$ times. $O(nm \cdot \alpha(nm))$.

2. For grids and planar graphs, union-find can be solved in linear time [1]. $O(nm)$.

References

[1] Jens Gustedt. Efficient union-find for planar graphs and other sparse graph classes. *Theoretical Computer Science*, 203(1):123–141, 1998.