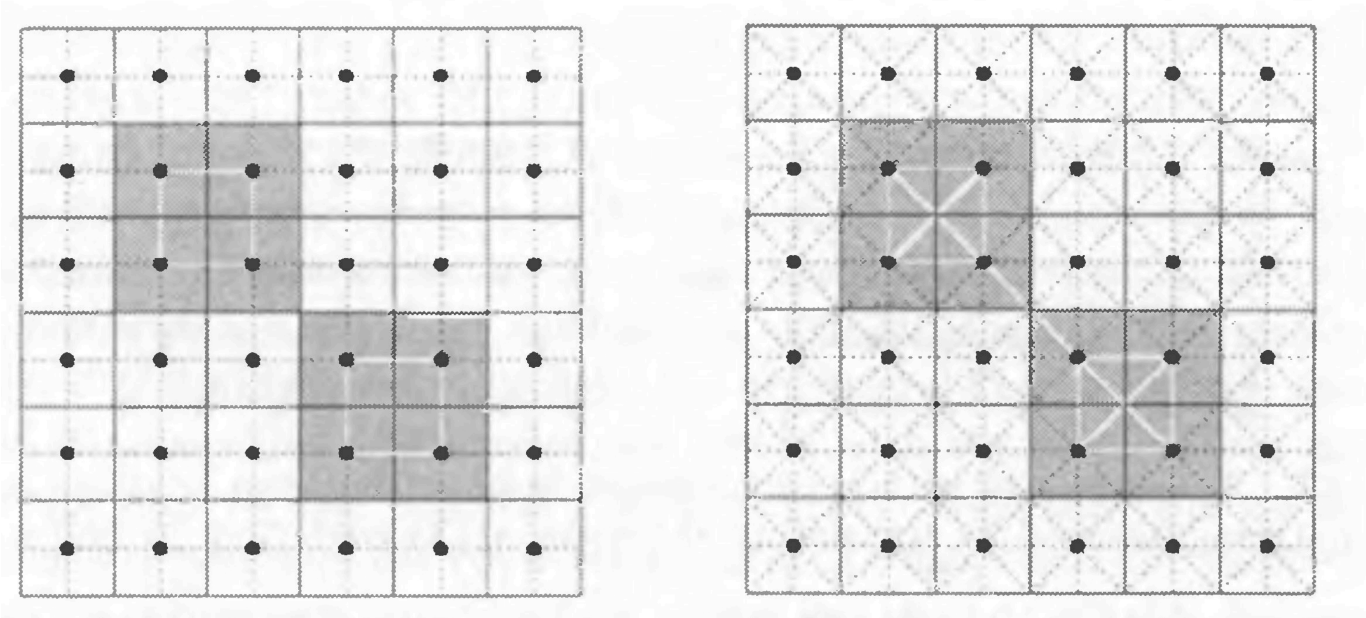
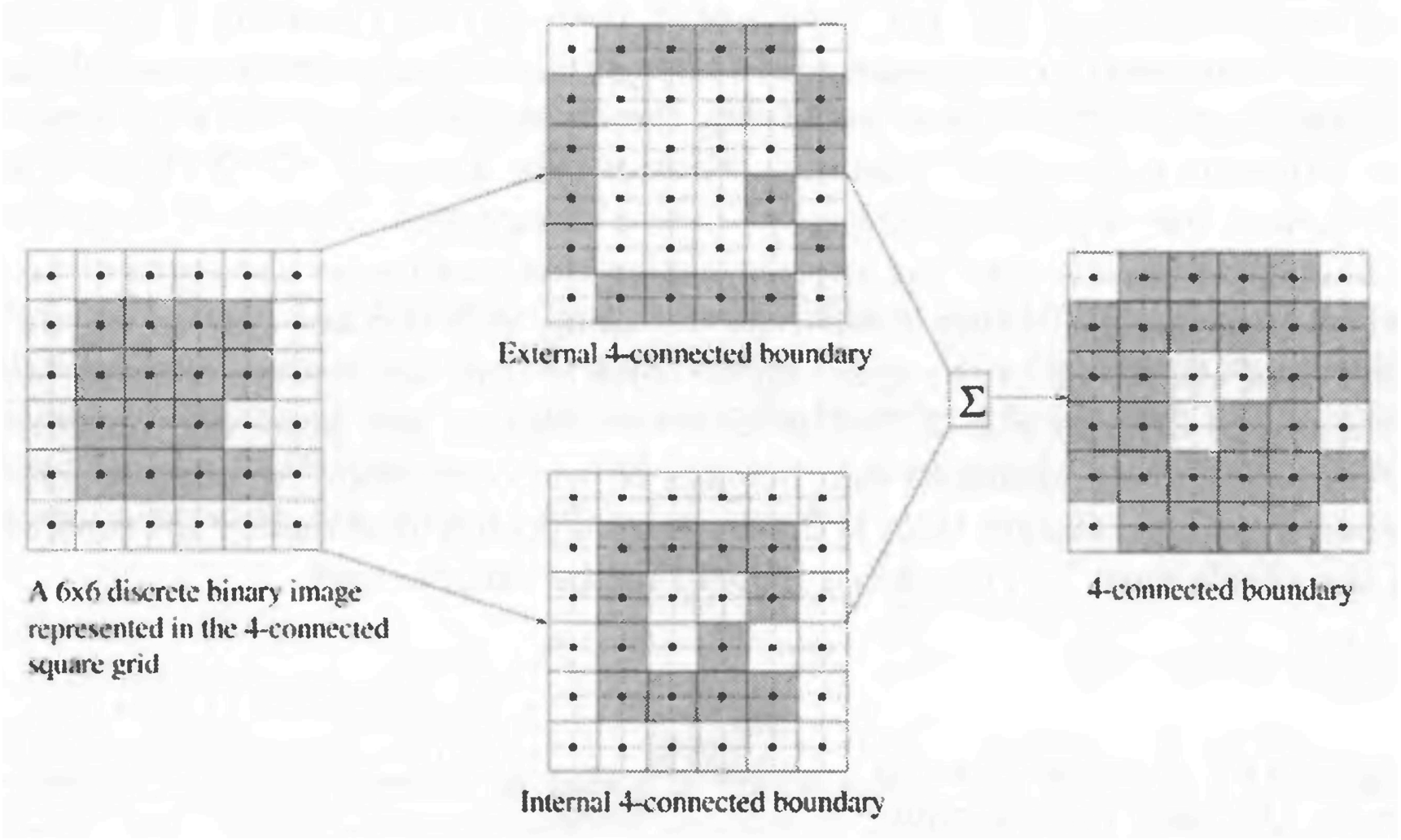
MA5313 – Lecture 2 Supplement

Background Notions (cont.)
Discrete Geometry and Topology: connectivity

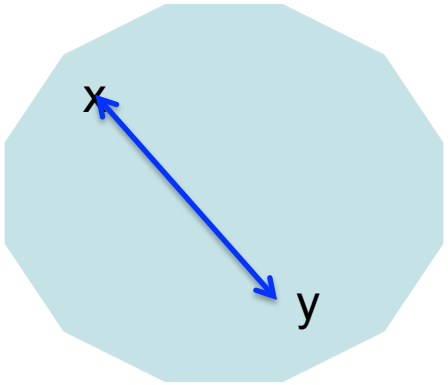


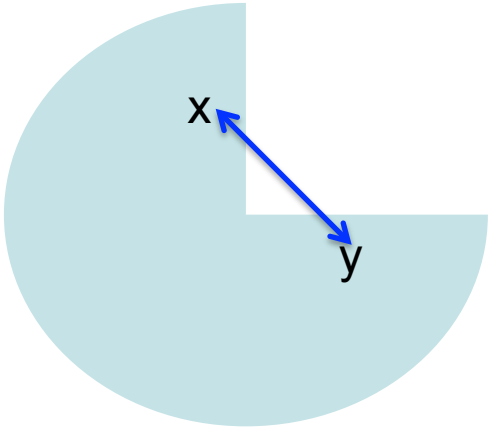
Are the two 2x2 squares connected?

Background Notions (cont.)
Discrete Geometry and Topology: boundaries



Background Notions (cont.)
Discrete Geometry and Topology: convexity

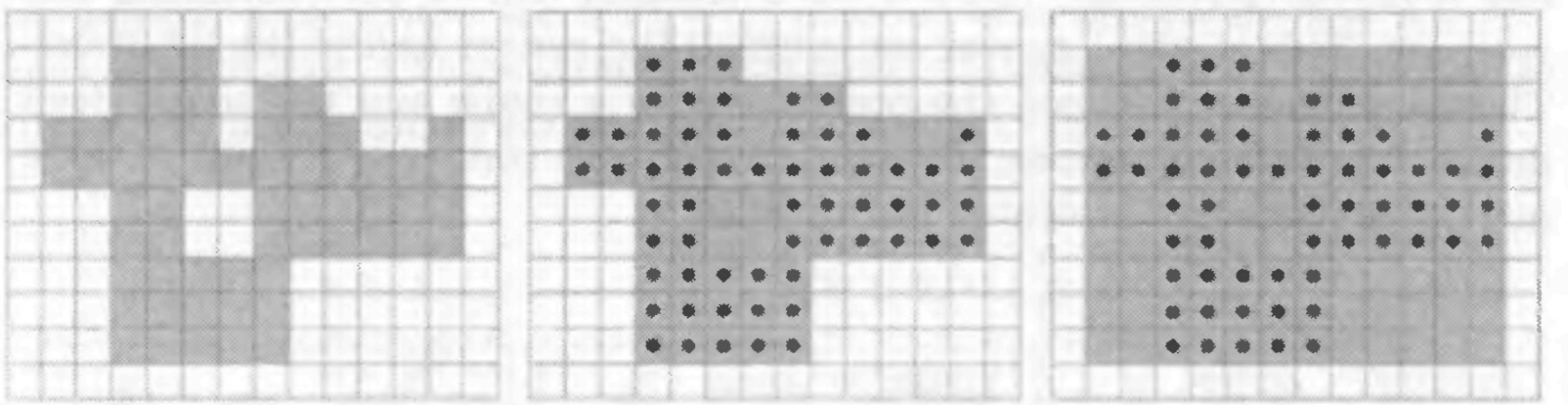




! Problem: more than one connected digital line segments connecting two points

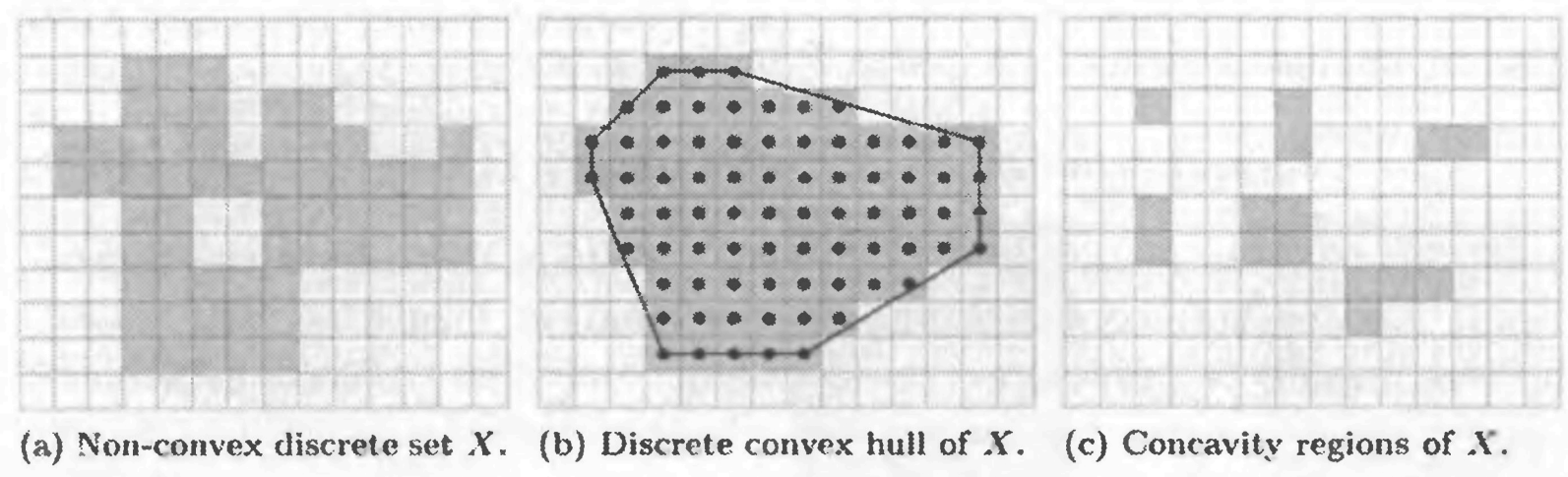
Hence, several definitions have been proposed

Background Notions (cont.)
Discrete Geometry and Topology: convex hull - 1



(a) Non-convex discrete set X. (b) Weak convex hull of X. (c) Strong convex hull of X.

Background Notions (cont.)
Discrete Geometry and Topology: convex hull - 2



(a) Non-convex discrete set X. (b) Discrete convex hull of X. (c) Concavity regions of X.

HW: think about it

Background Notions (cont.)
Discrete Distances - 1

1. $d(p,q) \geq 0$ and $d(p,q) = 0 \Leftrightarrow p = q$;
2. $d(p,q) = d(q,p)$ (symmetry);
3. $d(p,q) \leq d(p,r) + d(r,q)$ (triangle inequality).

the discrete distance between two vertices in a graph ?

the smallest length of paths linking the two points.

Q: what is the metric in the cases of 4 and 8 connectivities ?

Background Notions (cont.)
Discrete Distances - 2

$$d_4[(x_1, y_1), (x_2, y_2)] = |x_2 - x_1| + |y_2 - y_1|,$$

$$d_8[(x_1, y_1), (x_2, y_2)] = \max\{|x_2 - x_1|, |y_2 - y_1|\}.$$

An alternative is to consider embedding into Euclidean space, ignoring the neighborhood relations.

$$d_\mathcal{E}[(x_1, y_1), (x_2, y_2)] = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$