

Aufgabe 5-1

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minPts = 3

$\epsilon = 1.1$
minPts = 4

$\epsilon = 2.1$
minPts = 4

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minPts = 5

$\epsilon = 4.1$
minPts = 4

Aufgabe 5-2

Data Mining Tutorial

Clusteranalyse – Teil II

Erich Schubert, Arthur Zimek

Ludwig-Maximilians-Universität München

2015-05-20 — KDD Übung

Aufgabe 5-1

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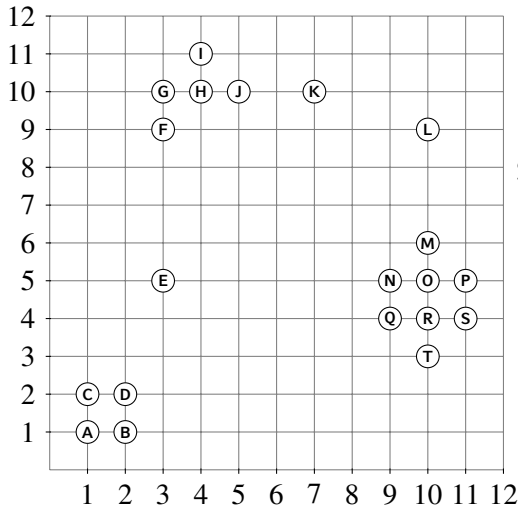
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 2$

Seed list:

Aufgabe 5-1

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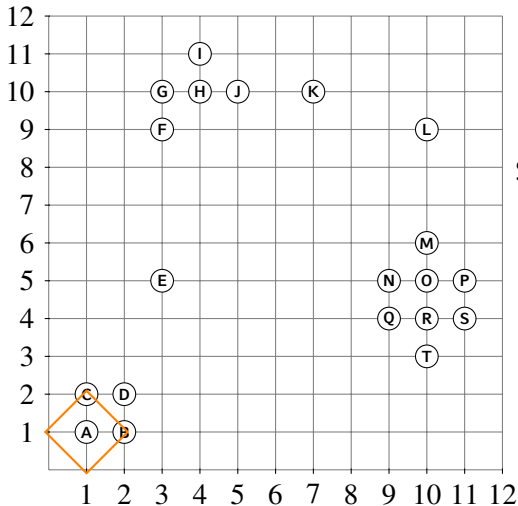
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 2$

Seed list:

Aufgabe 5-1

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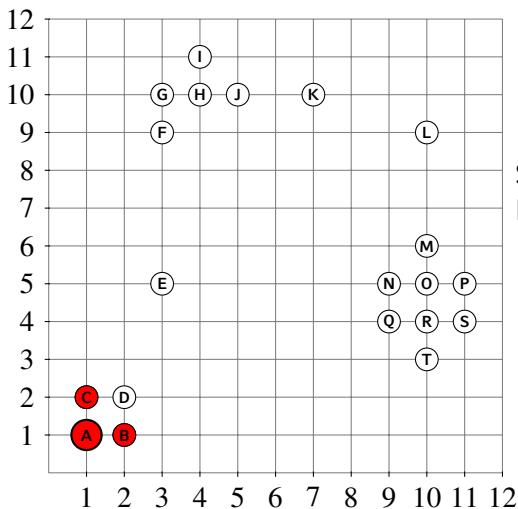
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Aufgabe 5-2



$\varepsilon = 1.1$

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Seed list:
BC

Aufgabe 5-1

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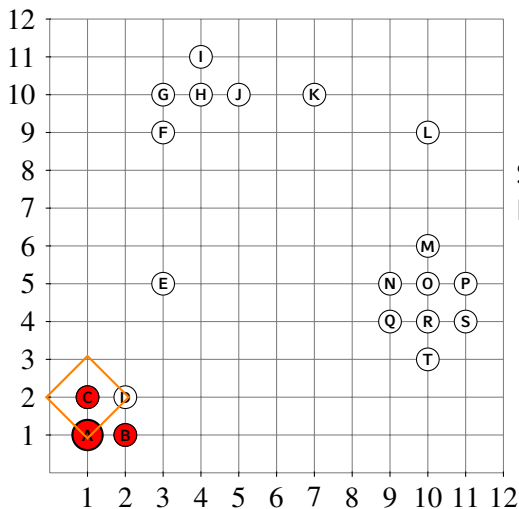
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Aufgabe 5-2



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Seed list:

B

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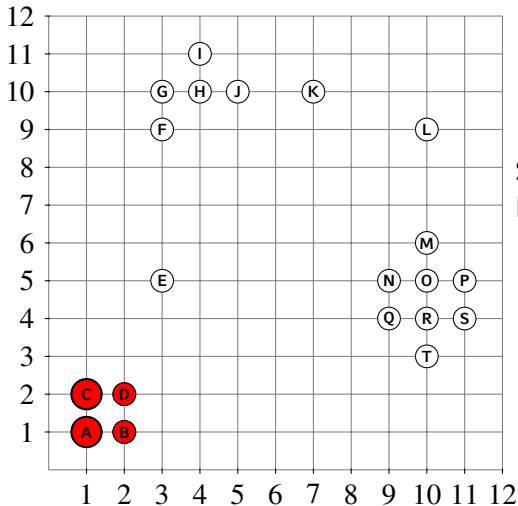
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Aufgabe 5-2



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Seed list:
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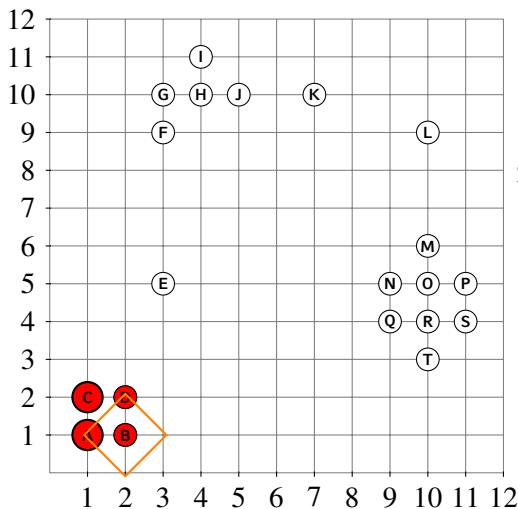
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Aufgabe 5-2



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Seed list:
D

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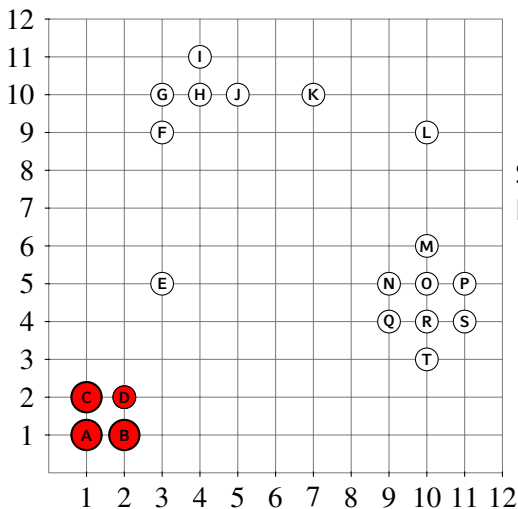
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Aufgabe 5-2



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Seed list:
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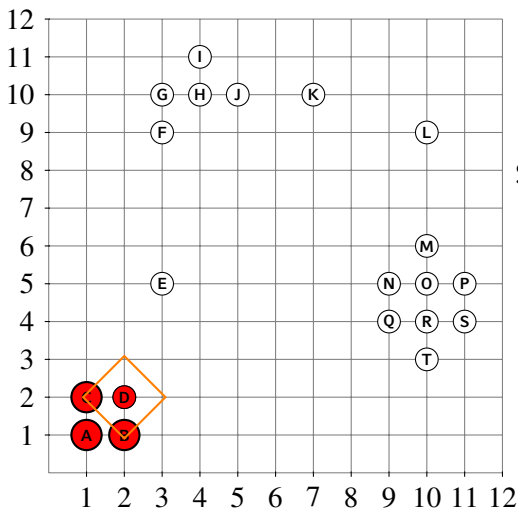
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Aufgabe 5-2



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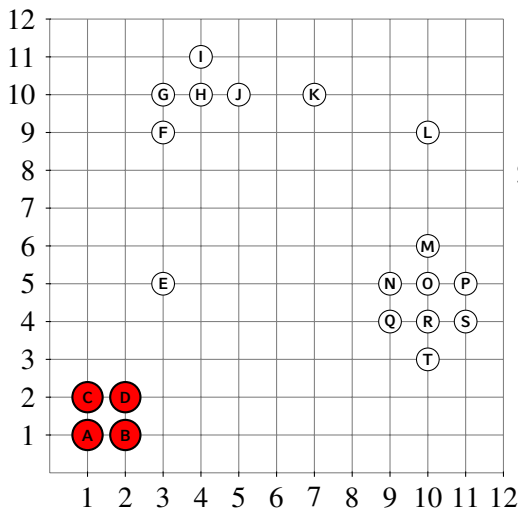
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Aufgabe 5-2



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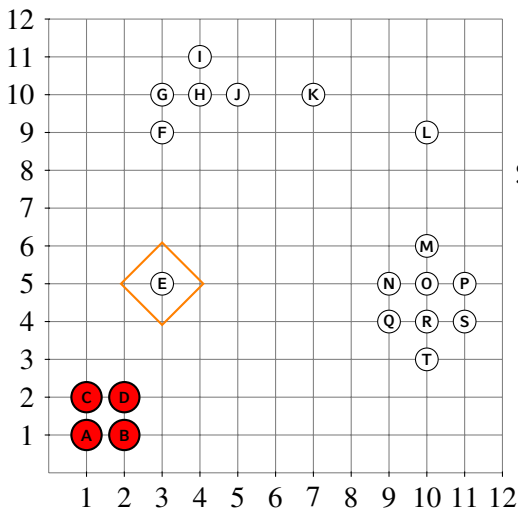
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Aufgabe 5-2



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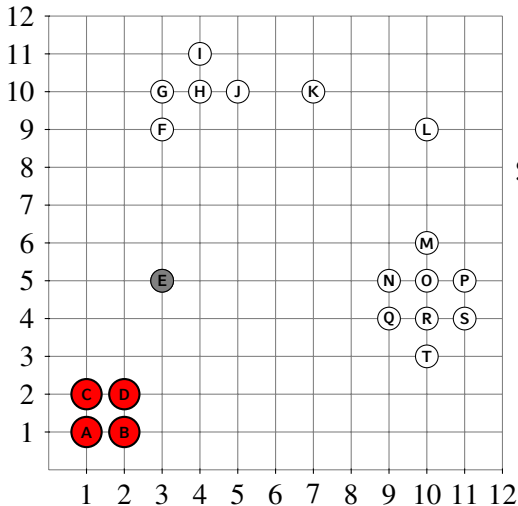
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Aufgabe 5-2



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Aufgabe 5-1

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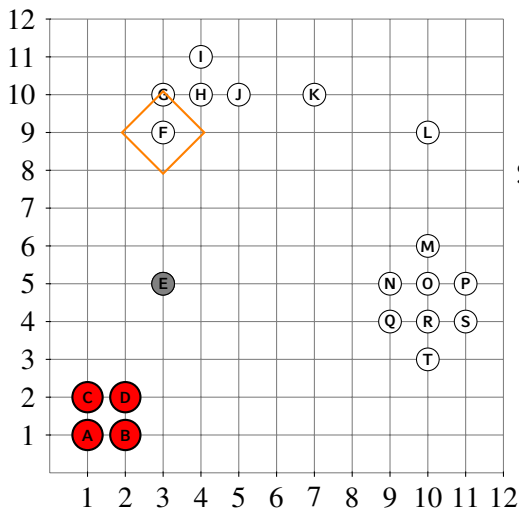
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Aufgabe 5-2



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Seed list:

Aufgabe 5-1

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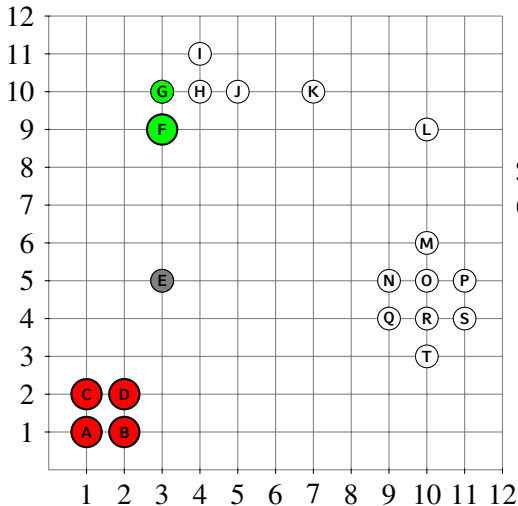
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Aufgabe 5-2



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Seed list:

G

Aufgabe 5-1

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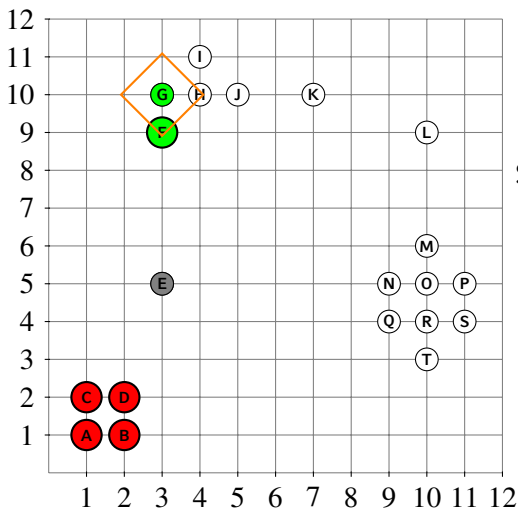
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Aufgabe 5-2



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Aufgabe 5-1

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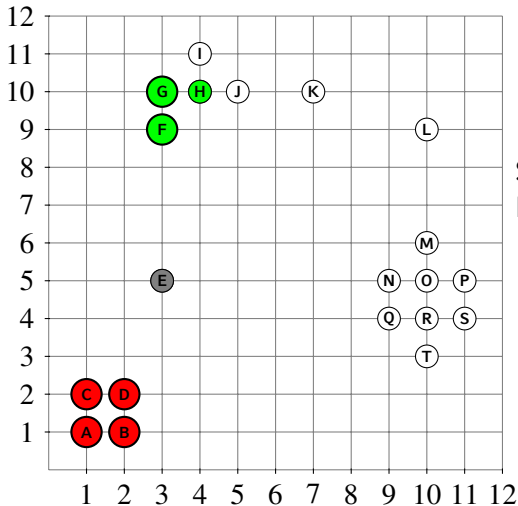
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Aufgabe 5-2



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Seed list:

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Aufgabe 5-1

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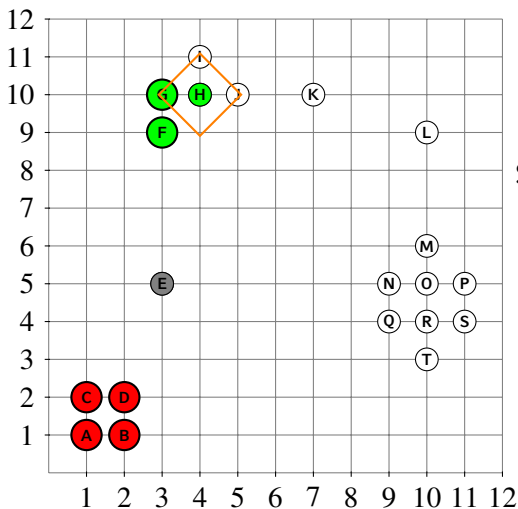
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Aufgabe 5-2



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Aufgabe 5-1

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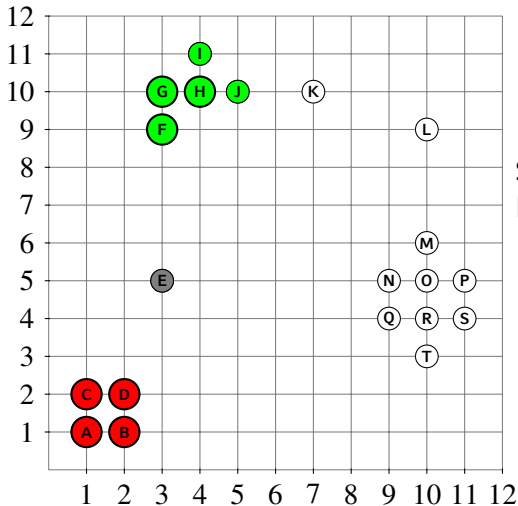
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Aufgabe 5-2



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Seed list:

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Aufgabe 5-1

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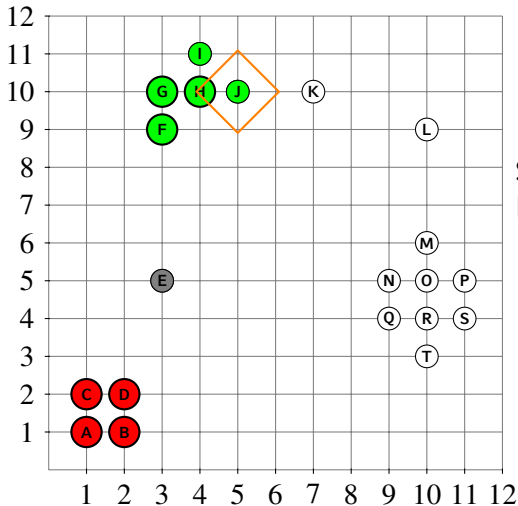
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Aufgabe 5-2



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Seed list:

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Aufgabe 5-1

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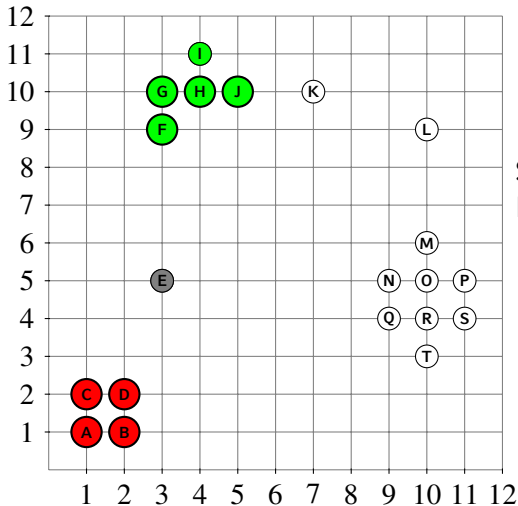
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Aufgabe 5-2



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Aufgabe 5-1

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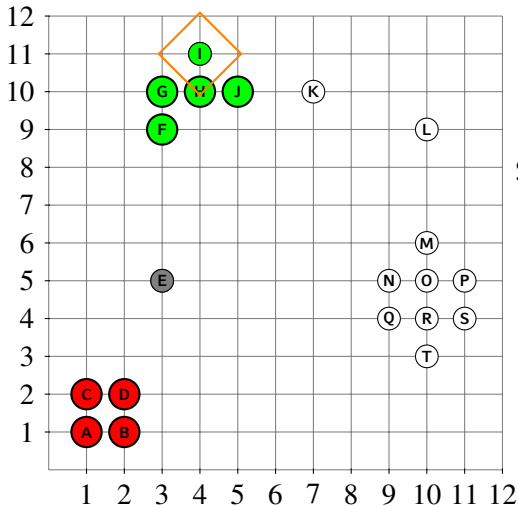
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Aufgabe 5-2



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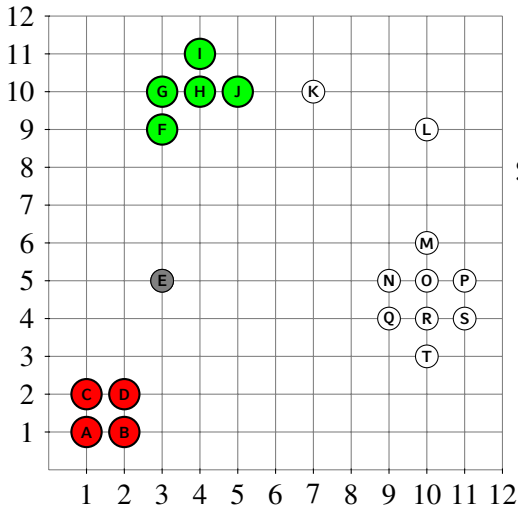
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Aufgabe 5-2



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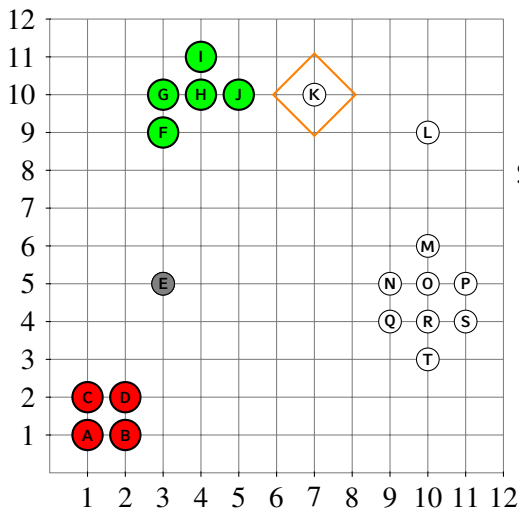
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Aufgabe 5-2



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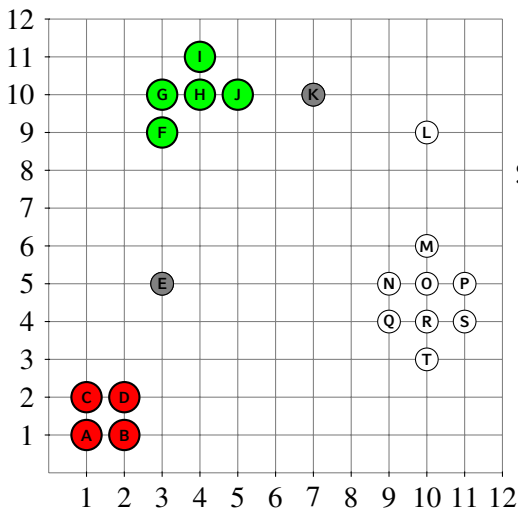
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Aufgabe 5-2



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Aufgabe 5-1

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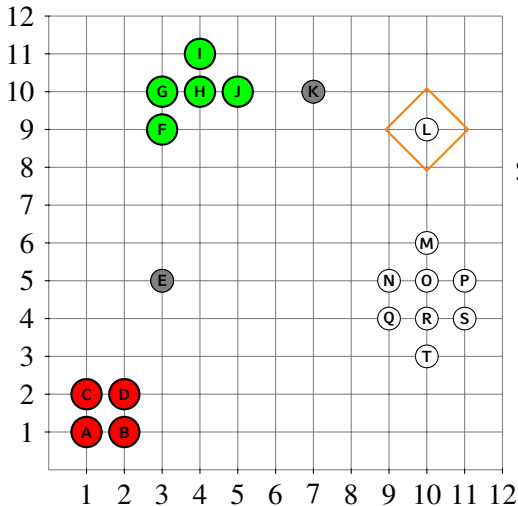
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Aufgabe 5-2



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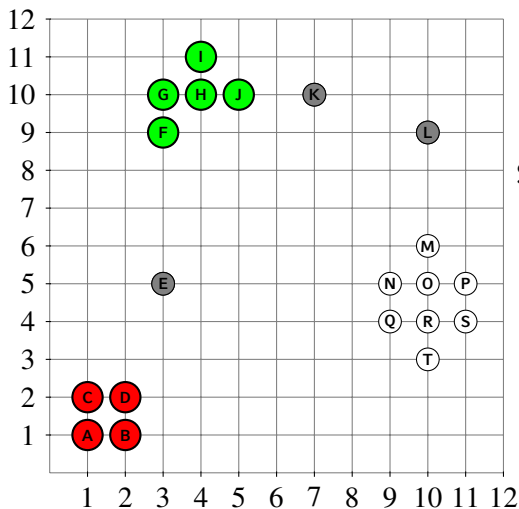
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Aufgabe 5-2



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Aufgabe 5-1

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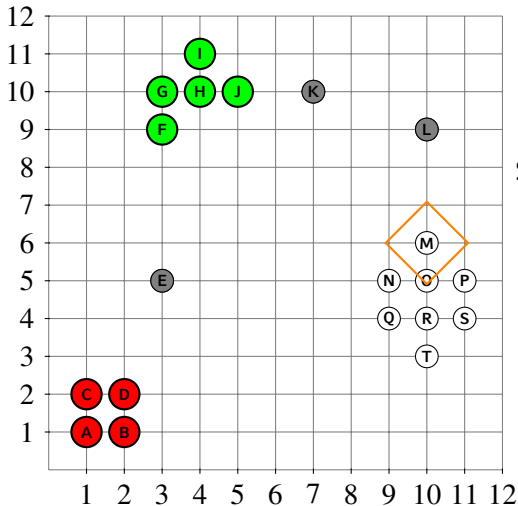
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Aufgabe 5-2



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Aufgabe 5-1

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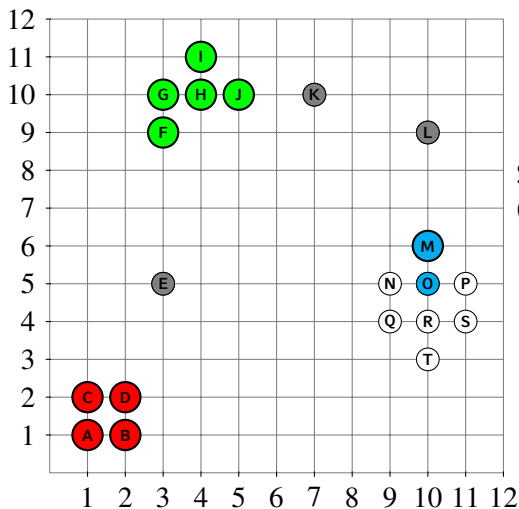
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Aufgabe 5-2



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Seed list:

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Aufgabe 5-1

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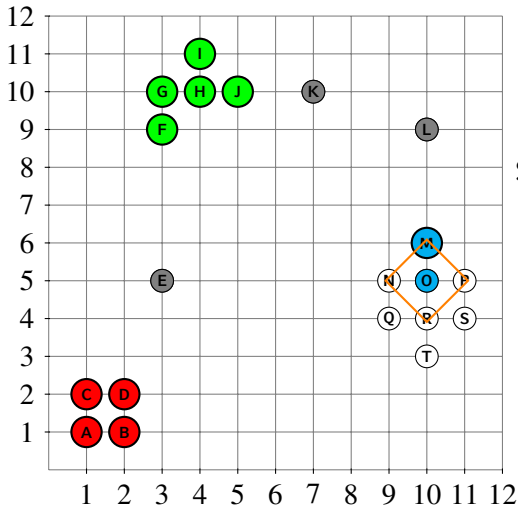
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Aufgabe 5-2



$\varepsilon = 1.1$

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Aufgabe 5-1

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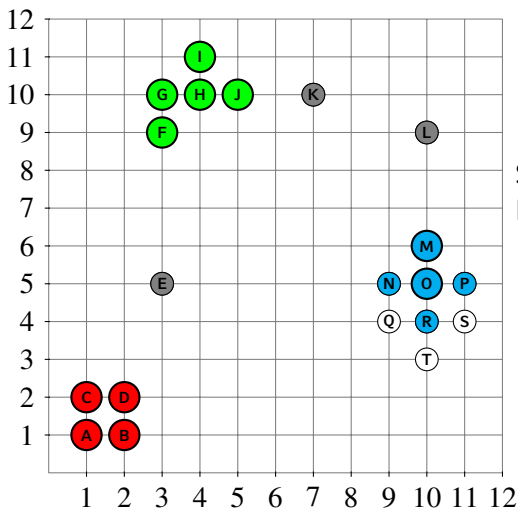
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 2$

Seed list:
NPR

Aufgabe 5-1

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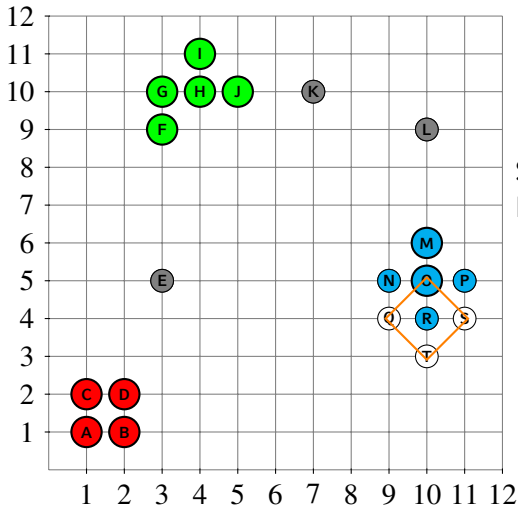
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Aufgabe 5-2



$\epsilon = 1.1$

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Seed list:
NP

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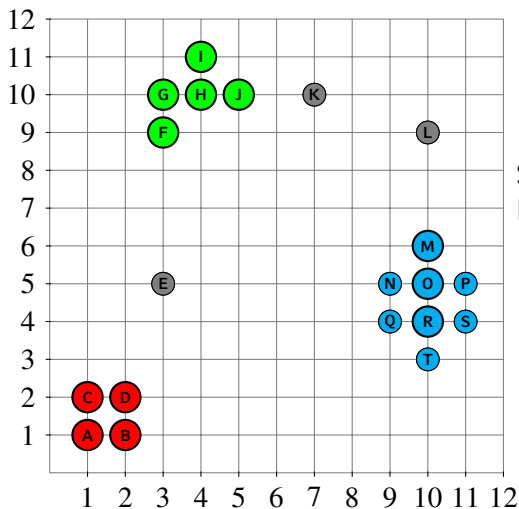
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Aufgabe 5-2



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Seed list:
NPQST

Aufgabe 5-1

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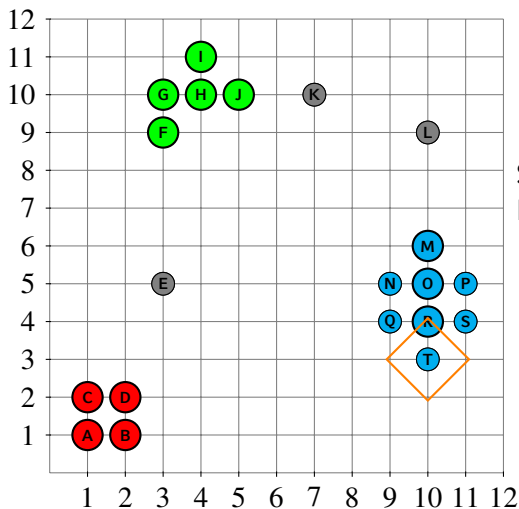
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$\epsilon = 4.1$
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Aufgabe 5-2



$\epsilon = 1.1$

$\text{minPts} = 2$

Seed list:
NPQS

Aufgabe 5-1

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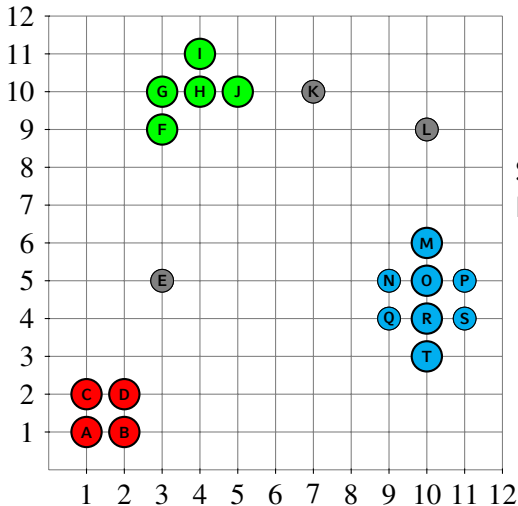
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 2$

Seed list:
NPQS

Aufgabe 5-1

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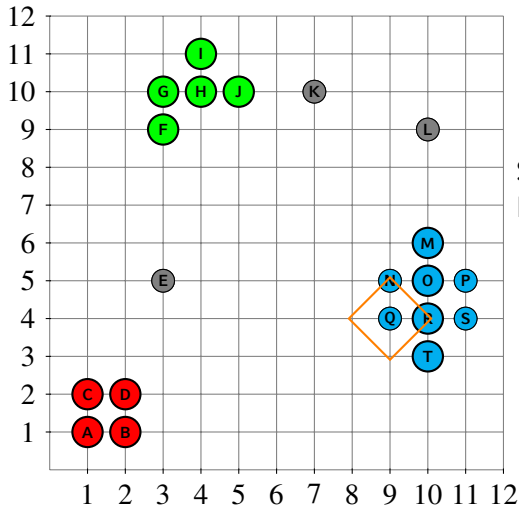
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 2$

Seed list:
NPS

Aufgabe 5-1

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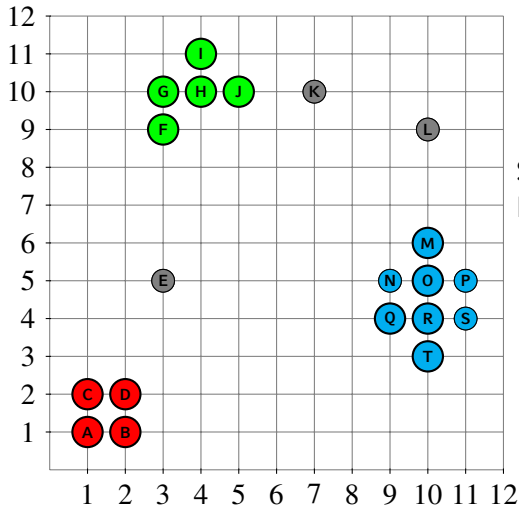
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Aufgabe 5-2



$\epsilon = 1.1$

$\text{minPts} = 2$

Seed list:
NPS

Aufgabe 5-1

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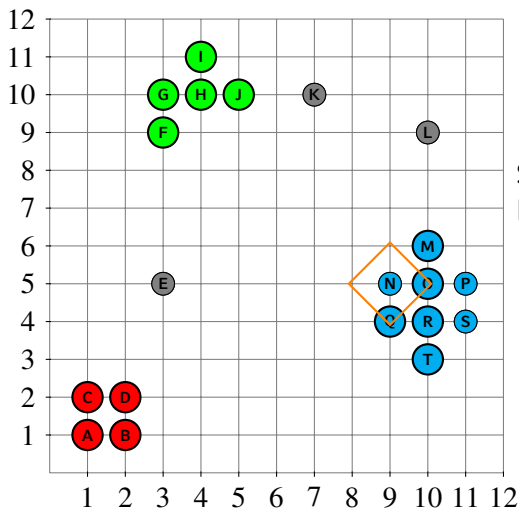
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 2$

Seed list:
PS

Aufgabe 5-1

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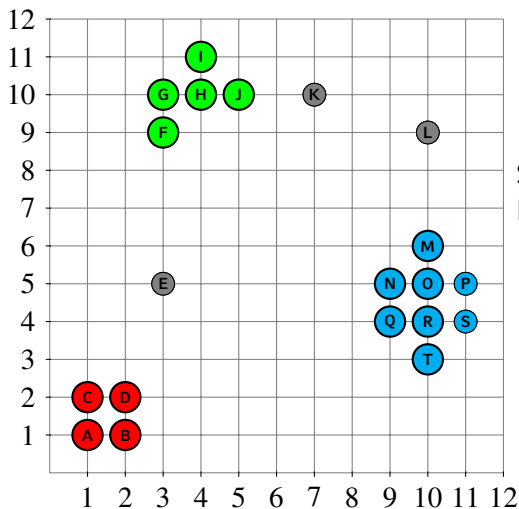
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 2$

Seed list:
PS

Aufgabe 5-1

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$\epsilon = 1.1$
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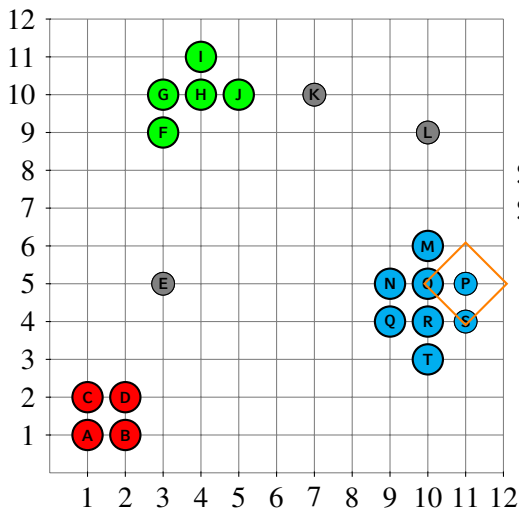
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Aufgabe 5-2



$\epsilon = 1.1$

$\text{minPts} = 2$

Seed list:

S

Aufgabe 5-1

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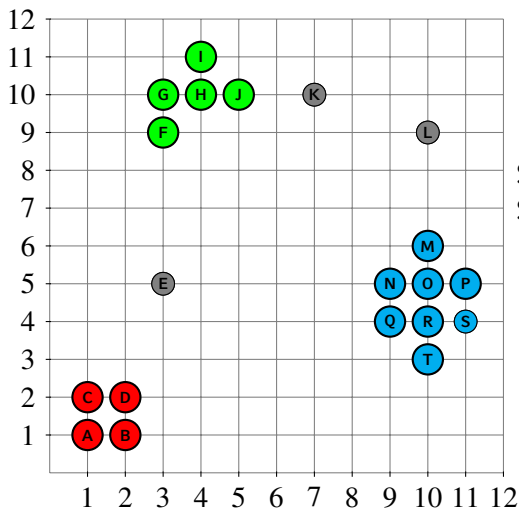
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Aufgabe 5-2



$\epsilon = 1.1$

$\text{minPts} = 2$

Seed list:

S

Aufgabe 5-1

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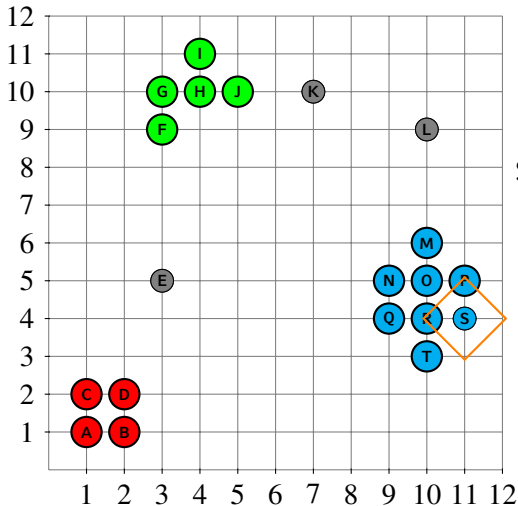
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 2$

Seed list:

Aufgabe 5-1

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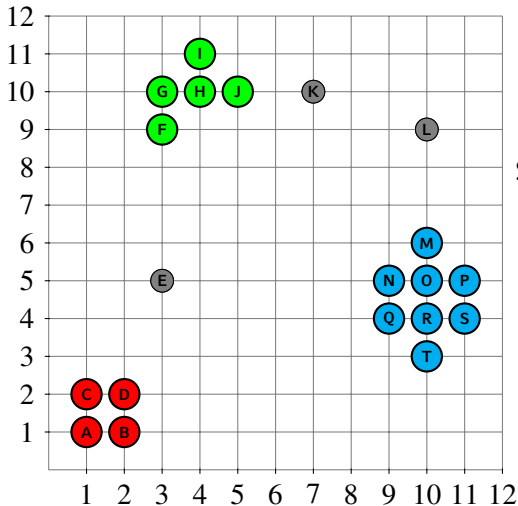
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 2$

Seed list:

Aufgabe 5-1

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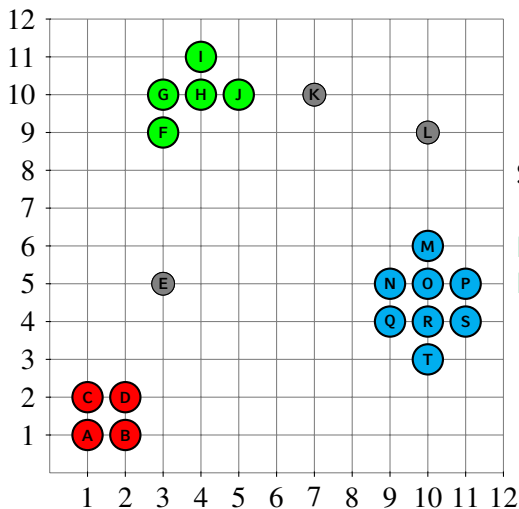
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 2$

Seed list:

Keine
Randpunkte!

Aufgabe 5-1

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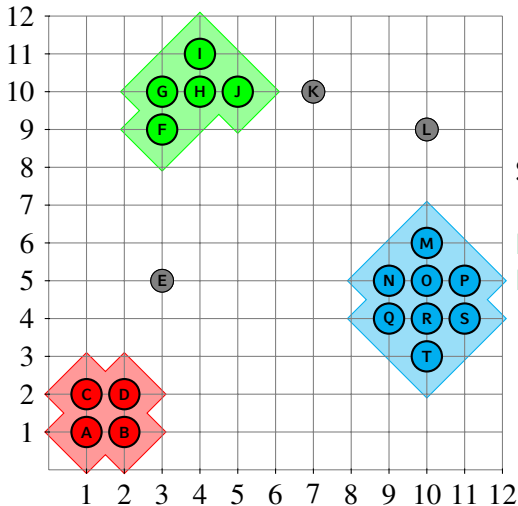
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Aufgabe 5-2



$\epsilon = 1.1$

$\text{minPts} = 2$

Seed list:

Keine
Randpunkte!

Aufgabe 5-1

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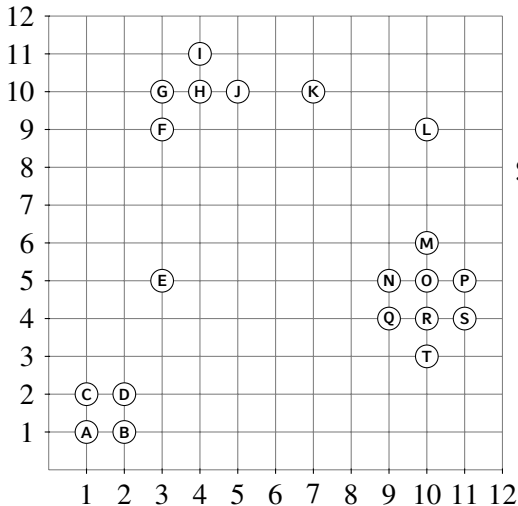
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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$\varepsilon = 1.1$
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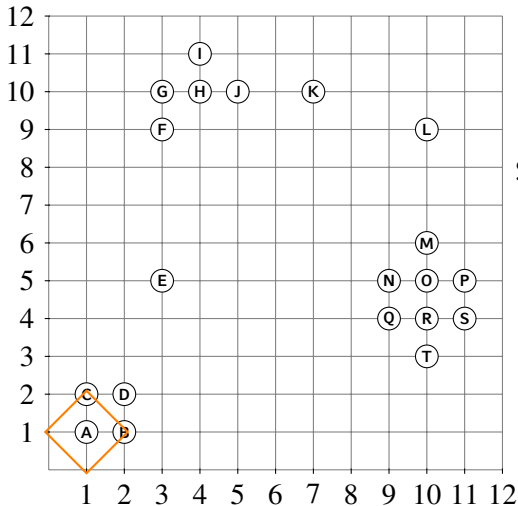
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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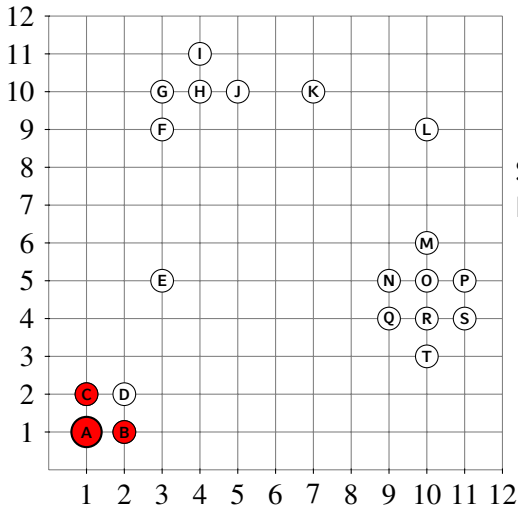
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:
BC

Aufgabe 5-1

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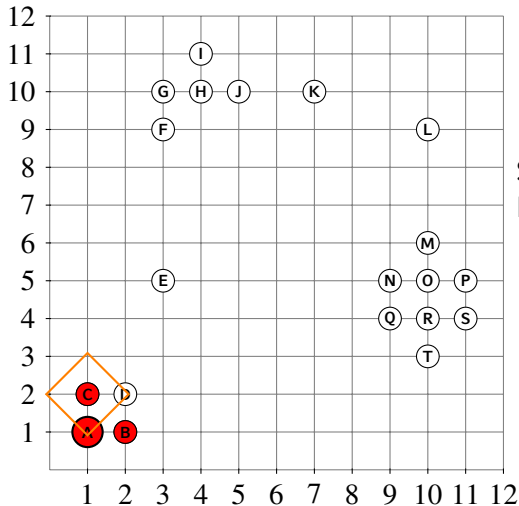
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

B

Aufgabe 5-1

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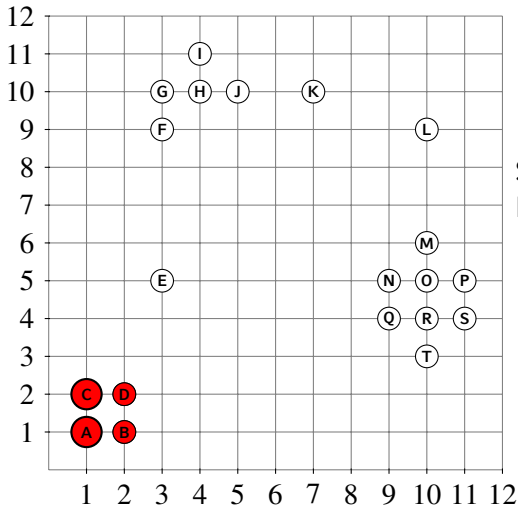
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:
BD

Aufgabe 5-1

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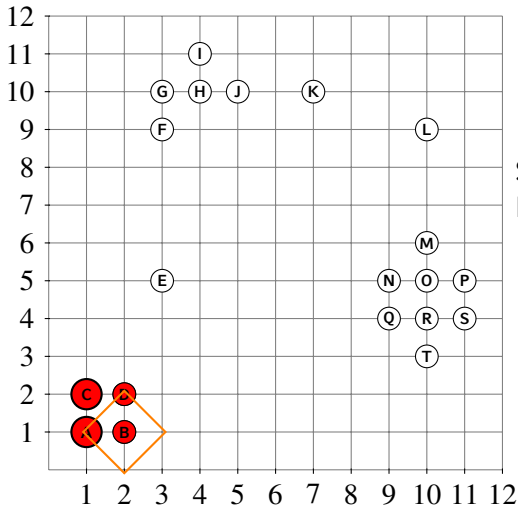
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:
D

Aufgabe 5-1

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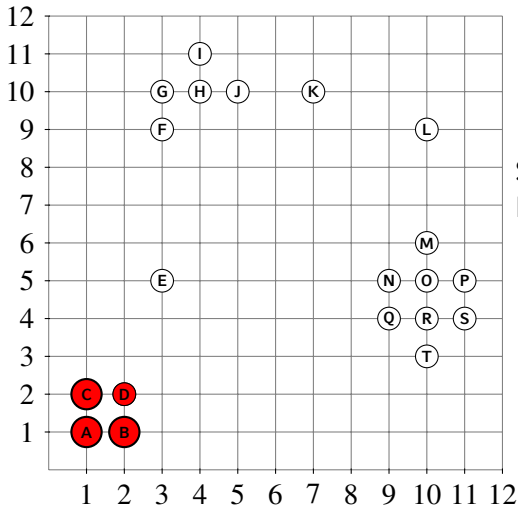
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Aufgabe 5-2



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$\text{minPts} = 3$

Seed list:
D

Aufgabe 5-1

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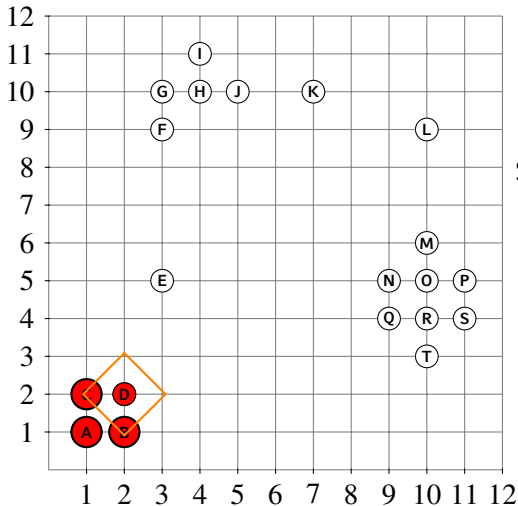
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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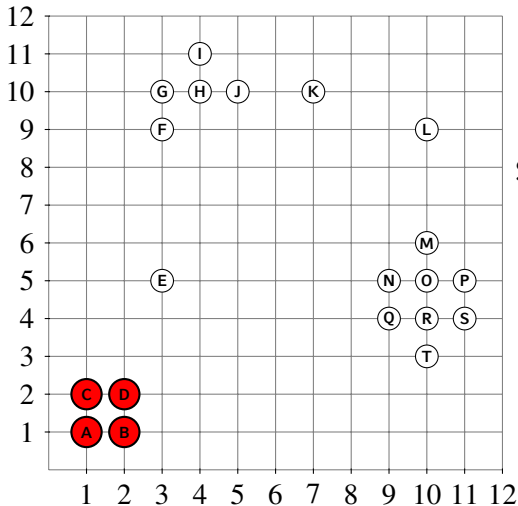
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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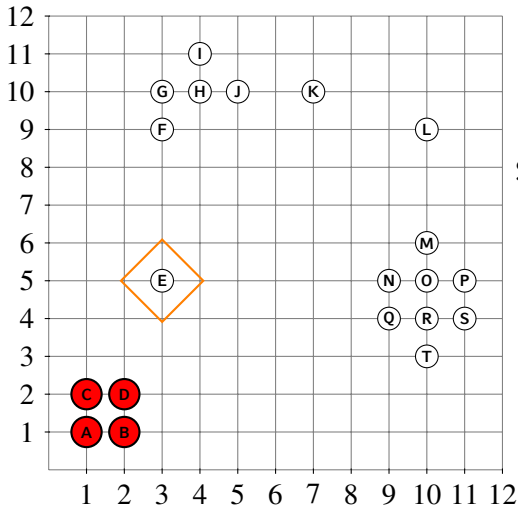
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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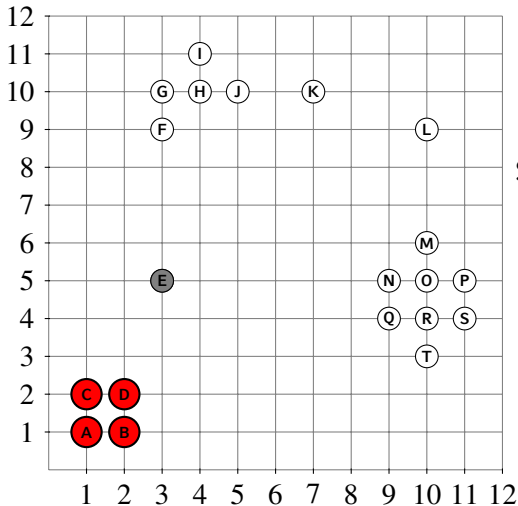
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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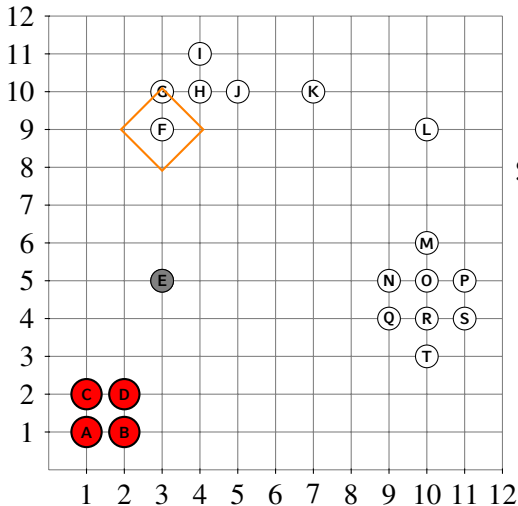
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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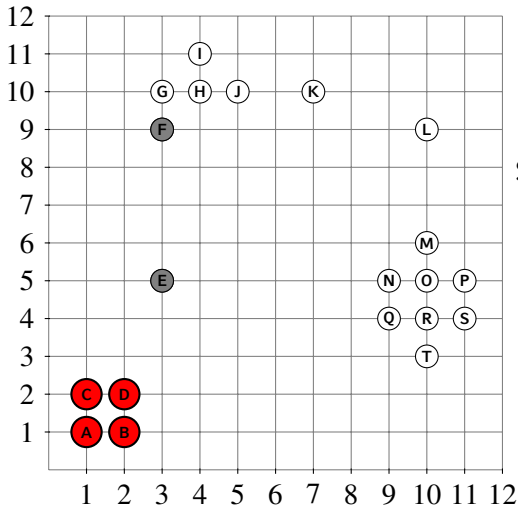
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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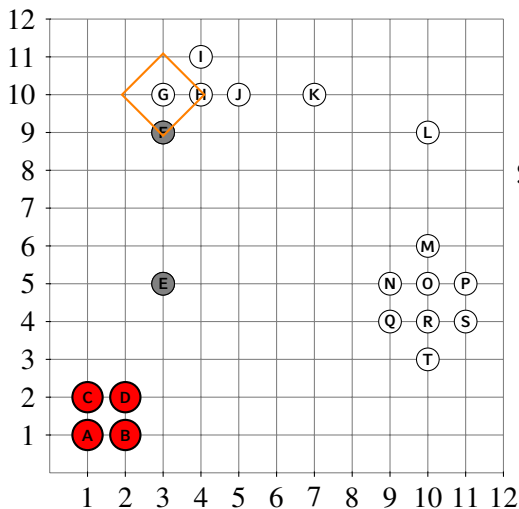
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$\varepsilon = 4.1$
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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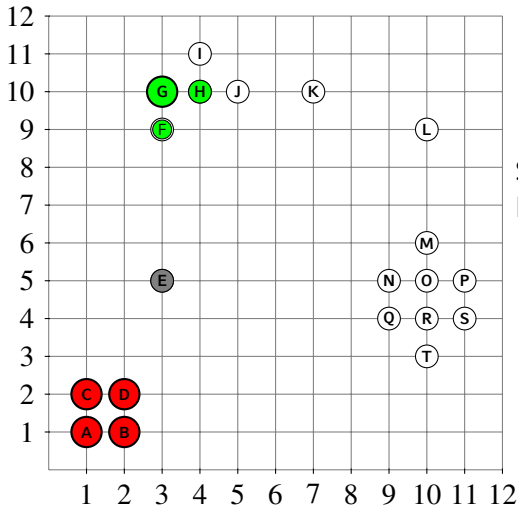
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$\varepsilon = 4.1$
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:
H

Aufgabe 5-1

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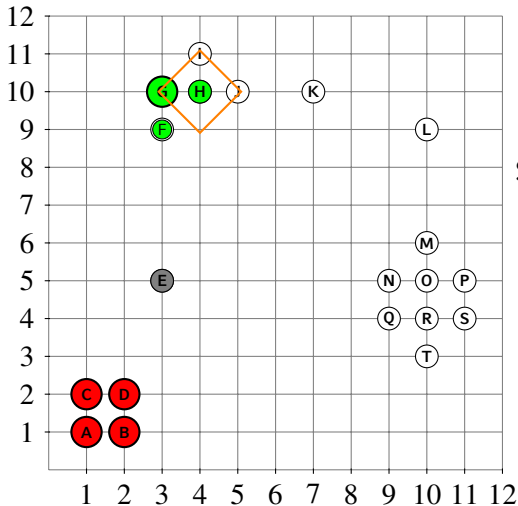
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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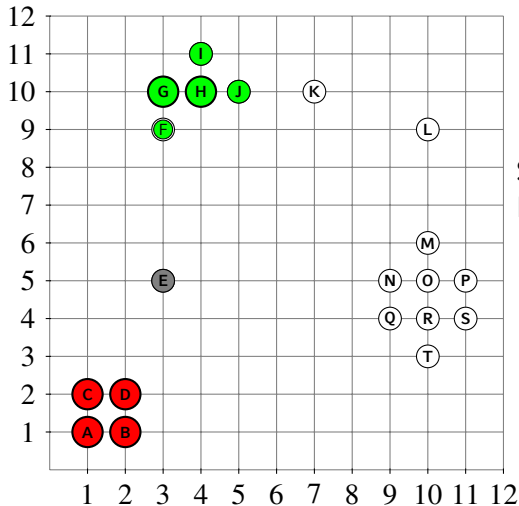
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:
IJ

Aufgabe 5-1

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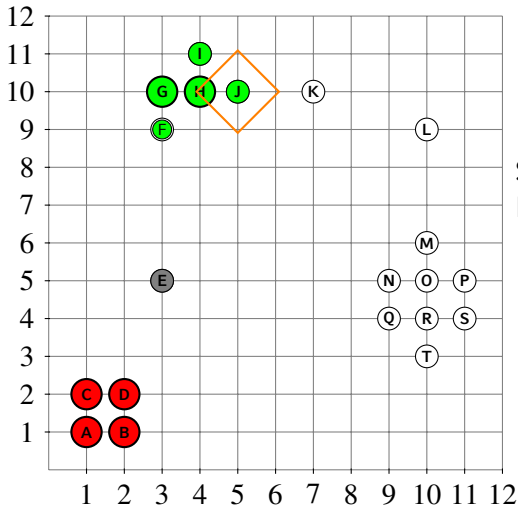
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 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

I

Aufgabe 5-1

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$\varepsilon = 1.1$
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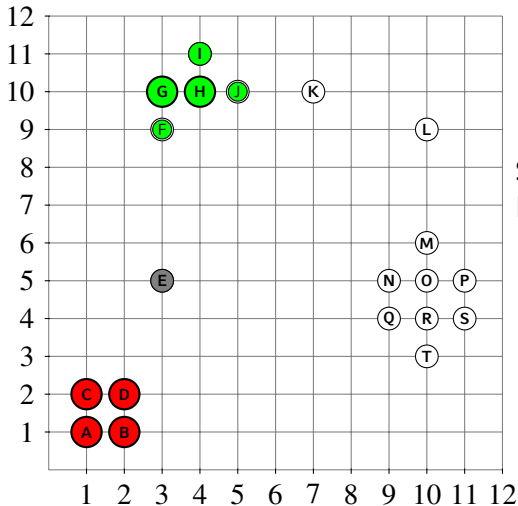
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$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

I

Aufgabe 5-1

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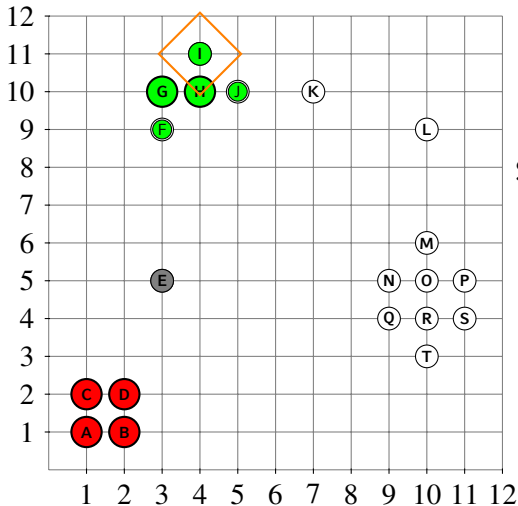
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$\varepsilon = 4.1$
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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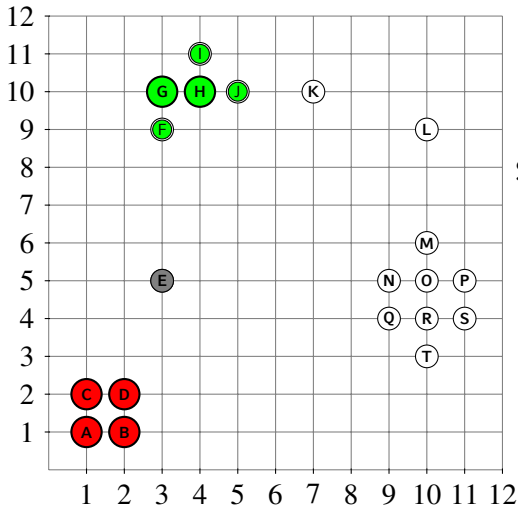
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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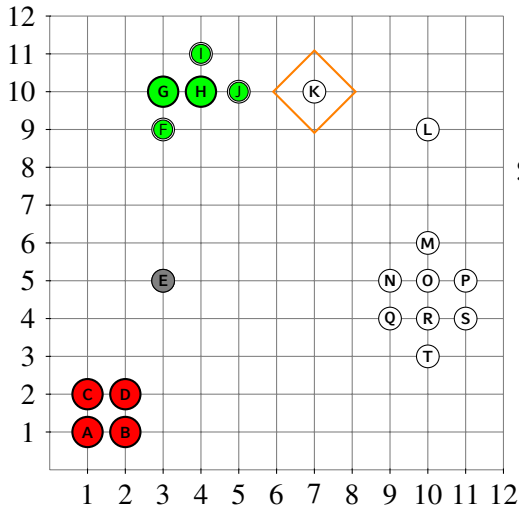
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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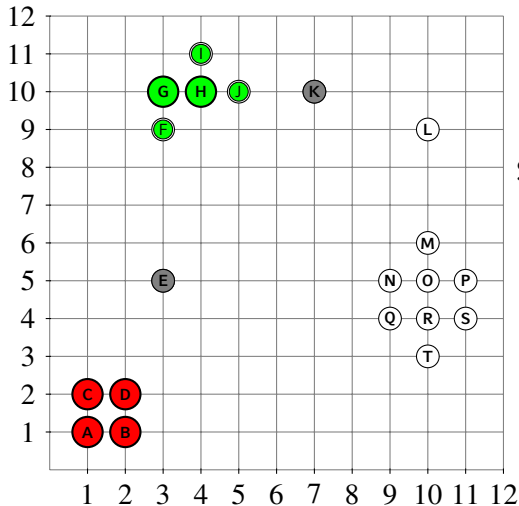
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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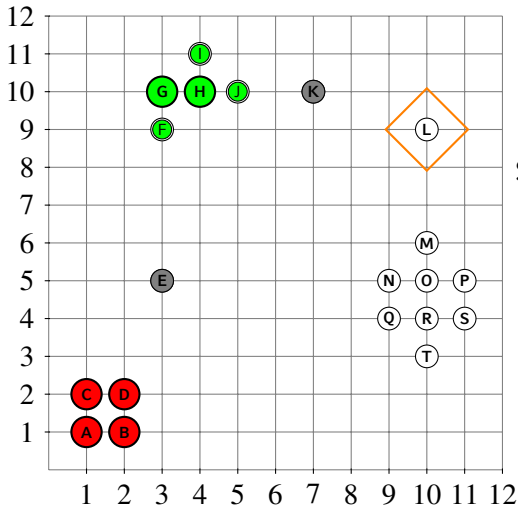
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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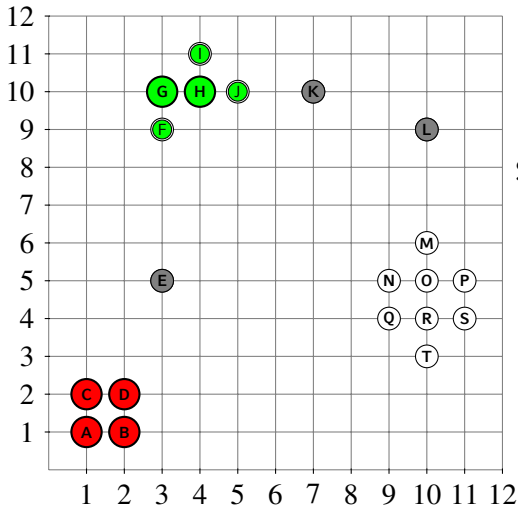
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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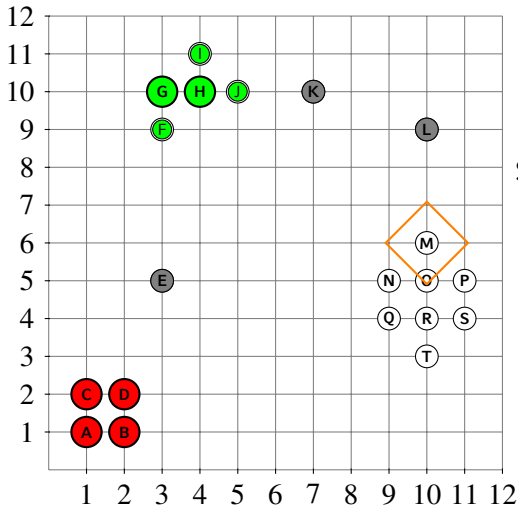
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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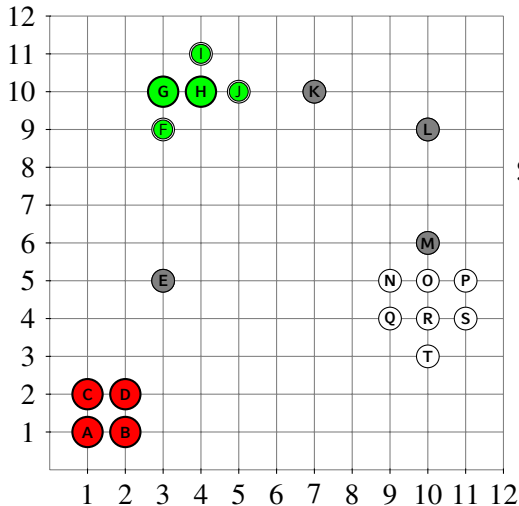
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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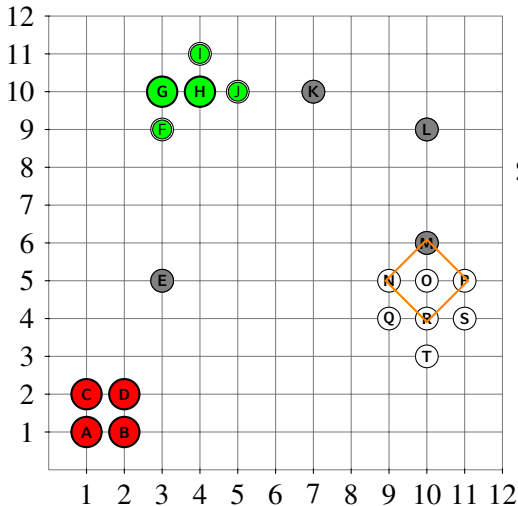
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

Aufgabe 5-1

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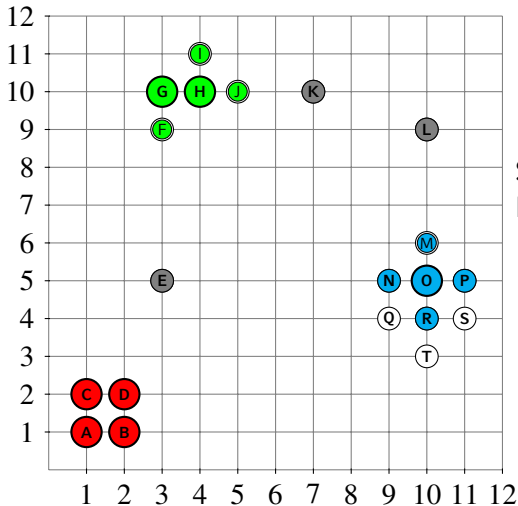
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:
NPR

Aufgabe 5-1

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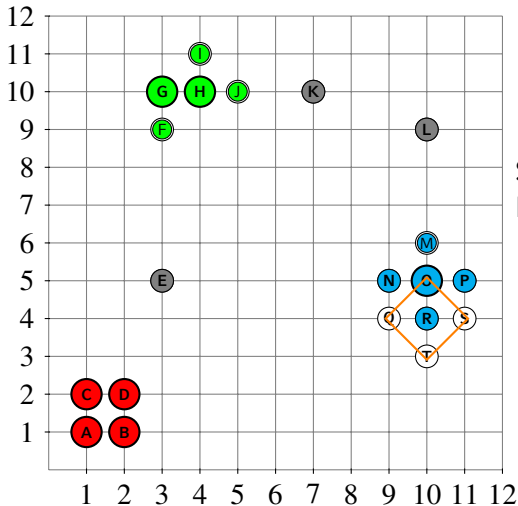
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:
NP

Aufgabe 5-1

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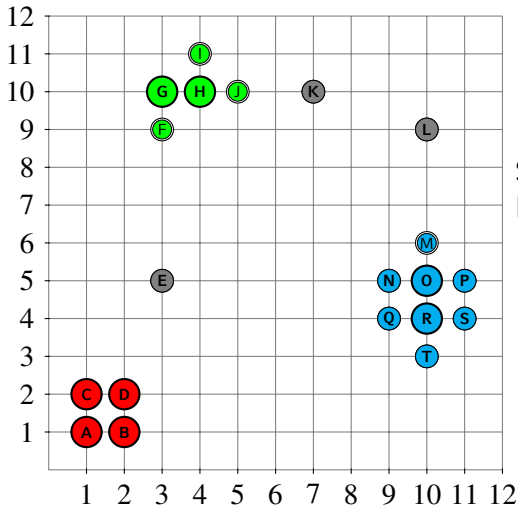
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:
NPQST

Aufgabe 5-1

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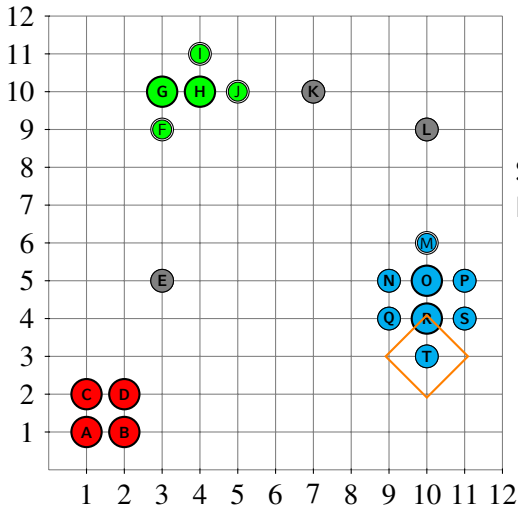
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:
NPQS

Aufgabe 5-1

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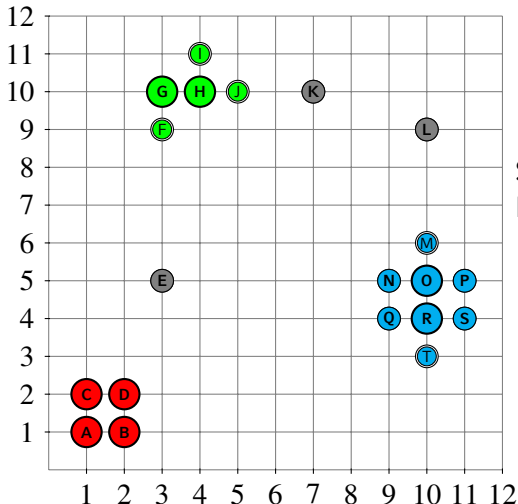
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:
NPQS

Aufgabe 5-1

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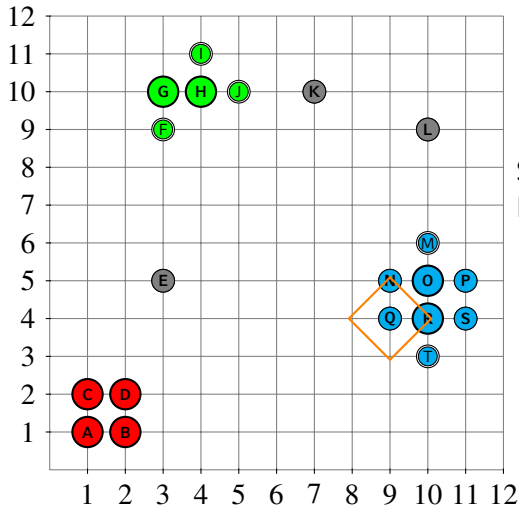
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:
NPS

Aufgabe 5-1

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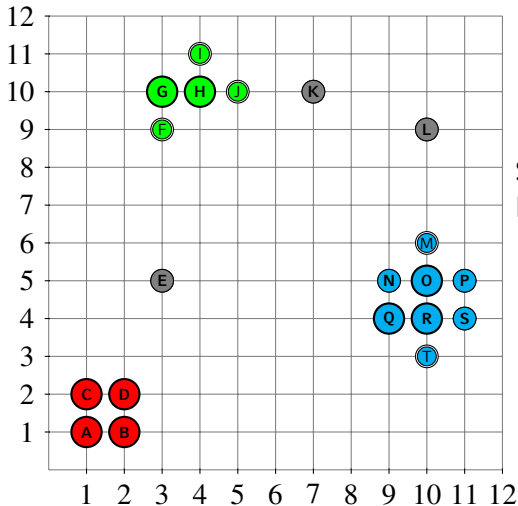
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:
NPS

Aufgabe 5-1

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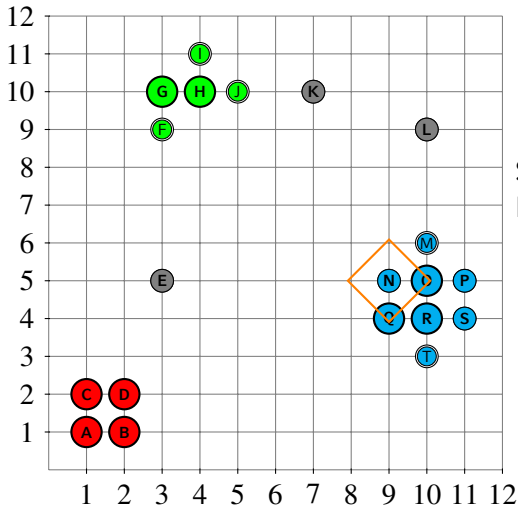
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:
PS

Aufgabe 5-1

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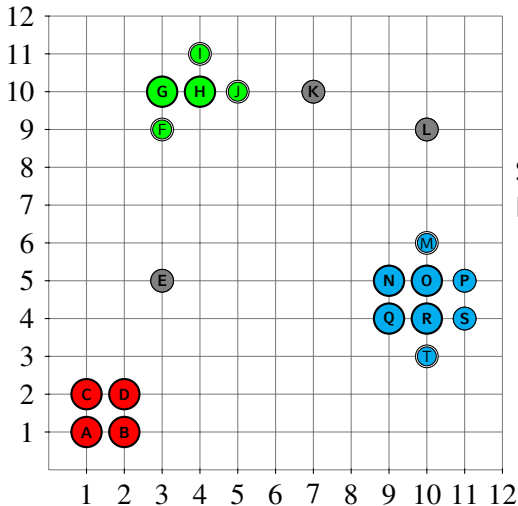
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:
PS

Aufgabe 5-1

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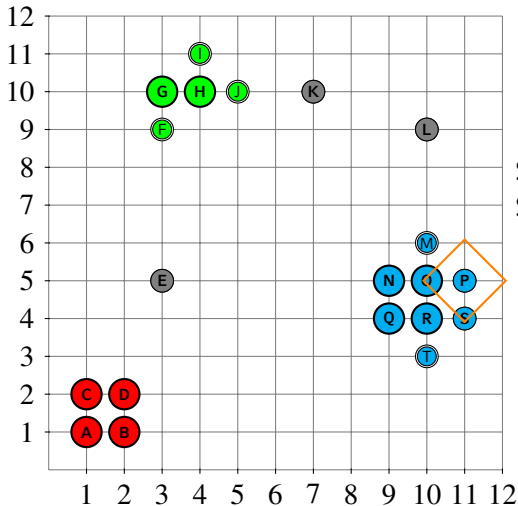
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

S

Aufgabe 5-1

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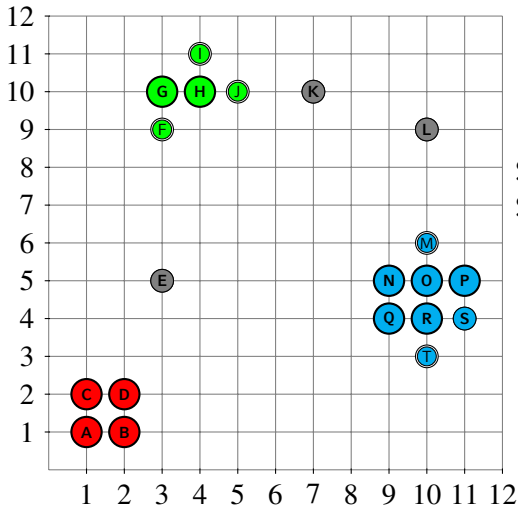
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 3$

Seed list:

S

Aufgabe 5-1

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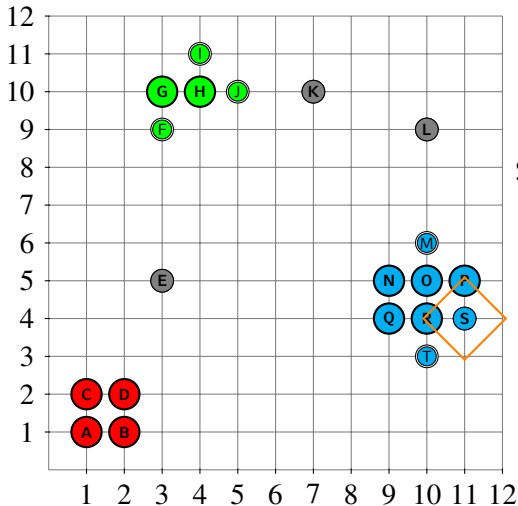
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Aufgabe 5-2



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Seed list:

Aufgabe 5-1

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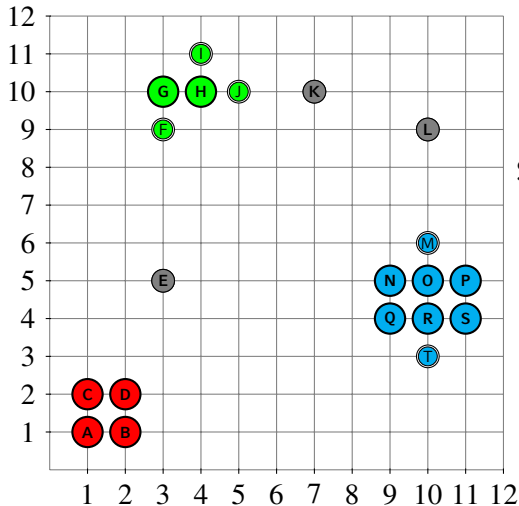
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Aufgabe 5-2



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Seed list:

Aufgabe 5-1

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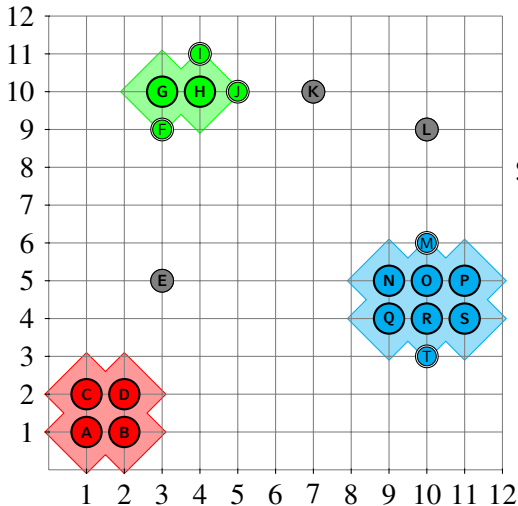
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Aufgabe 5-2



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Seed list:

Aufgabe 5-1

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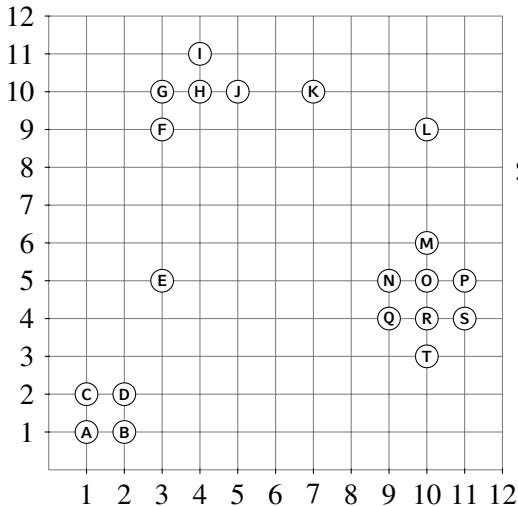
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Aufgabe 5-2



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Seed list:

Aufgabe 5-1

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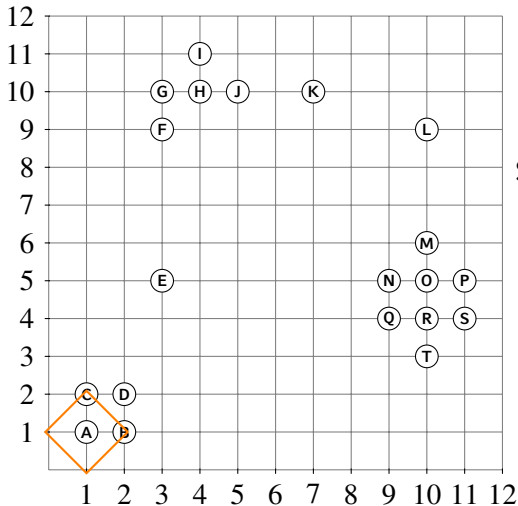
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Aufgabe 5-2



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Seed list:

Aufgabe 5-1

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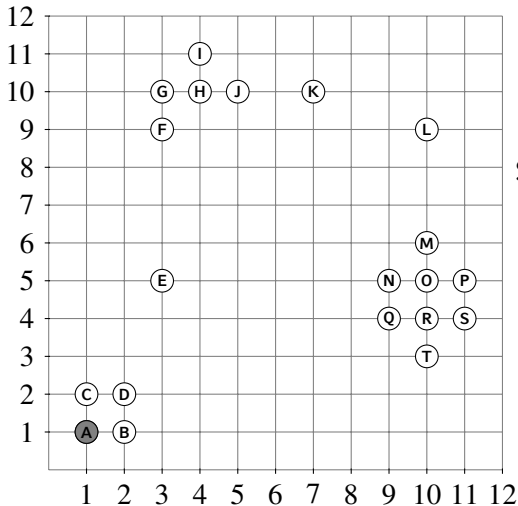
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Aufgabe 5-2



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Aufgabe 5-1

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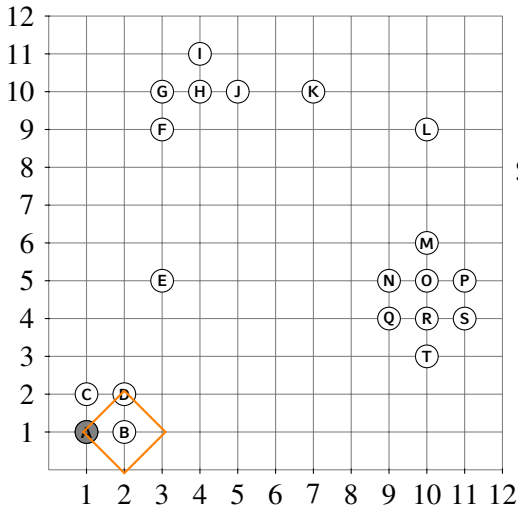
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Aufgabe 5-2



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Seed list:

Aufgabe 5-1

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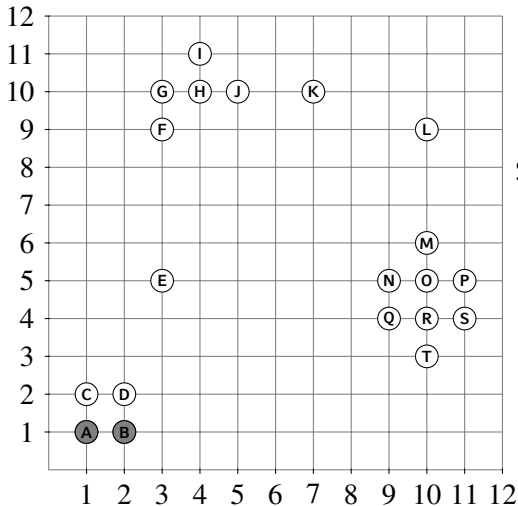
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Aufgabe 5-2



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Aufgabe 5-1

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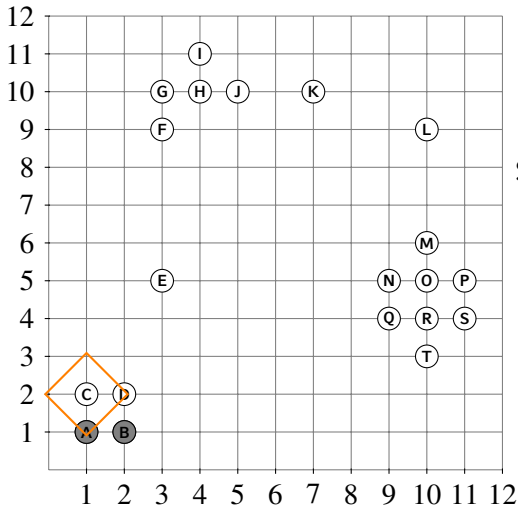
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Aufgabe 5-2



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Seed list:

Aufgabe 5-1

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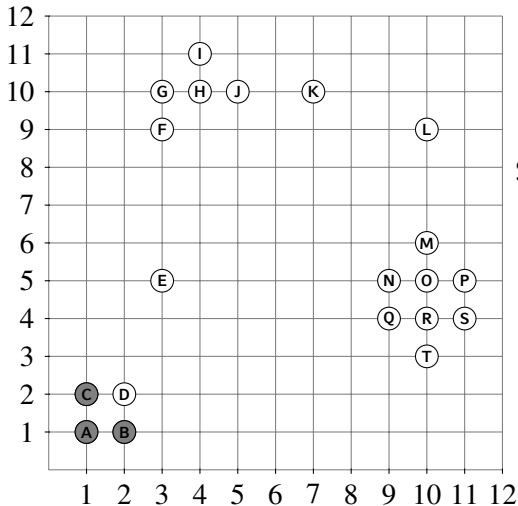
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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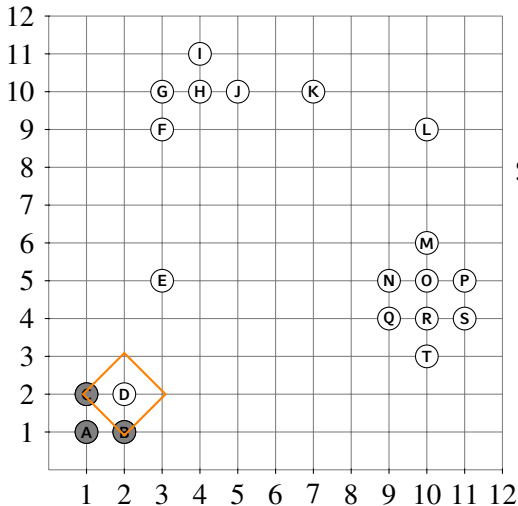
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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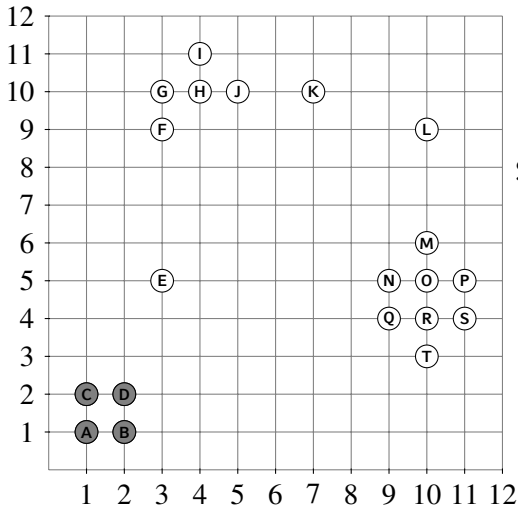
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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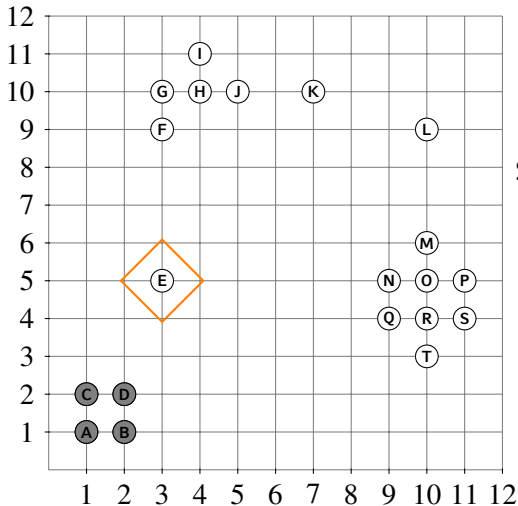
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$\varepsilon = 4.1$
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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 $\text{minPts} = 3$

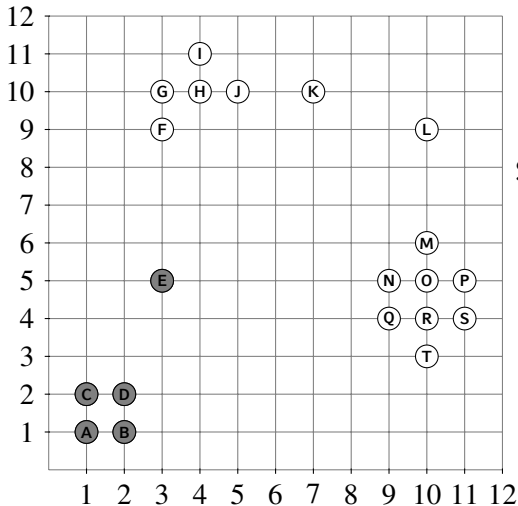
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$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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 $\text{minPts} = 3$

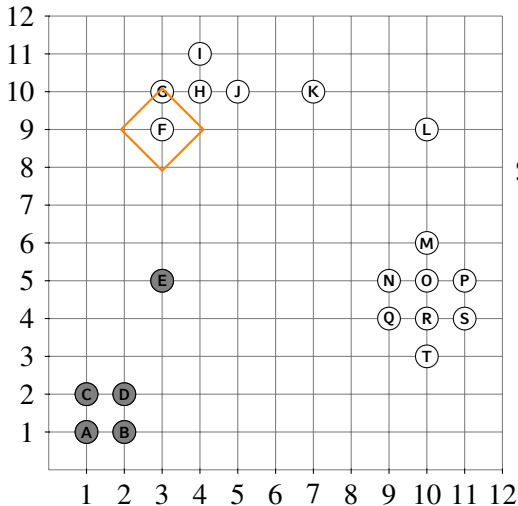
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$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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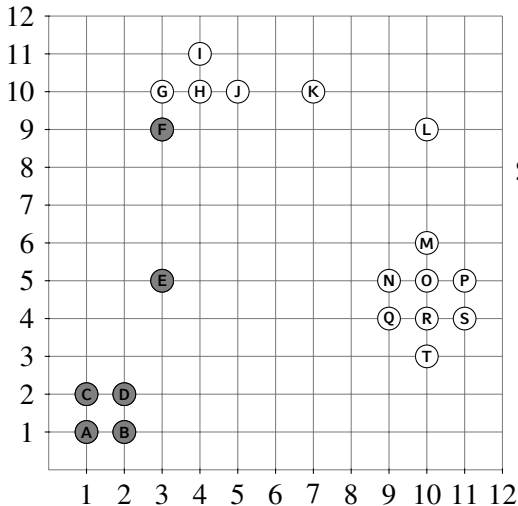
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$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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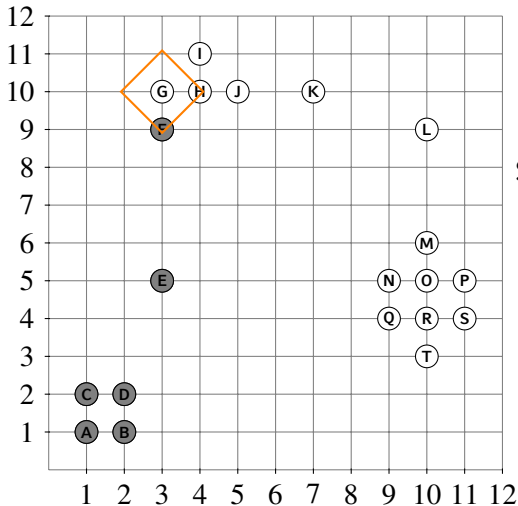
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$\varepsilon = 4.1$
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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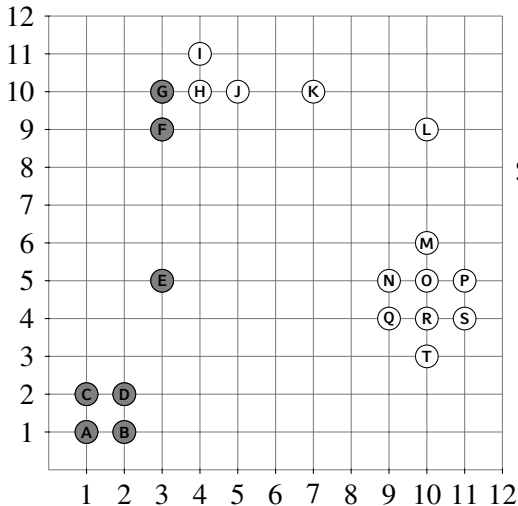
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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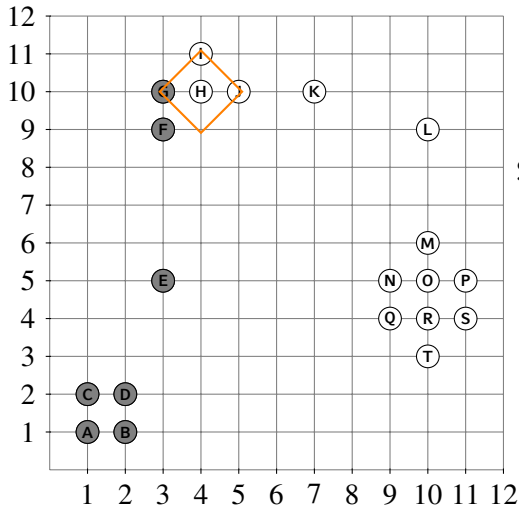
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$\varepsilon = 4.1$
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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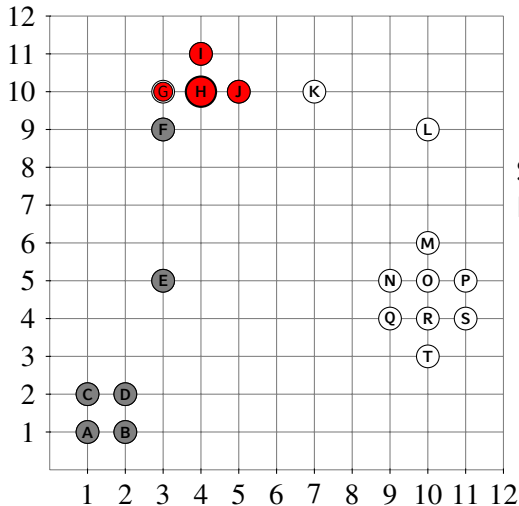
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:
IJ

Aufgabe 5-1

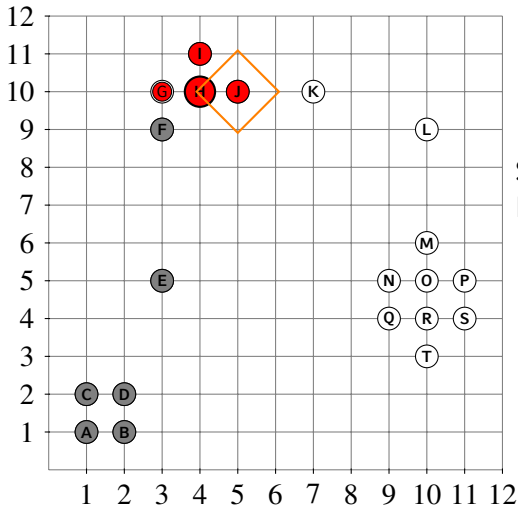
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ε = 1.1
minPts= 2
ε = 1.1
minPts= 3

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Aufgabe 5-2


$$\varepsilon = 1.1$$
$$minPts = 4$$

Seed list:

1

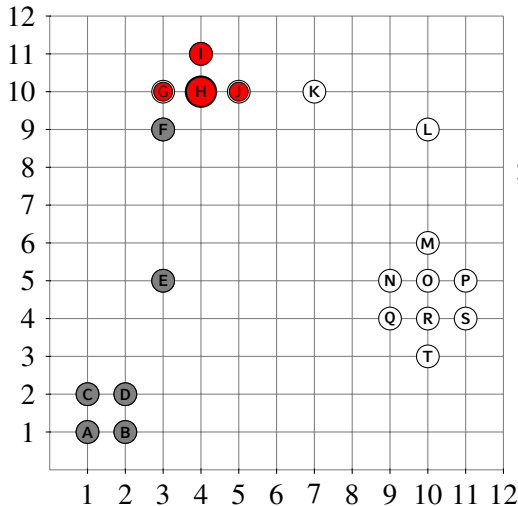
Aufgabe 5-1

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 $\text{minPts} = 3$

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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

I

Aufgabe 5-1

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ε = 1.1
minPts= 2
ε = 1.1
minPts= 3

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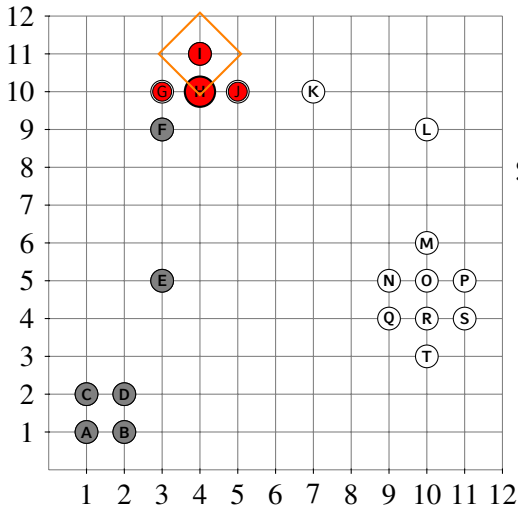
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$$\text{minPts} = 4$$

Aufgabe 5-2



$$\varepsilon = 1.1$$

$$minPts = 4$$

Seed list:

Aufgabe 5-1

$\varepsilon = 1.1$
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 $\text{minPts} = 3$

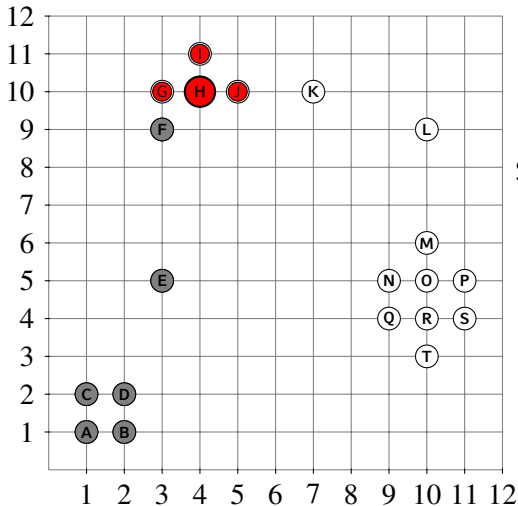
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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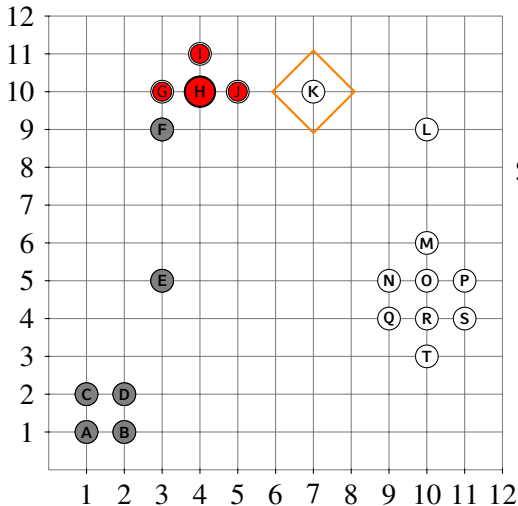
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ε = 1.1
minPts= 3

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minPts = 4

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Aufgabe 5-2


$$\varepsilon = 1.1$$
$$minPts = 4$$

Seed list:

Aufgabe 5-1

$\varepsilon = 1.1$
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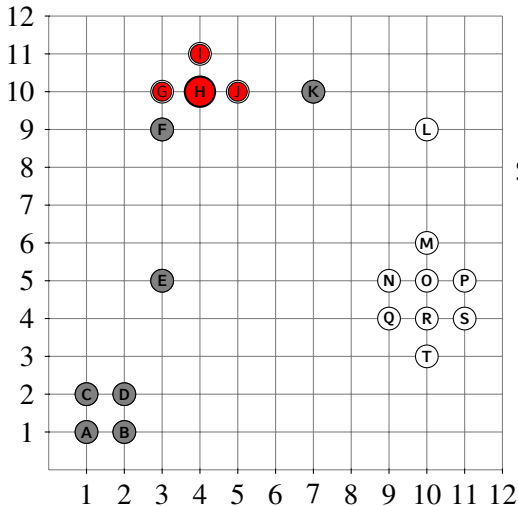
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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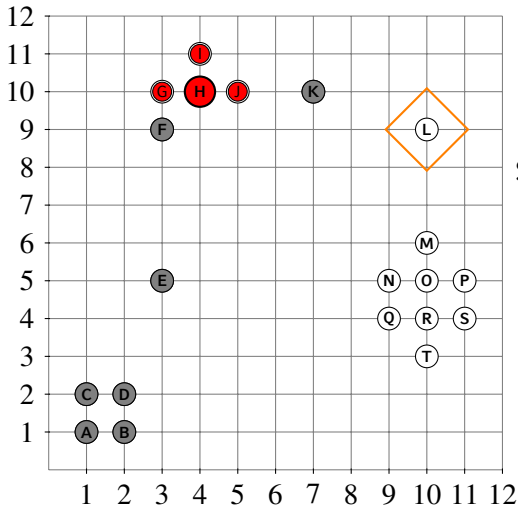
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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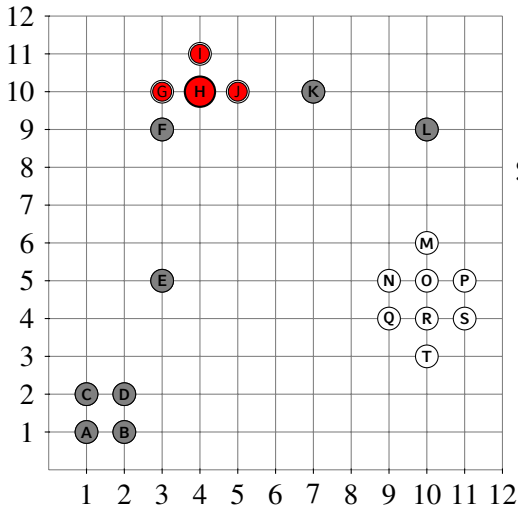
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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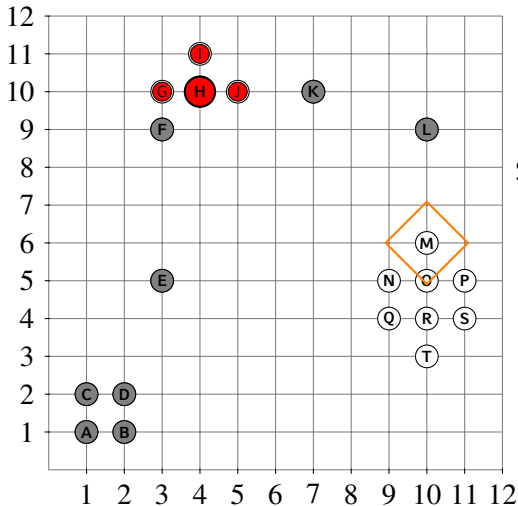
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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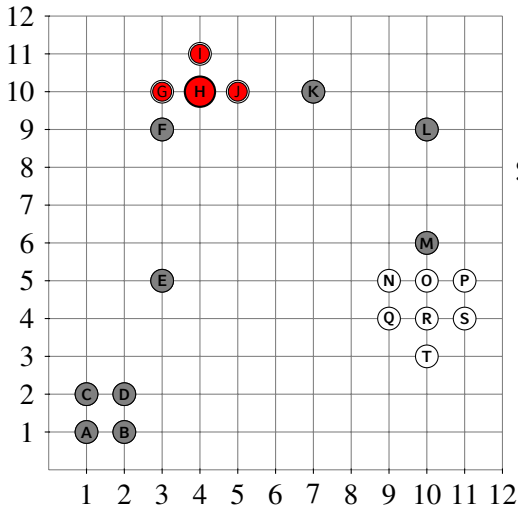
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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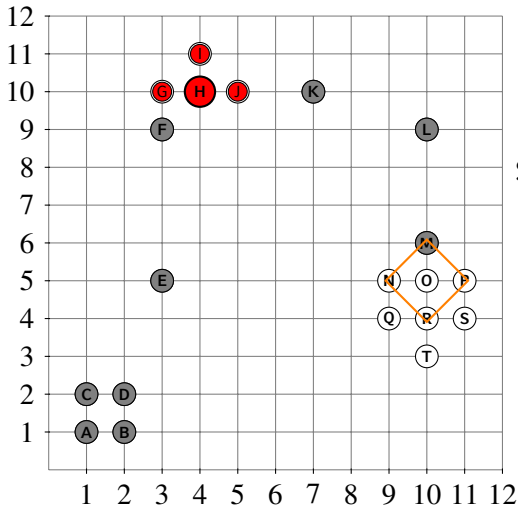
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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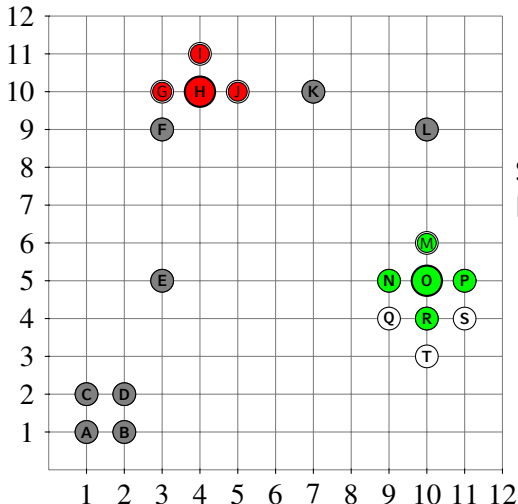
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:
NPR

Aufgabe 5-1

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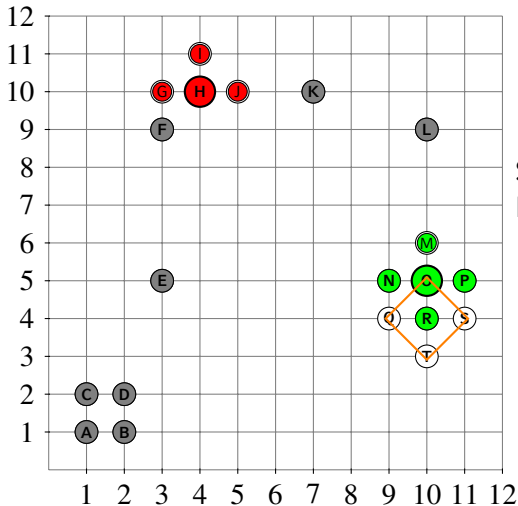
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Aufgabe 5-2



$\varepsilon = 1.1$

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Seed list:
NP

Aufgabe 5-1

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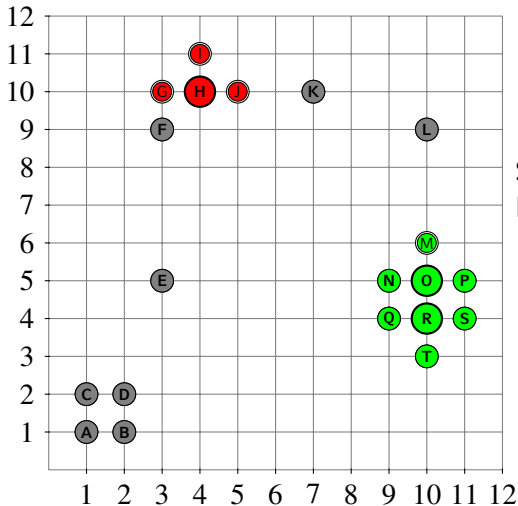
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Aufgabe 5-2



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Seed list:
NPQST

Aufgabe 5-1

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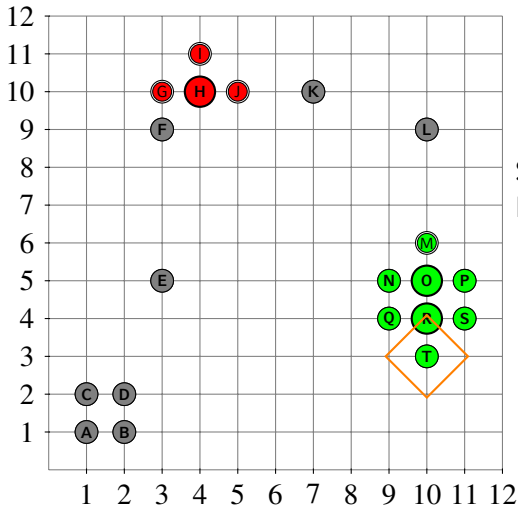
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Aufgabe 5-2



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Seed list:
NPQS

Aufgabe 5-1

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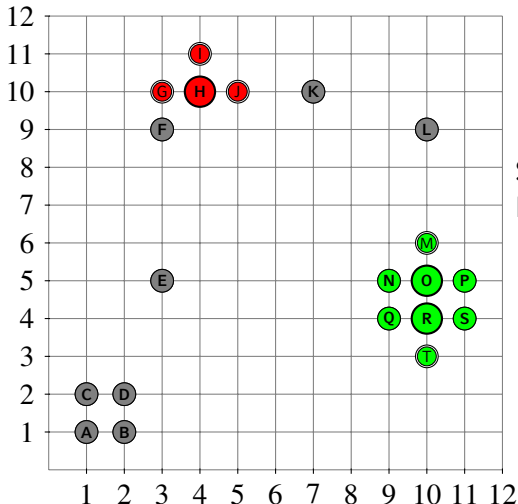
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Aufgabe 5-2



$\varepsilon = 1.1$

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Seed list:
NPQS

Aufgabe 5-1

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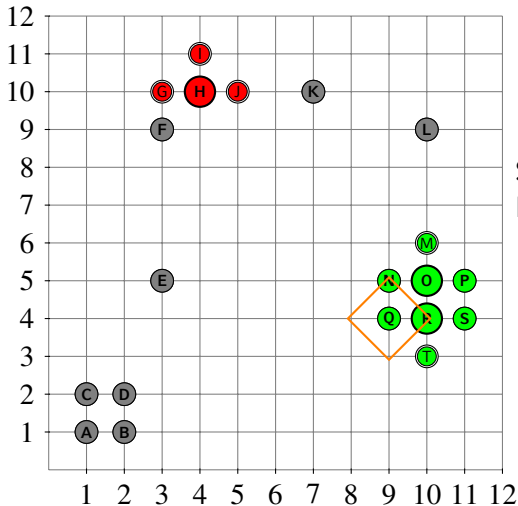
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Aufgabe 5-2



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$\text{minPts} = 4$

Seed list:
NPS

Aufgabe 5-1

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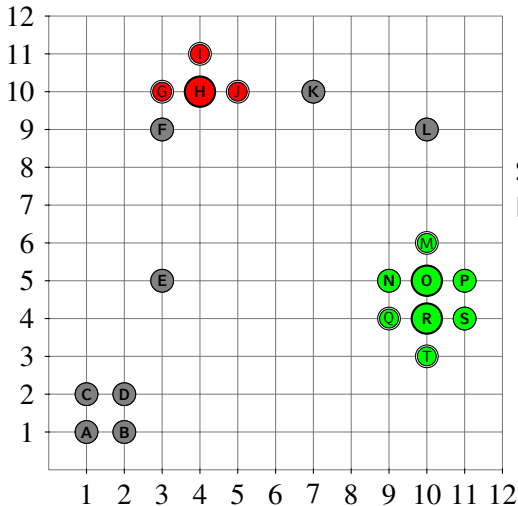
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:
NPS

Aufgabe 5-1

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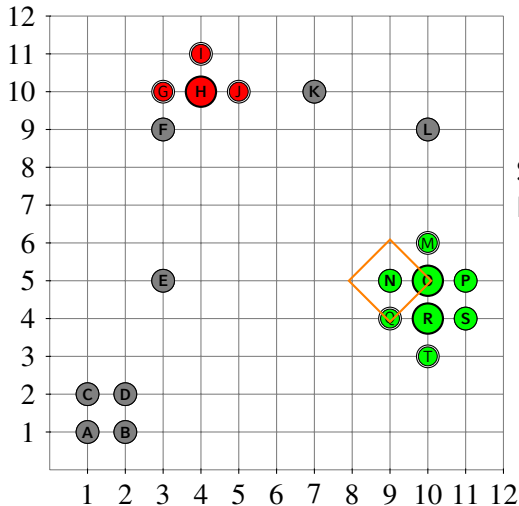
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:
PS

Aufgabe 5-1

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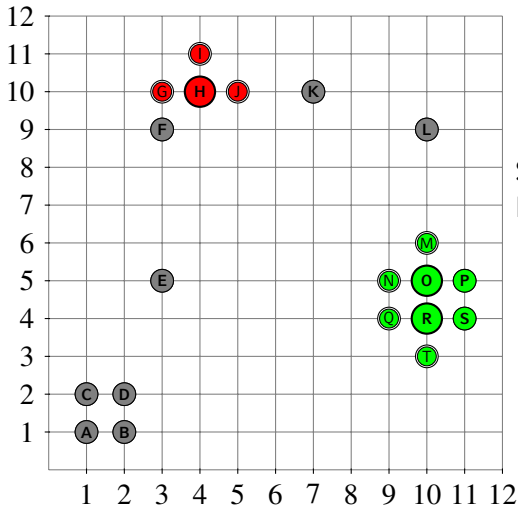
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:
PS

Aufgabe 5-1

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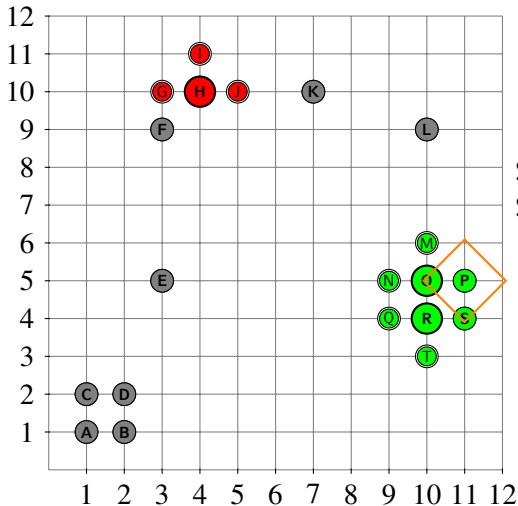
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Aufgabe 5-2


$$\varepsilon = 1.1$$
$$minPts = 4$$

Seed list:
S

Aufgabe 5-1

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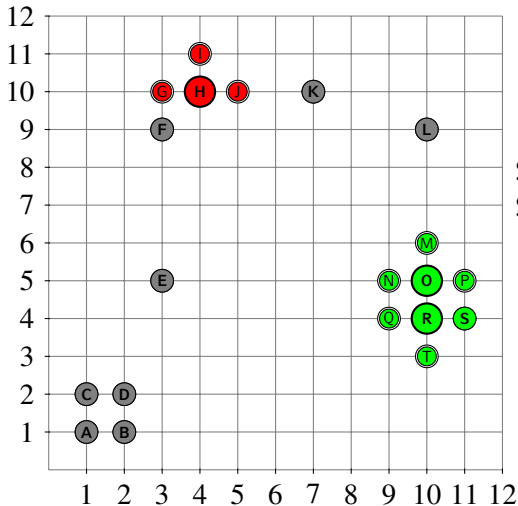
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:
S

Aufgabe 5-1

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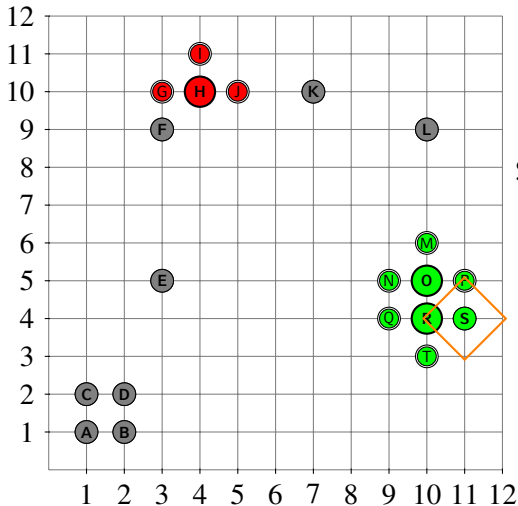
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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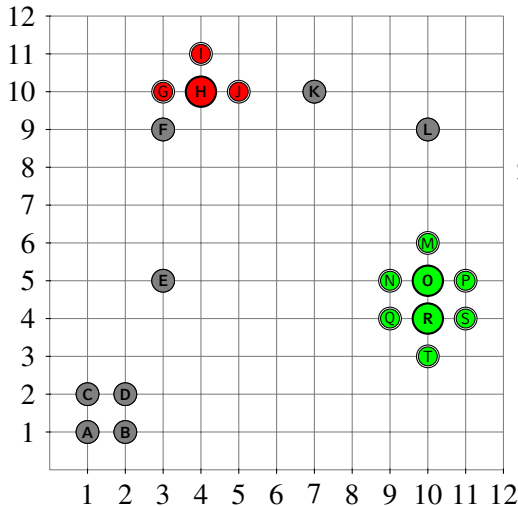
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Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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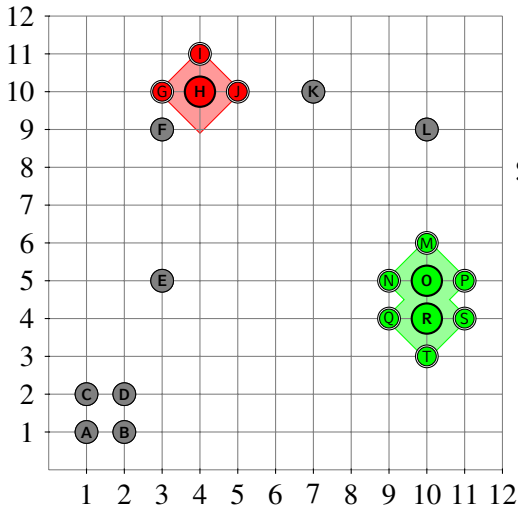
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 $\text{minPts} = 4$

$\varepsilon = 4.1$
 $\text{minPts} = 5$

$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 1.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

$\epsilon = 1.1$
 $\text{minPts} = 2$

$\epsilon = 1.1$
 $\text{minPts} = 3$

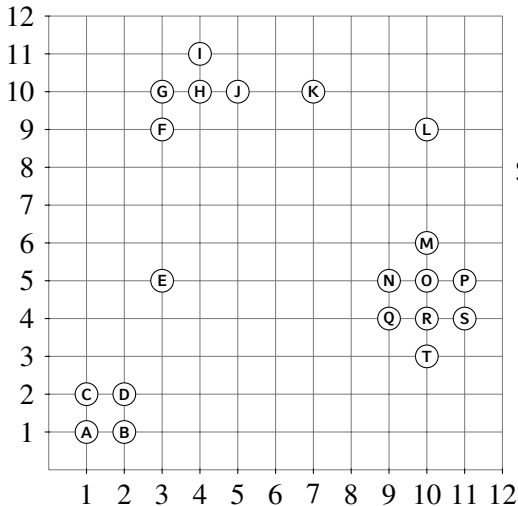
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$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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$\epsilon = 1.1$
 $\text{minPts} = 3$

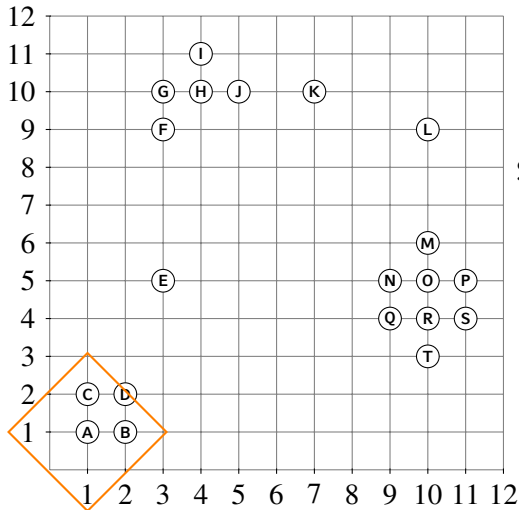
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$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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$\varepsilon = 1.1$
 $\text{minPts} = 3$

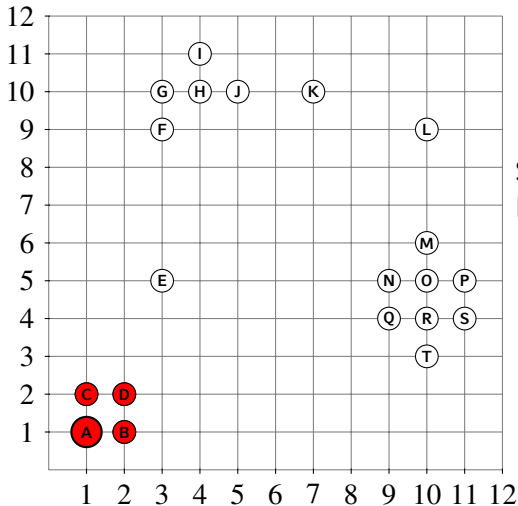
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$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 2.1$

$\text{minPts} = 4$

Seed list:
BCD

Aufgabe 5-1

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$\epsilon = 1.1$
 $\text{minPts} = 3$

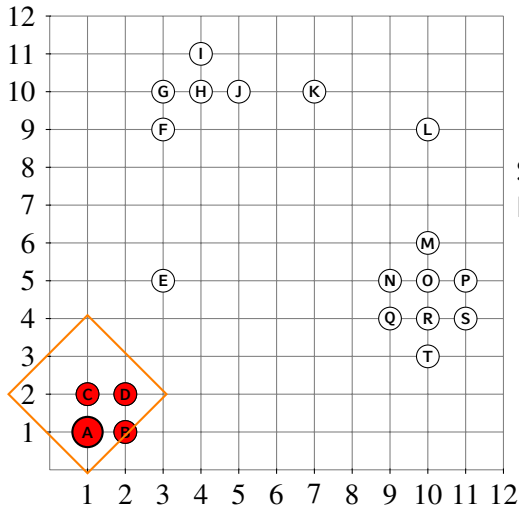
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$\epsilon = 4.1$
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:
BD

Aufgabe 5-1

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$\epsilon = 1.1$
 $\text{minPts} = 3$

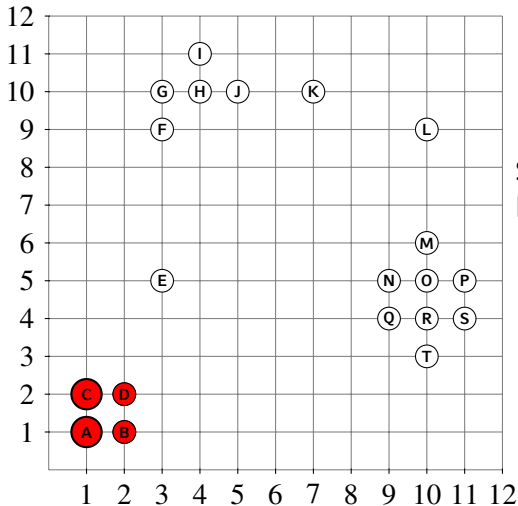
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 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:
BD

Aufgabe 5-1

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$\epsilon = 1.1$
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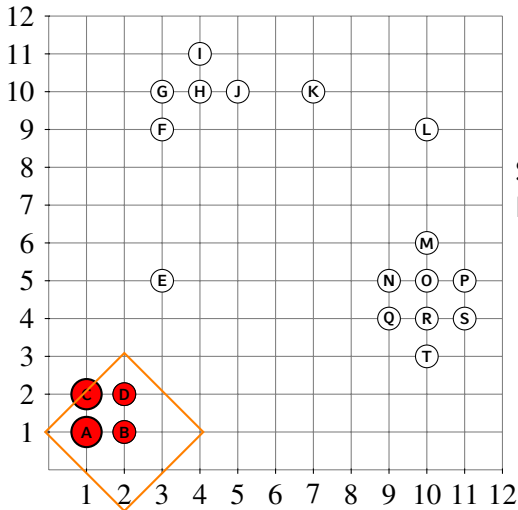
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:
D

Aufgabe 5-1

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$\epsilon = 1.1$
 $\text{minPts} = 3$

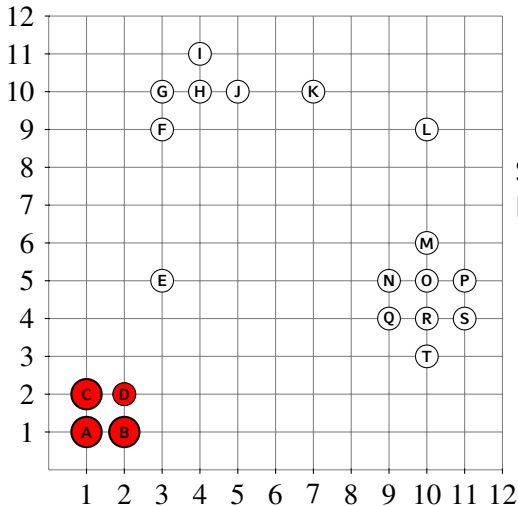
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$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:
D

Aufgabe 5-1

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$\epsilon = 1.1$
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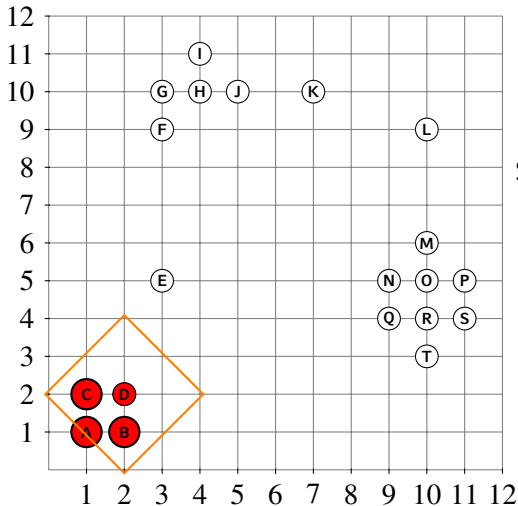
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$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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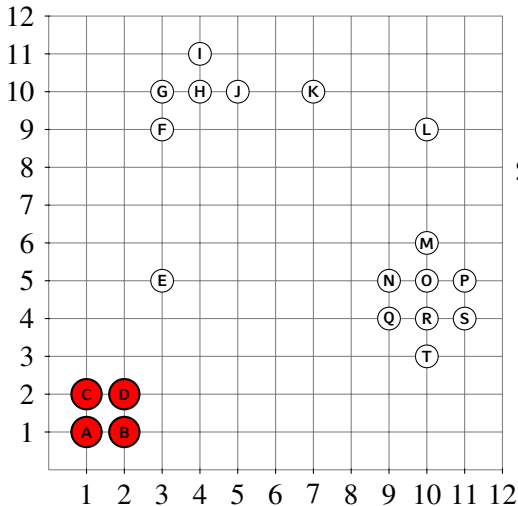
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Aufgabe 5-2



$\varepsilon = 2.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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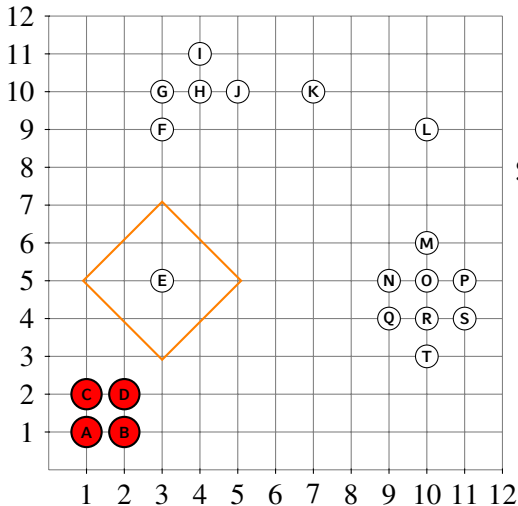
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Aufgabe 5-2



Aufgabe 5-1

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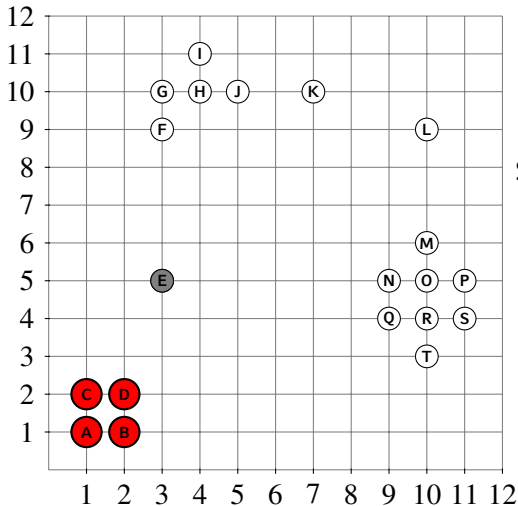
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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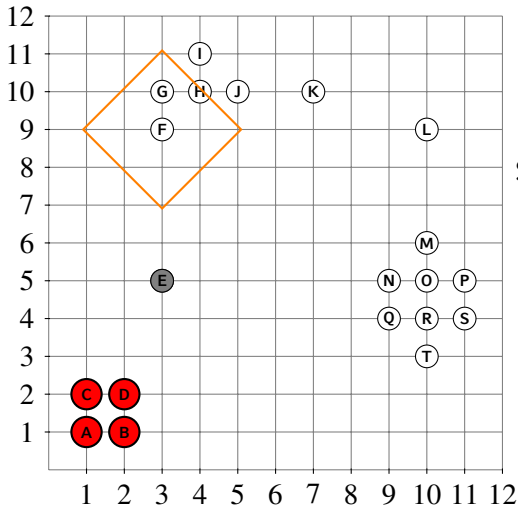
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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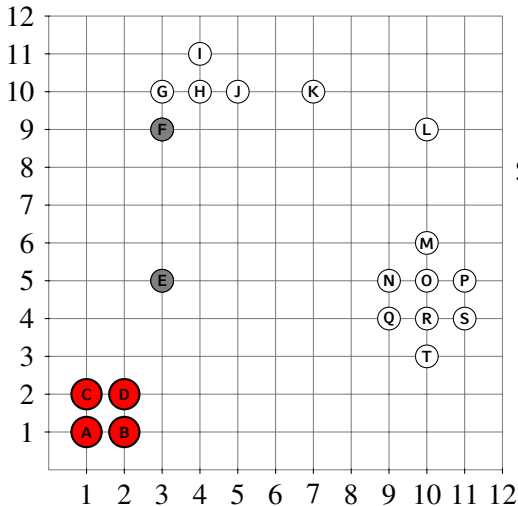
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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$\text{minPts} = 4$

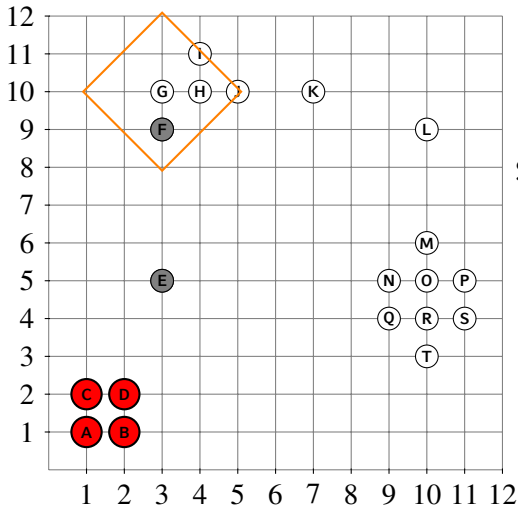
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Aufgabe 5-2



$\varepsilon = 2.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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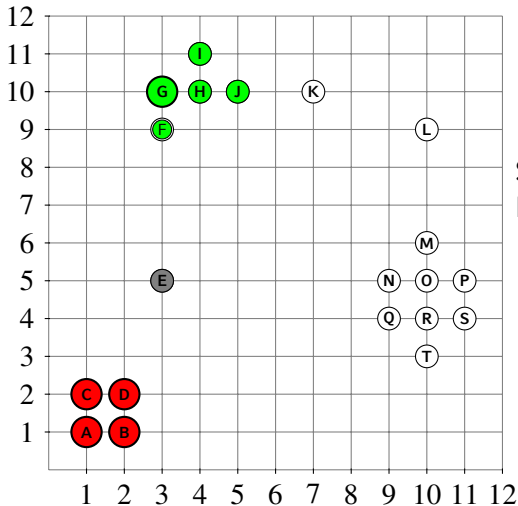
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:
HIJ

Aufgabe 5-1

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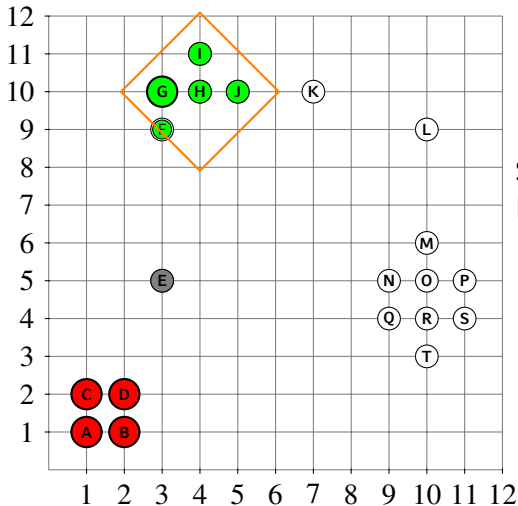
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:
IJ

Aufgabe 5-1

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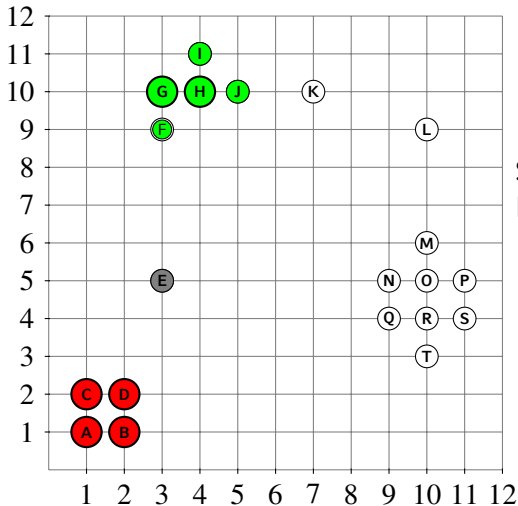
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:
IJ

Aufgabe 5-1

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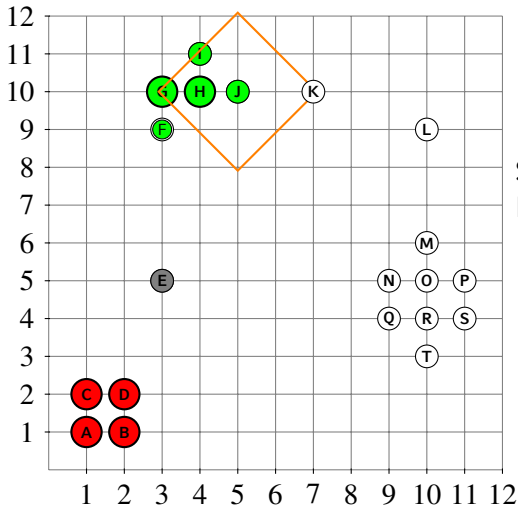
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:

1

Aufgabe 5-1

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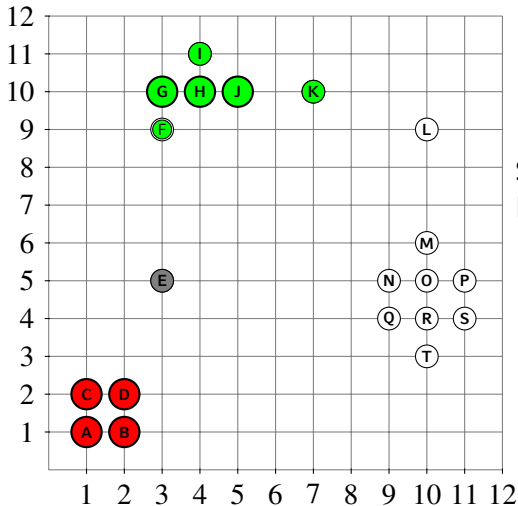
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:
IK

Aufgabe 5-1

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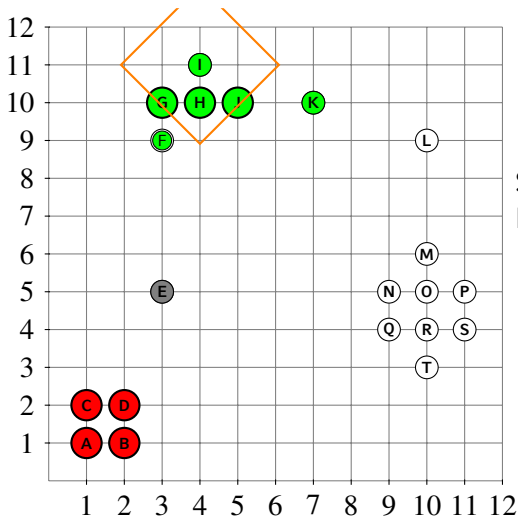
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:
K

Aufgabe 5-1

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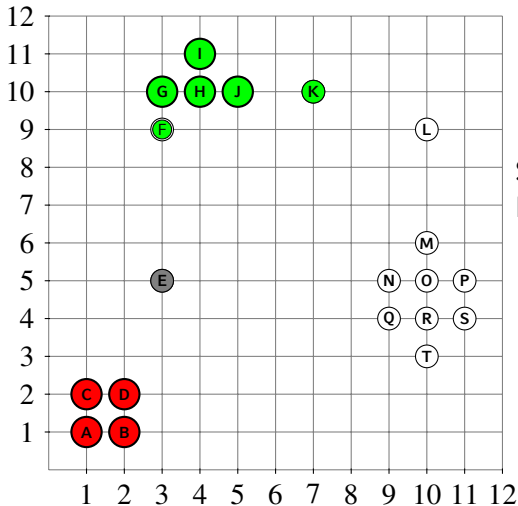
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:
K

Aufgabe 5-1

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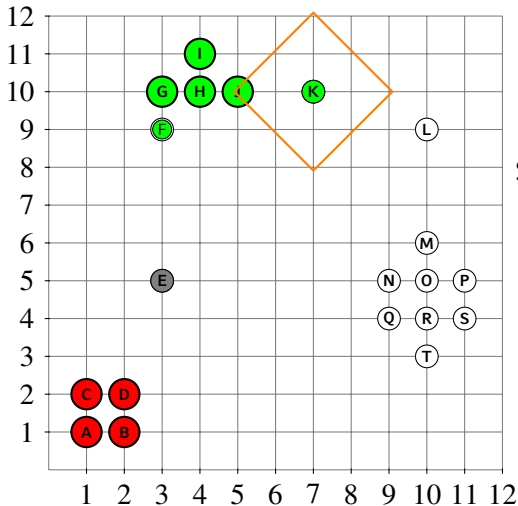
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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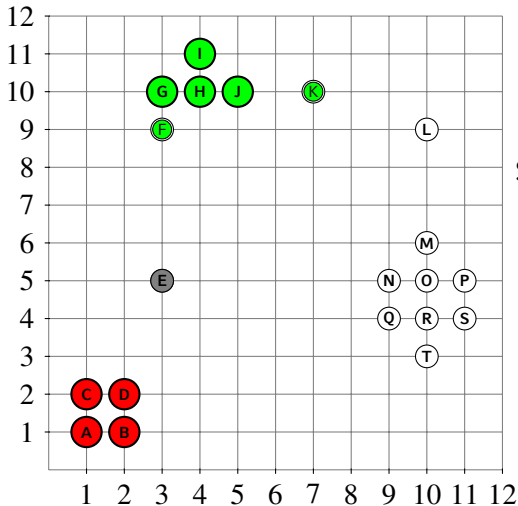
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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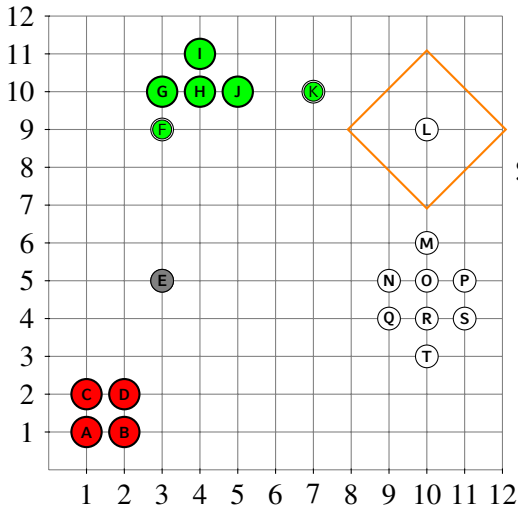
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Aufgabe 5-2



$\varepsilon = 2.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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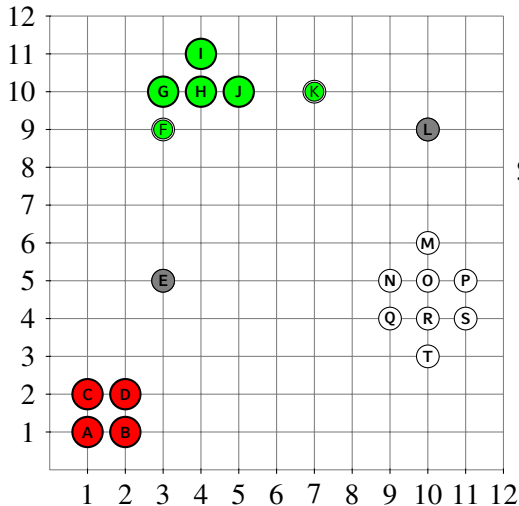
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Aufgabe 5-2



$\varepsilon = 2.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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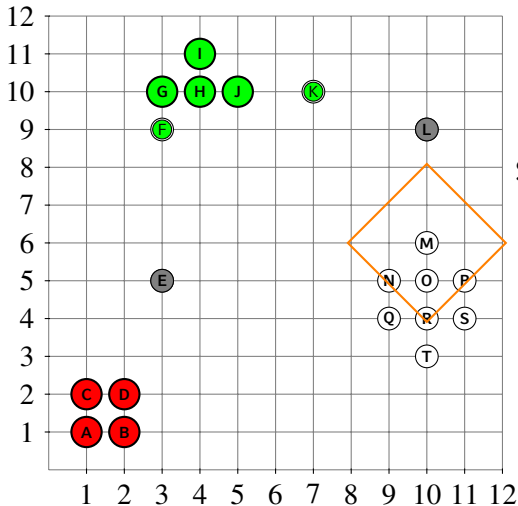
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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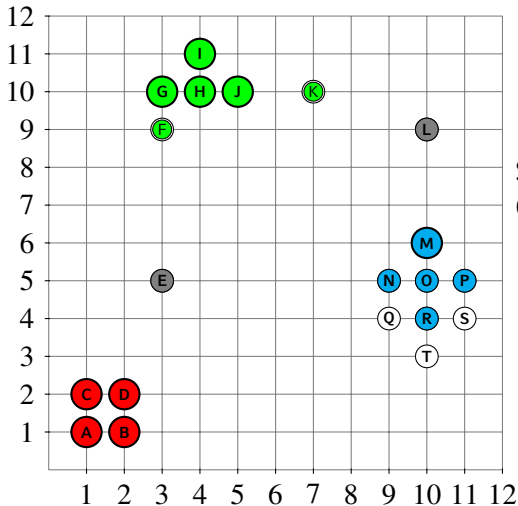
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Aufgabe 5-2



$\varepsilon = 2.1$

$\text{minPts} = 4$

Seed list:
ONPR

Aufgabe 5-1

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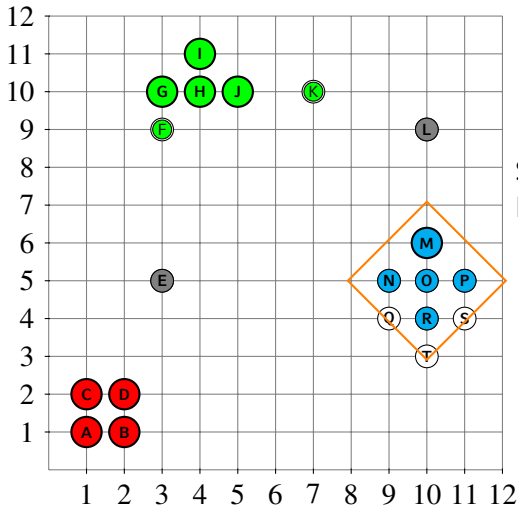
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Aufgabe 5-2



$\varepsilon = 2.1$

$\text{minPts} = 4$

Seed list:
NPR

Aufgabe 5-1

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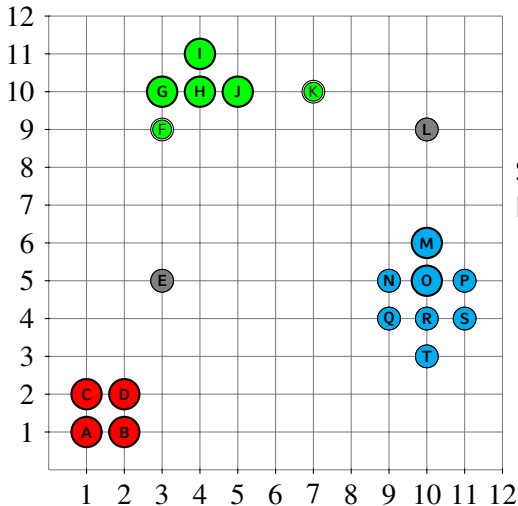
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:
NPRQST

Aufgabe 5-1

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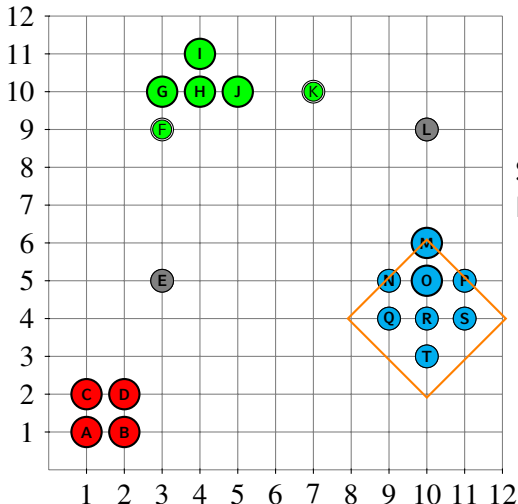
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:
NPQST

Aufgabe 5-1

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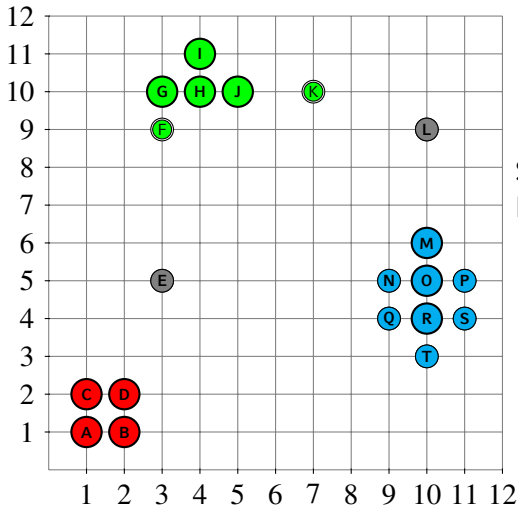
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 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:
NPQST

Aufgabe 5-1

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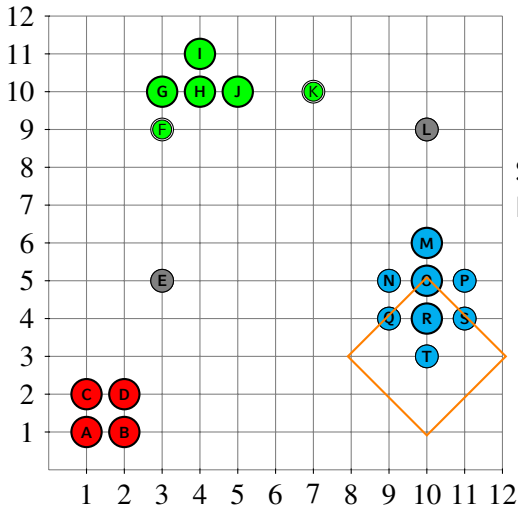
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$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 2.1$

$\text{minPts} = 4$

Seed list:
NPQS

Aufgabe 5-1

$\varepsilon = 1.1$
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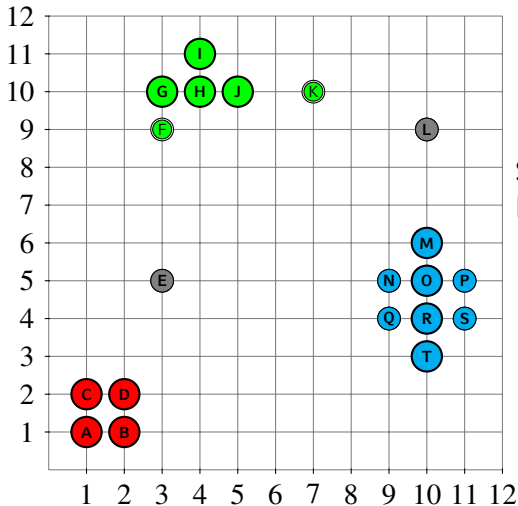
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Aufgabe 5-2



$\varepsilon = 2.1$

$\text{minPts} = 4$

Seed list:
NPQS

Aufgabe 5-1

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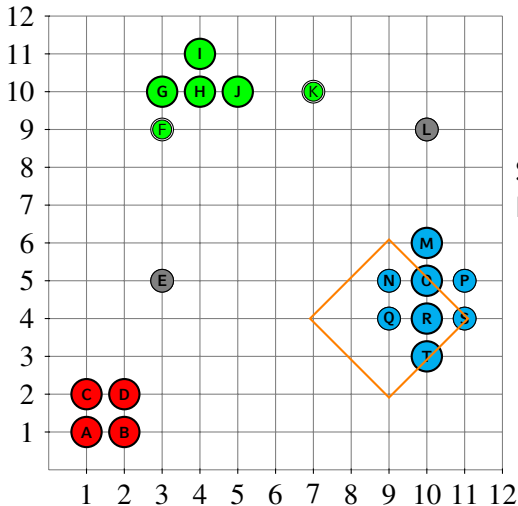
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:
NPS

Aufgabe 5-1

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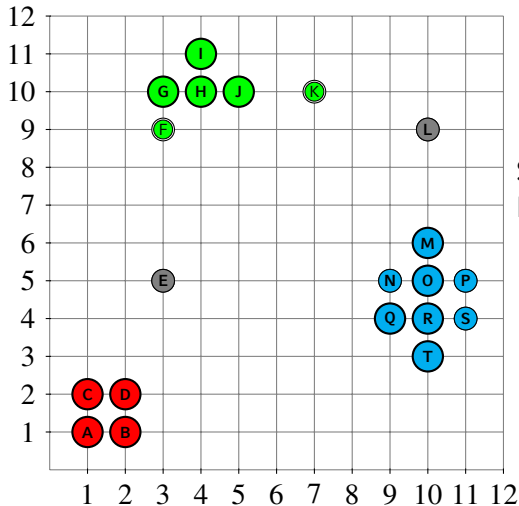
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:
NPS

Aufgabe 5-1

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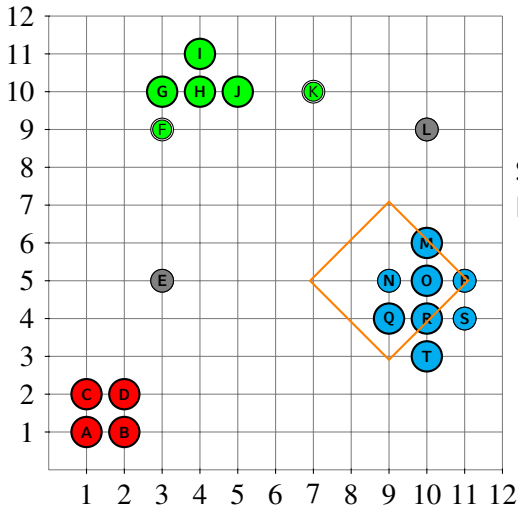
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$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 2.1$

$\text{minPts} = 4$

Seed list:
PS

Aufgabe 5-1

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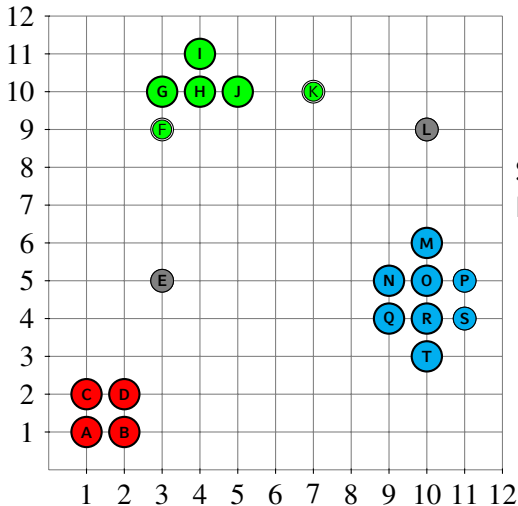
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:
PS

Aufgabe 5-1

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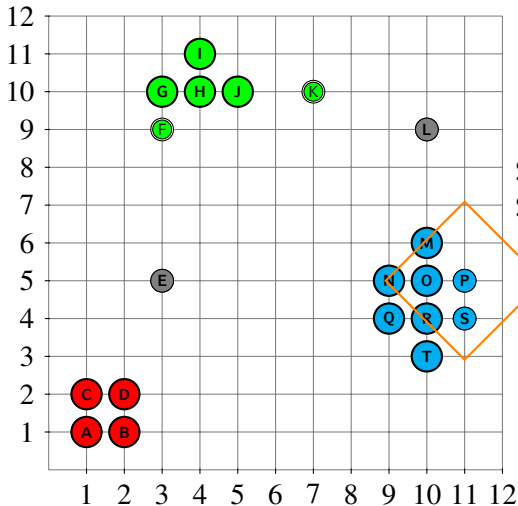
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$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:

S

Aufgabe 5-1

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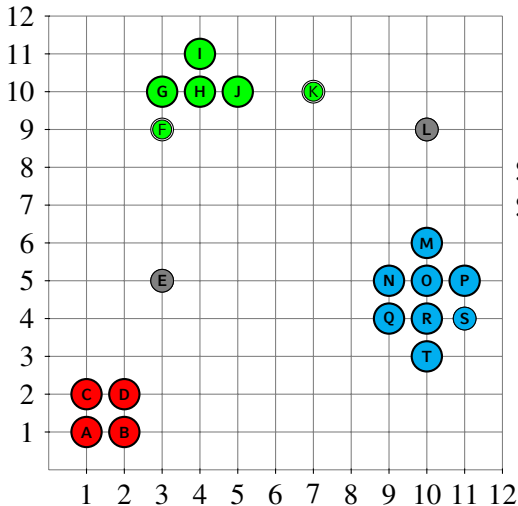
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$\epsilon = 4.1$
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:

S

Aufgabe 5-1

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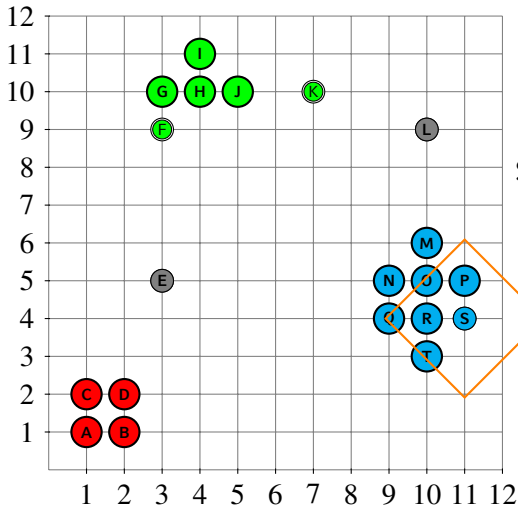
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$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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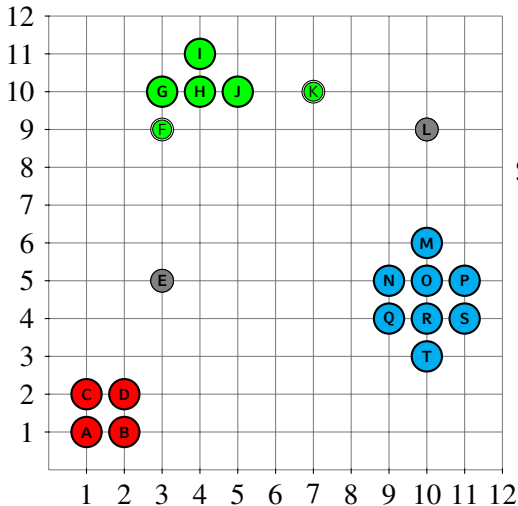
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$\epsilon = 4.1$
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Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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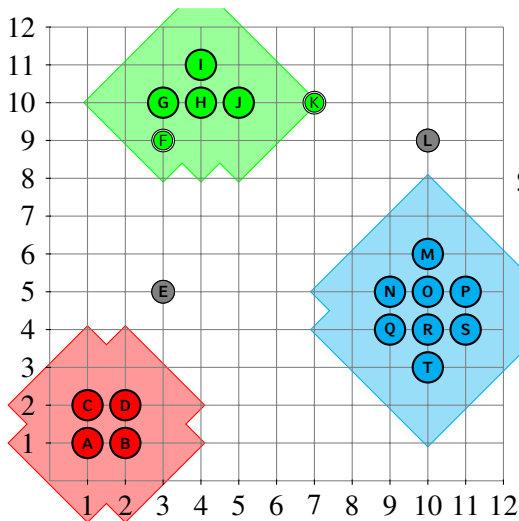
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 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 2.1$

$\text{minPts} = 4$

Seed list:

Aufgabe 5-1

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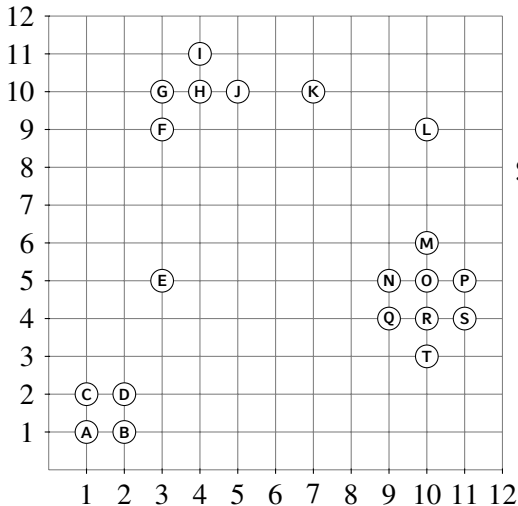
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Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

Aufgabe 5-1

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$\text{minPts} = 2$

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$\varepsilon = 1.1$

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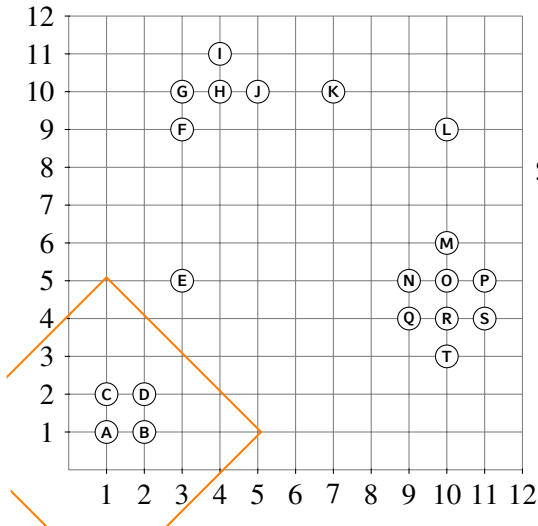
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$\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

Aufgabe 5-1

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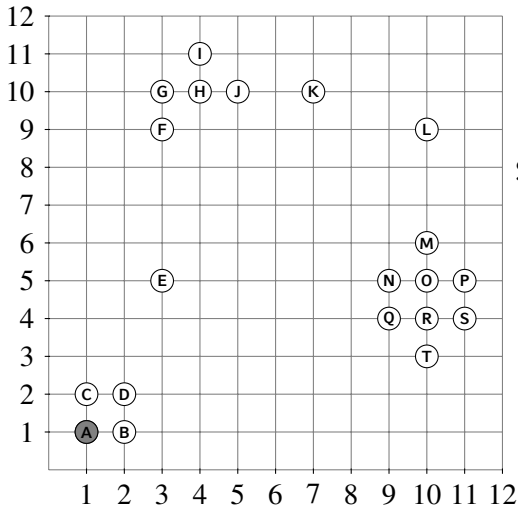
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Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

Aufgabe 5-1

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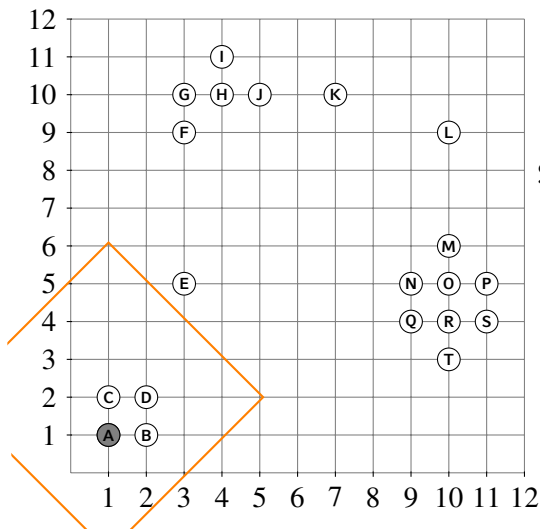
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$\varepsilon = 4.1$
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Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

Aufgabe 5-1

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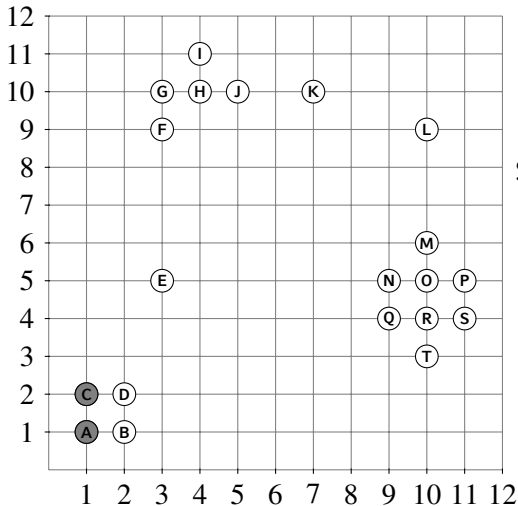
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Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 5$

Seed list:

Aufgabe 5-1

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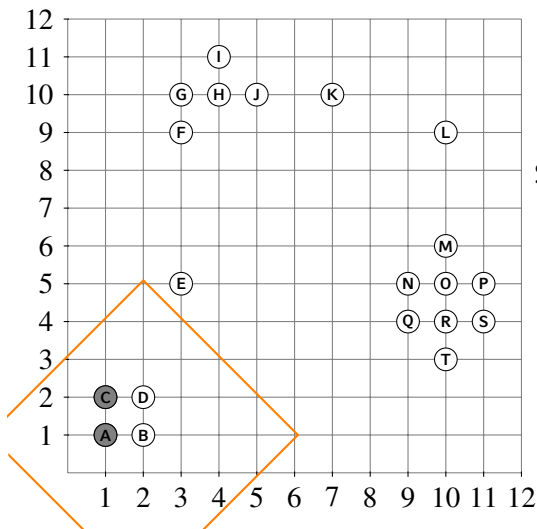
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Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 5$

Seed list:

Aufgabe 5-1

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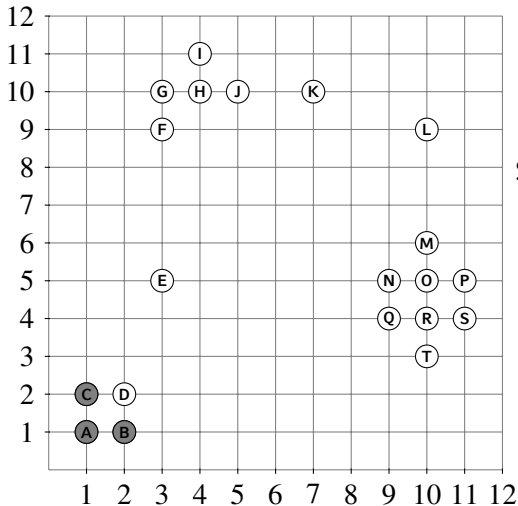
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Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

Aufgabe 5-1

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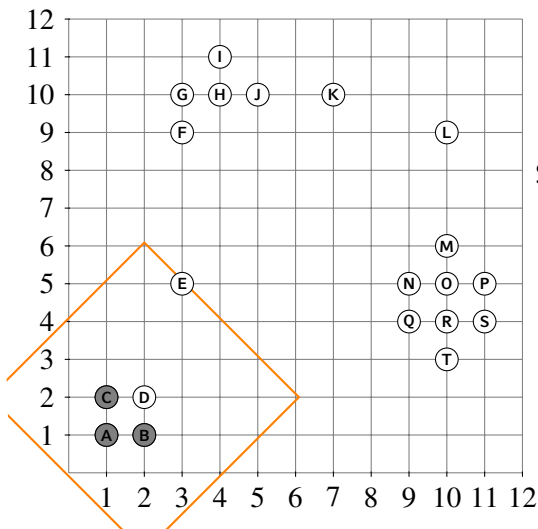
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Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

Aufgabe 5-1

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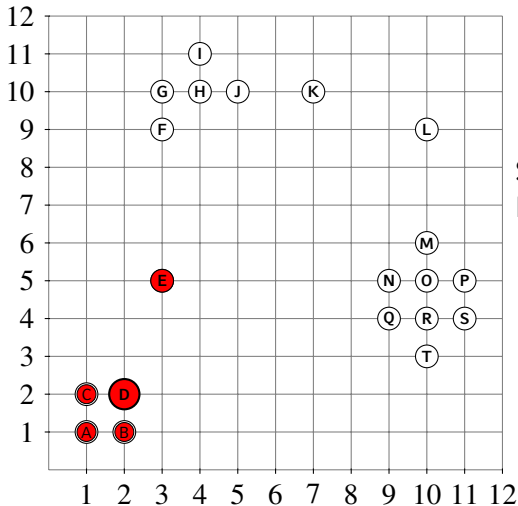
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Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 5$

Seed list:

E

Aufgabe 5-1

$\varepsilon = 1.1$

$\text{minPts} = 2$

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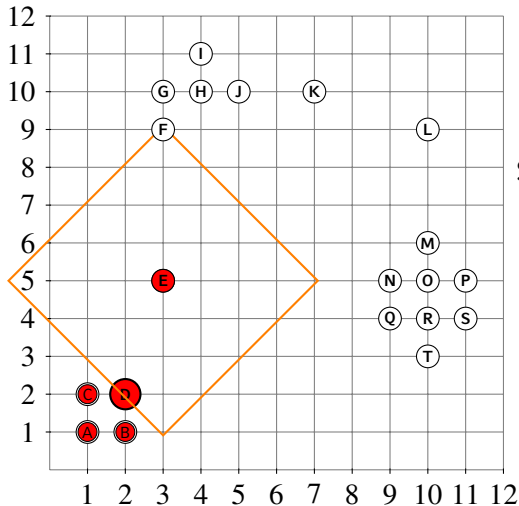
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Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

Aufgabe 5-1

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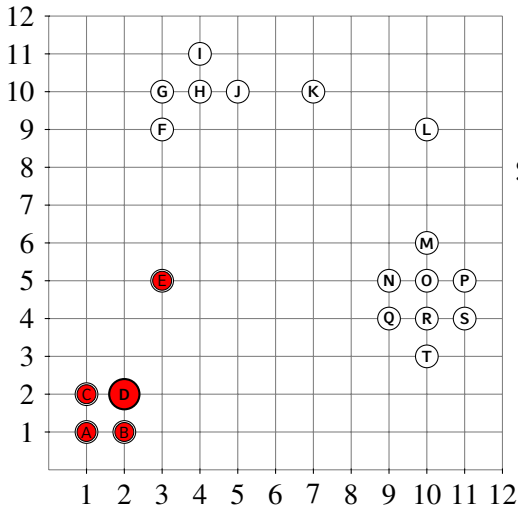
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Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 5$

Seed list:

Aufgabe 5-1

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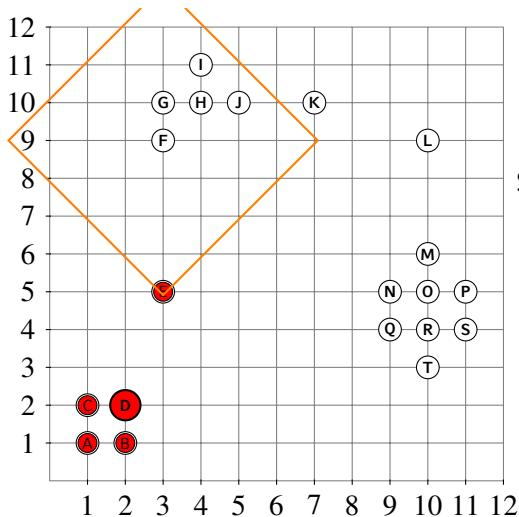
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Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

Aufgabe 5-1

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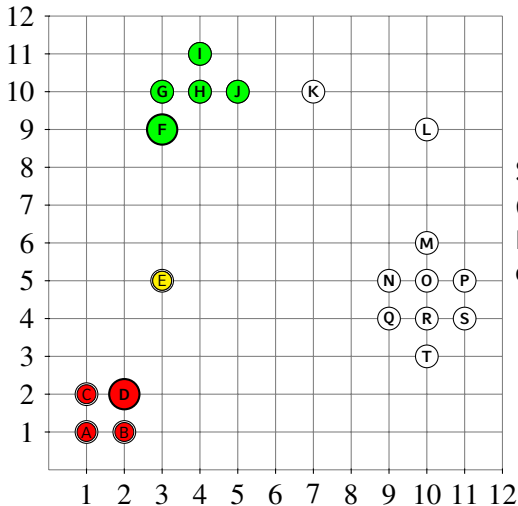
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Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

GHIJ

E nicht
eindeutig!

Aufgabe 5-1

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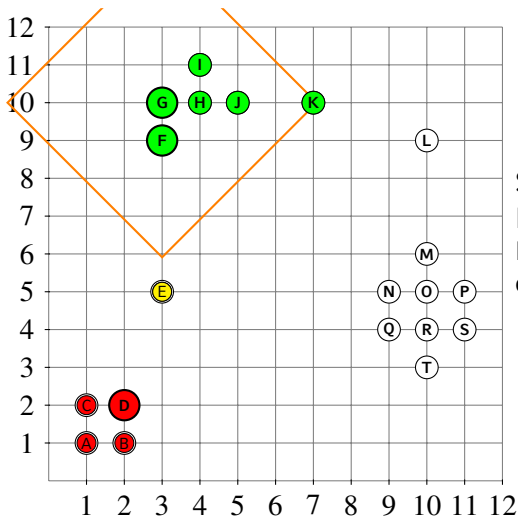
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Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

HIJ

E nicht
eindeutig!

Aufgabe 5-1

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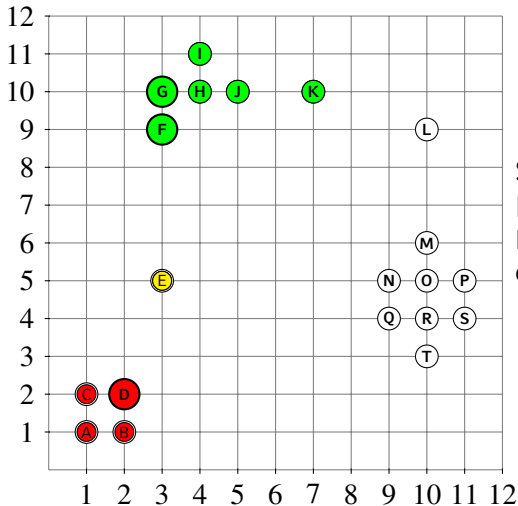
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Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

HIJK

E nicht
eindeutig!

Aufgabe 5-1

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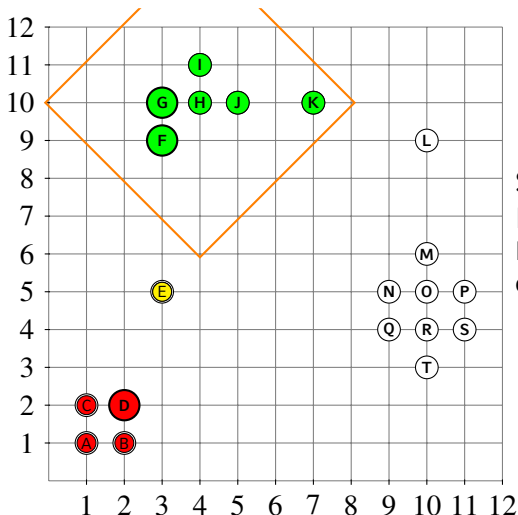
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$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

IJK

E nicht
eindeutig!

Aufgabe 5-1

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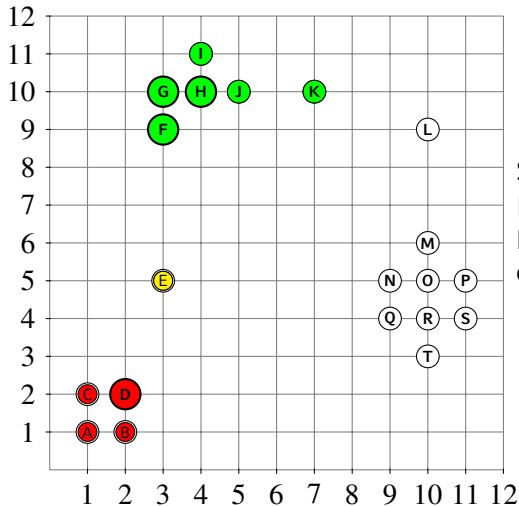
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$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 5$

Seed list:

IJK

E nicht
eindeutig!

Aufgabe 5-1

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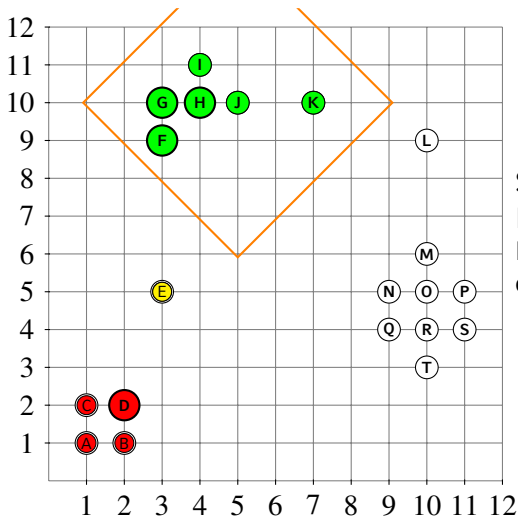
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Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

IK

E nicht
eindeutig!

Aufgabe 5-1

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$\varepsilon = 1.1$
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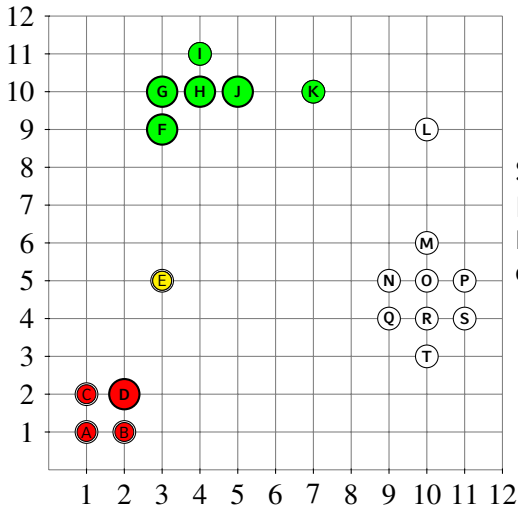
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Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

IK

E nicht
eindeutig!

Aufgabe 5-1

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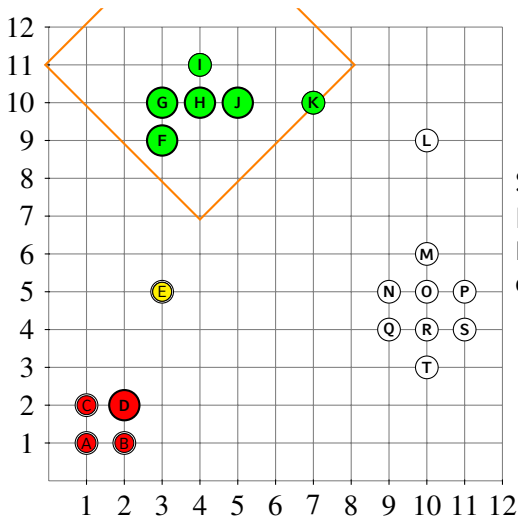
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Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 5$

Seed list:

K

E nicht
eindeutig!

Aufgabe 5-1

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$\varepsilon = 1.1$
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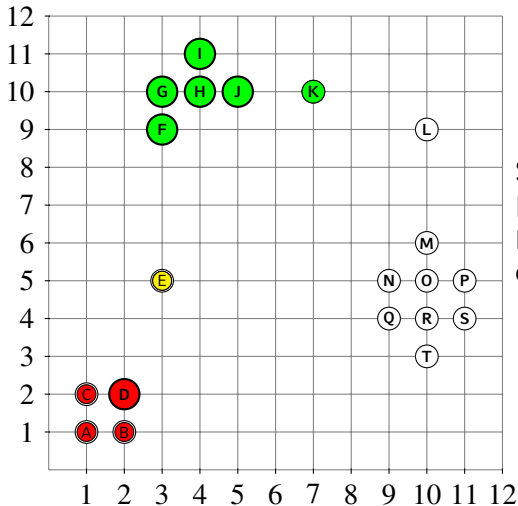
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 $\text{minPts} = 4$

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$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

K

E nicht
eindeutig!

Aufgabe 5-1

$\epsilon = 1.1$
 $\text{minPts} = 2$

$\epsilon = 1.1$
 $\text{minPts} = 3$

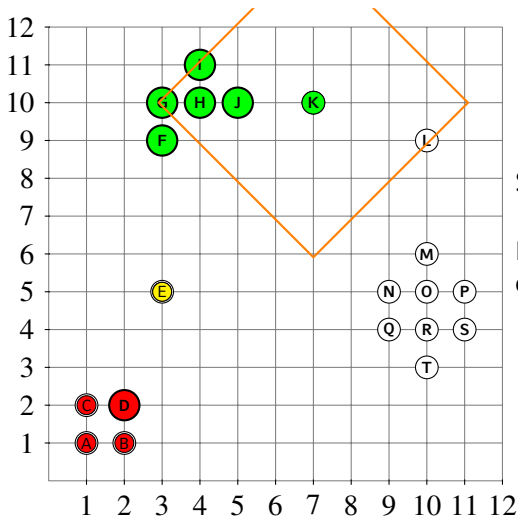
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$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 5$

Seed list:

E nicht
eindeutig!

Aufgabe 5-1

$\epsilon = 1.1$
 $\text{minPts} = 2$

$\epsilon = 1.1$
 $\text{minPts} = 3$

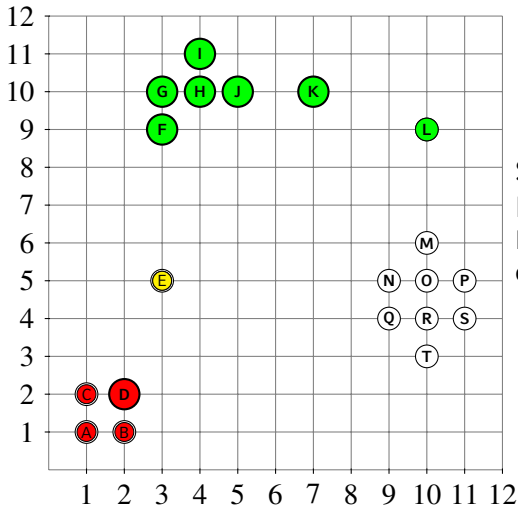
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$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 5$

Seed list:

L
E nicht
eindeutig!

Aufgabe 5-1

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 $\text{minPts} = 2$

$\epsilon = 1.1$
 $\text{minPts} = 3$

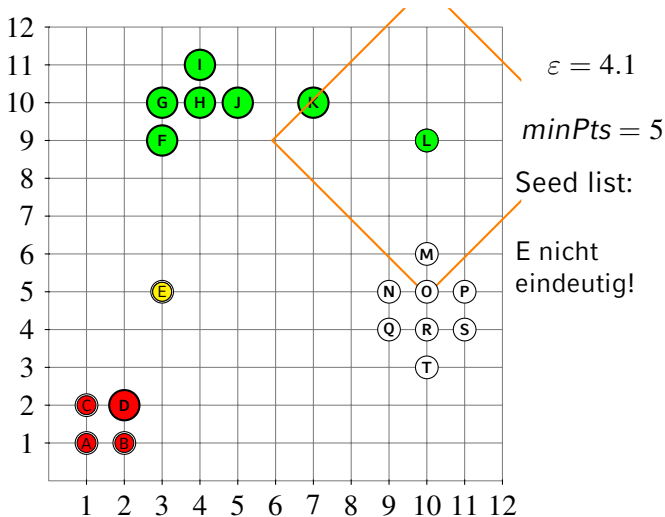
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$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



Aufgabe 5-1

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 $\text{minPts} = 2$

$\epsilon = 1.1$
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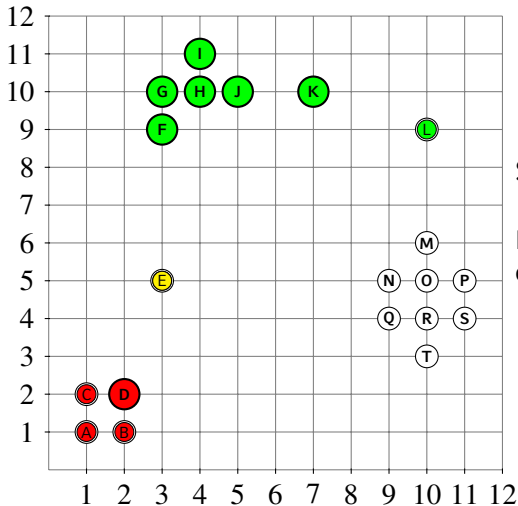
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$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 5$

Seed list:

E nicht
eindeutig!

Aufgabe 5-1

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$\epsilon = 1.1$
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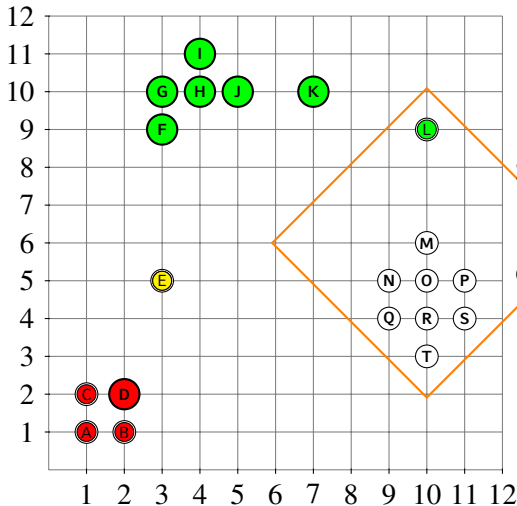
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Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 5$

Seed list:

E nicht
eindeutig!

Aufgabe 5-1

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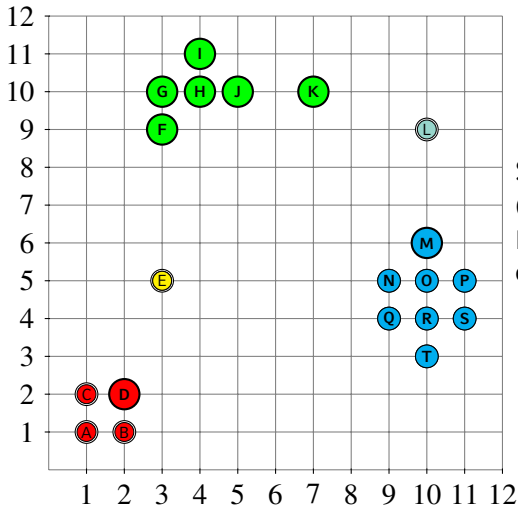
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$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:
ONPRQST
E und L nicht
eindeutig!

Aufgabe 5-1

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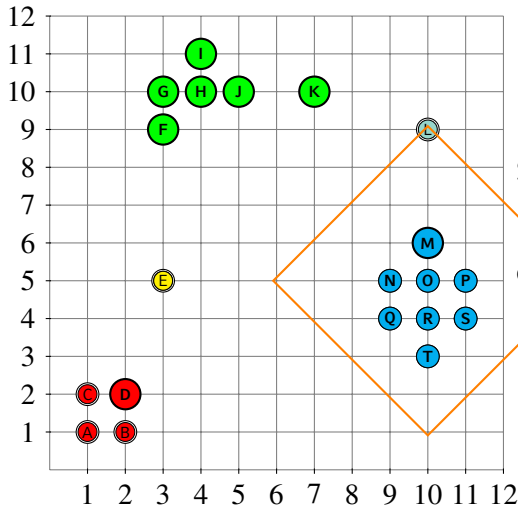
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$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:
NPQST
E und L nicht
eindeutig!

Aufgabe 5-1

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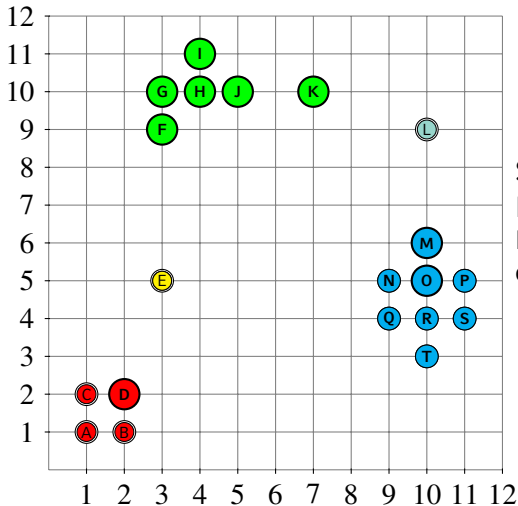
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$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:
NPQST
E und L nicht
eindeutig!

Aufgabe 5-1

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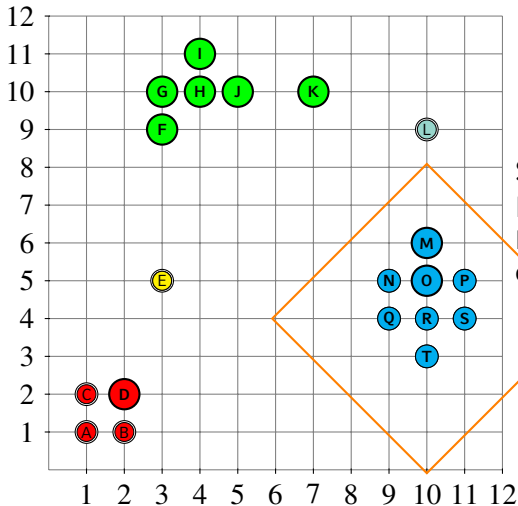
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$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

NPQST

E und L nicht
eindeutig!

Aufgabe 5-1

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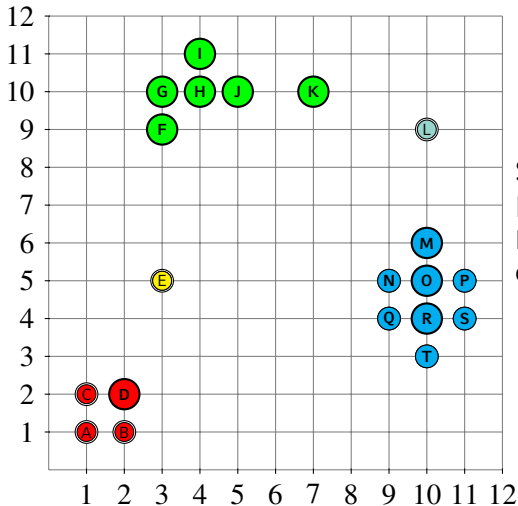
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$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:
NPQST
E und L nicht
eindeutig!

Aufgabe 5-1

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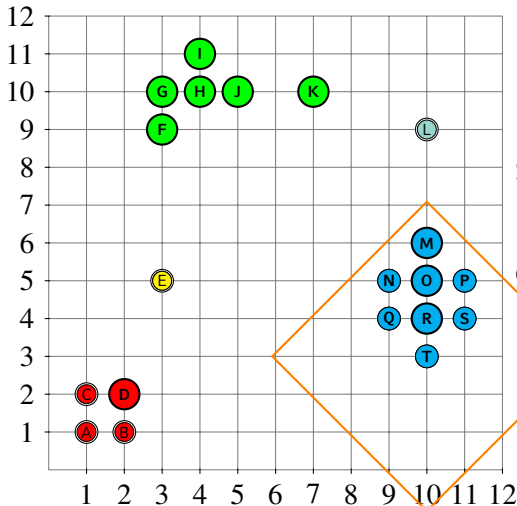
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$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

NPQS

E und L nicht
eindeutig!

Aufgabe 5-1

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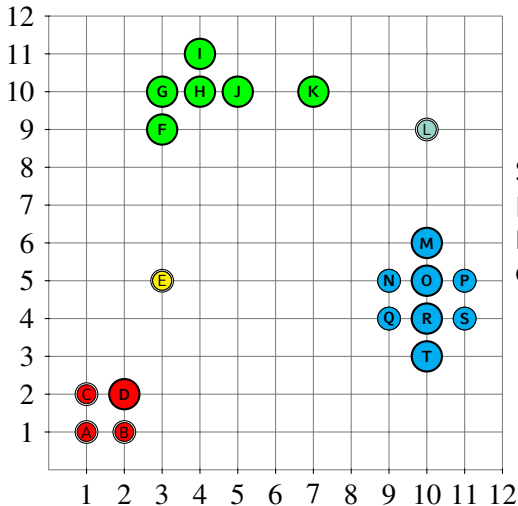
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$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 5$

Seed list:
NPQS
E und L nicht
eindeutig!

Aufgabe 5-1

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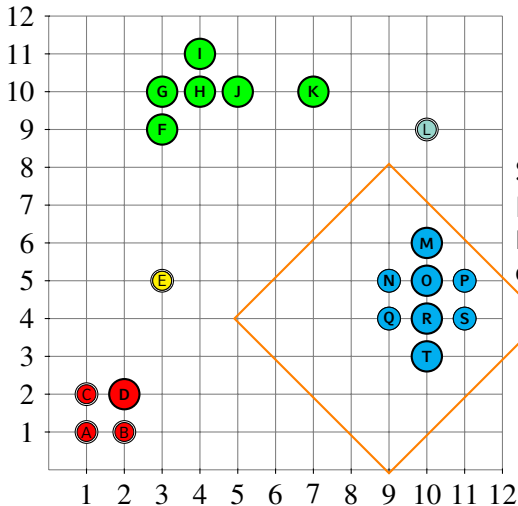
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Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 5$

Seed list:

NPS

E und L nicht
eindeutig!

Aufgabe 5-1

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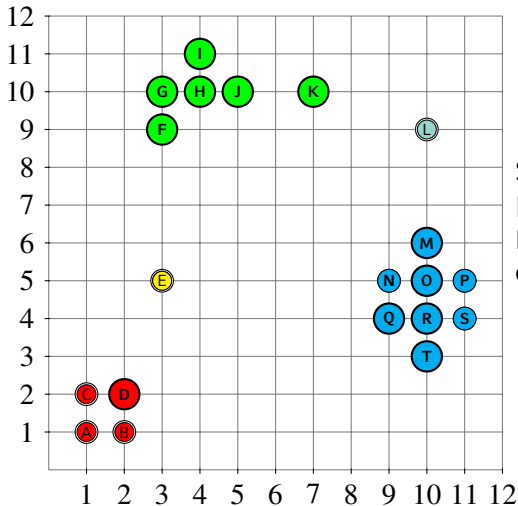
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$\varepsilon = 4.1$
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Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

NPS

E und L nicht
eindeutig!

Aufgabe 5-1

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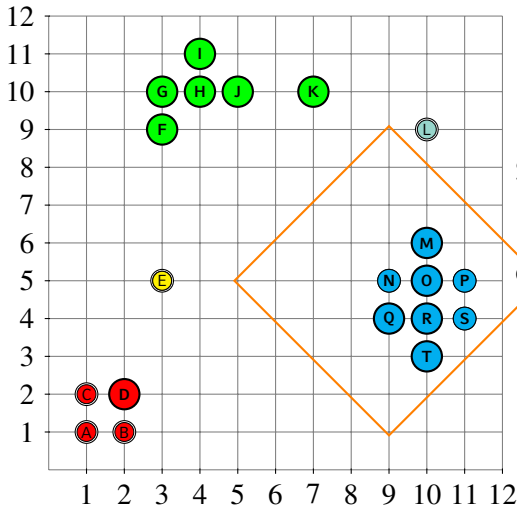
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$\epsilon = 4.1$
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Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 5$

Seed list:

PS

E und L nicht
eindeutig!

Aufgabe 5-1

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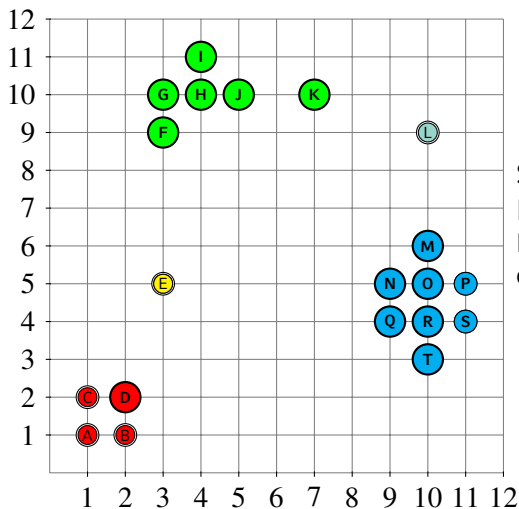
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$\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

PS

E und L nicht
eindeutig!

Aufgabe 5-1

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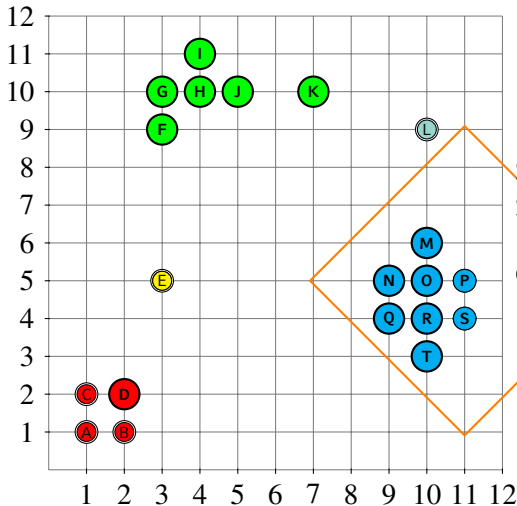
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$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 5$

Seed list:

S
E und L nicht
eindeutig!

Aufgabe 5-1

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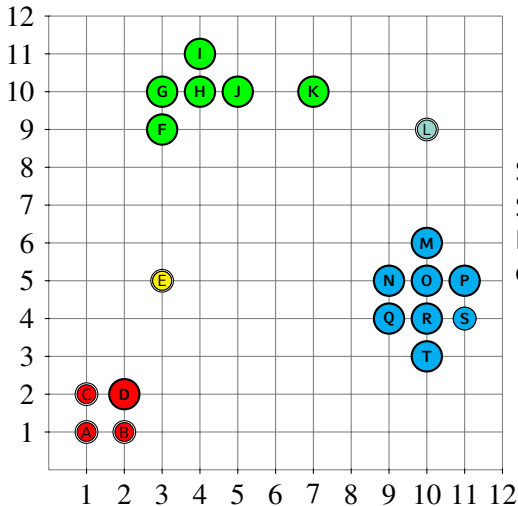
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$\varepsilon = 4.1$
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Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 5$

Seed list:

S

E und L nicht
eindeutig!

Aufgabe 5-1

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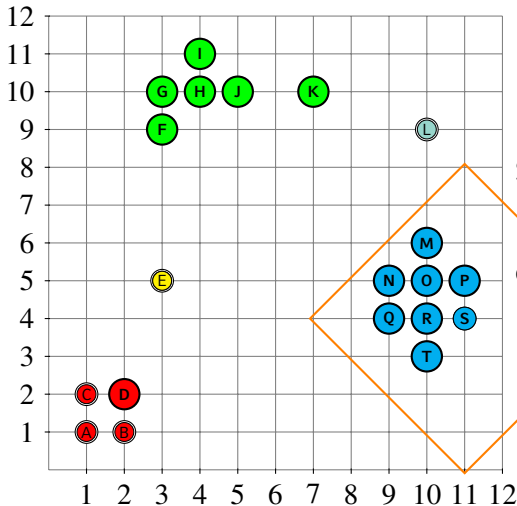
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$\epsilon = 4.1$
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Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 5$

Seed list:

E und L nicht
eindeutig!

Aufgabe 5-1

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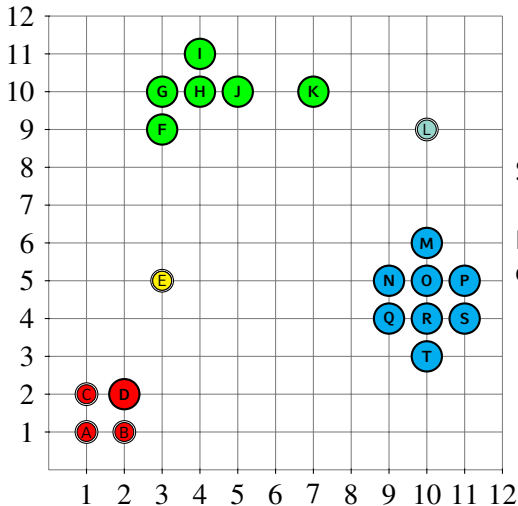
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Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 5$

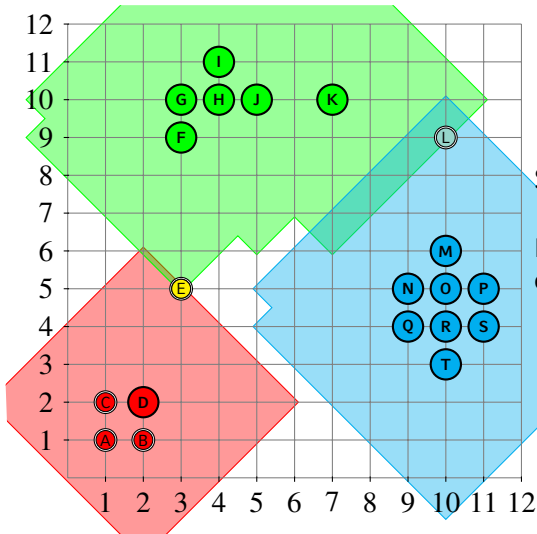
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E und L nicht
eindeutig!

Aufgabe 5-1

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 $\text{minPts} = 4$ $\varepsilon = 2.1$
 $\text{minPts} = 4$ $\varepsilon = 4.1$
 $\text{minPts} = 5$ $\varepsilon = 4.1$
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Aufgabe 5-2

 $\varepsilon = 4.1$ $\text{minPts} = 5$

Seed list:

E und L nicht
eindeutig!

Aufgabe 5-1

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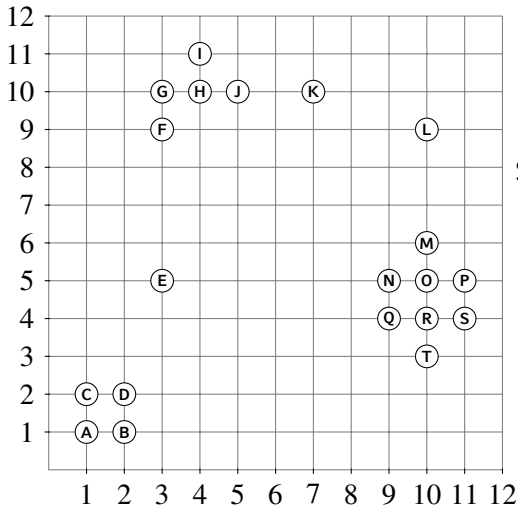
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Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 4$

Seeds:

Aufgabe 5-1

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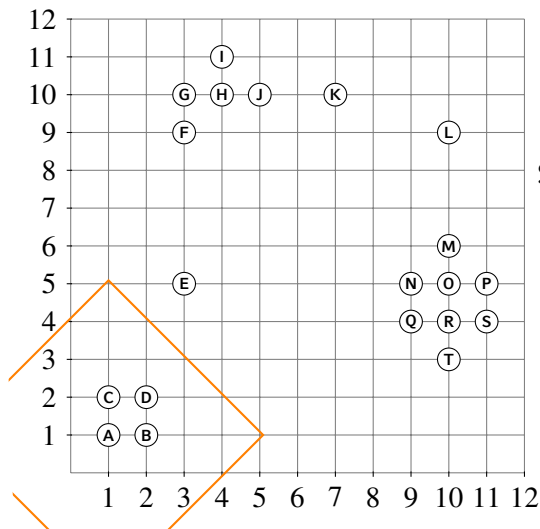
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Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 4$

Seeds:

Aufgabe 5-1

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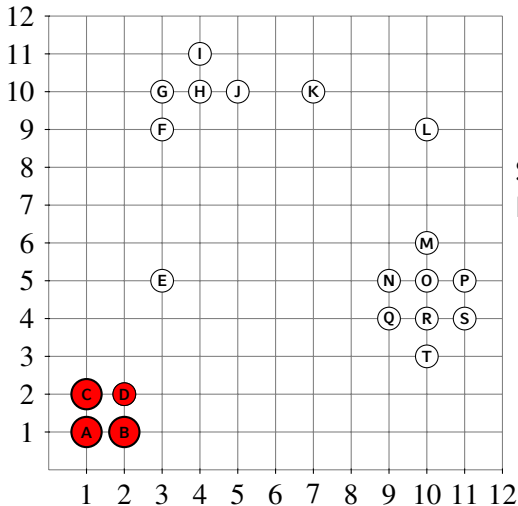
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Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 4$

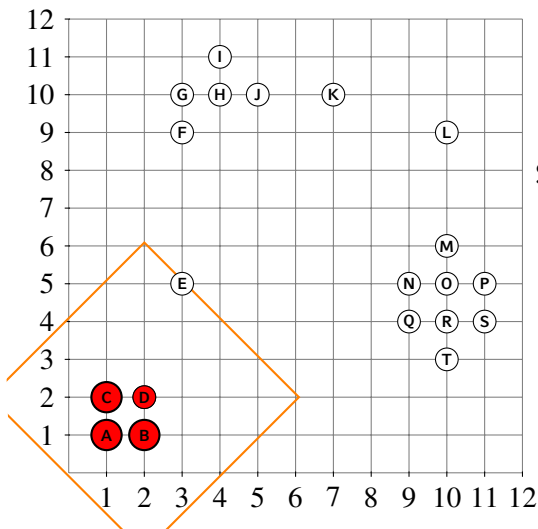
Seeds:

D

Aufgabe 5-1

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Aufgabe 5-2



$$\epsilon = 4.1$$

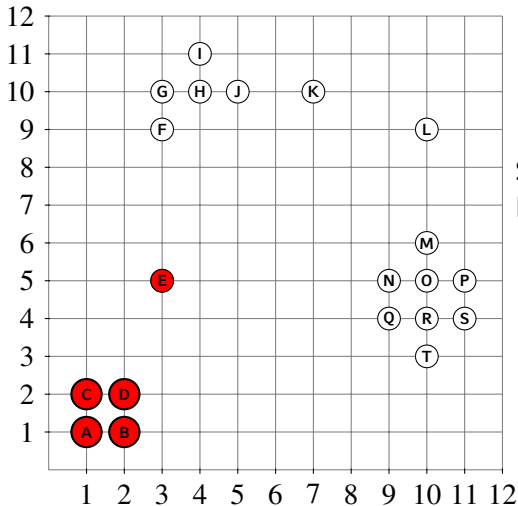
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Seeds:

Aufgabe 5-1

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Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 4$

Seeds:

E

Aufgabe 5-1

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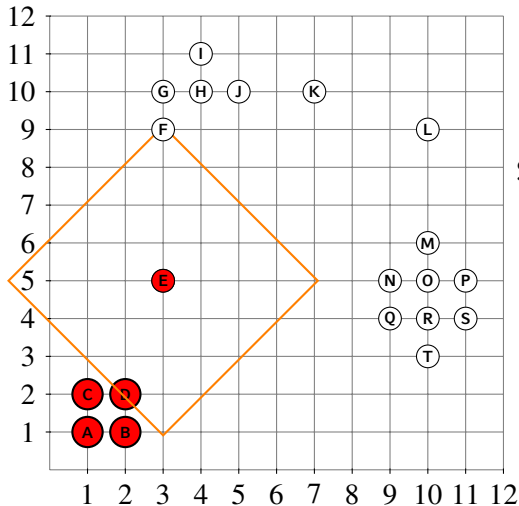
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Aufgabe 5-2



$\varepsilon = 4.1$

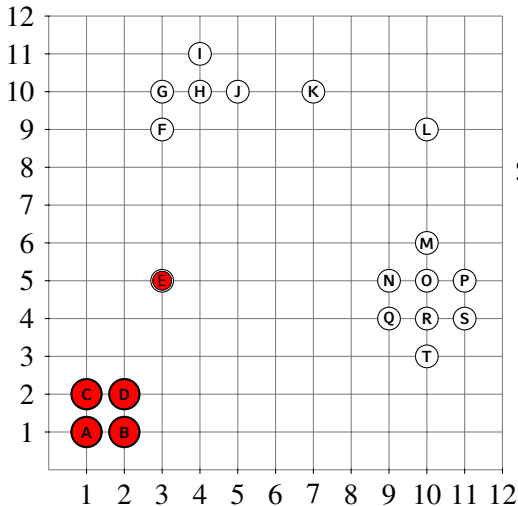
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Seeds:

Aufgabe 5-1

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minPts = 4

Aufgabe 5-2



$$\epsilon = 4.1$$

$$\text{minPts} = 4$$

Seeds:

Aufgabe 5-1

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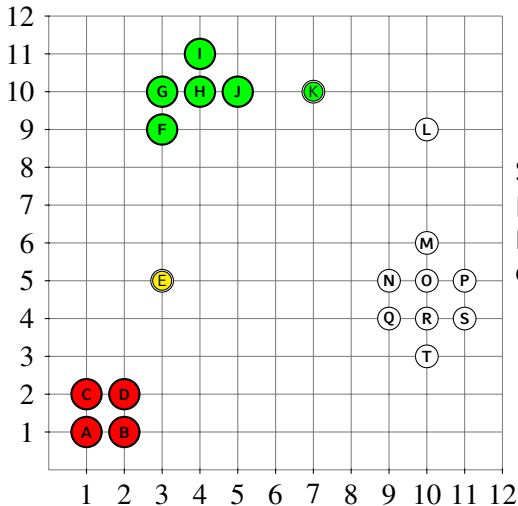
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Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 4$

Seeds:

K

E nicht
eindeutig!

Aufgabe 5-1

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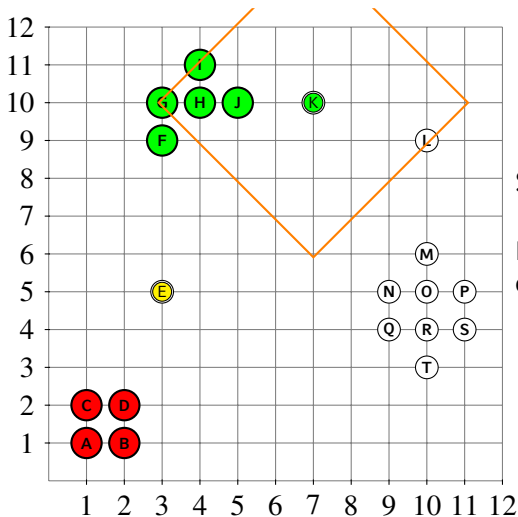
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Aufgabe 5-2



$\varepsilon = 4.1$

$\text{minPts} = 4$

Seeds:

E nicht
eindeutig!

Aufgabe 5-1

$\epsilon = 1.1$
 $\text{minPts} = 2$

$\epsilon = 1.1$
 $\text{minPts} = 3$

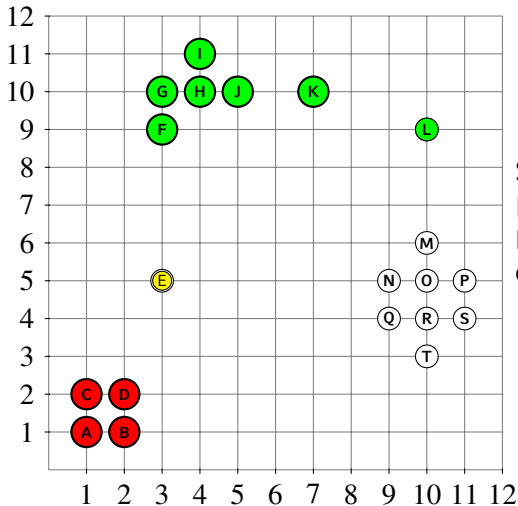
$\epsilon = 1.1$
 $\text{minPts} = 4$

$\epsilon = 2.1$
 $\text{minPts} = 4$

$\epsilon = 4.1$
 $\text{minPts} = 5$

$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 4$

Seeds:

L

E nicht
eindeutig!

Aufgabe 5-1

$\epsilon = 1.1$
 $\text{minPts} = 2$

$\epsilon = 1.1$
 $\text{minPts} = 3$

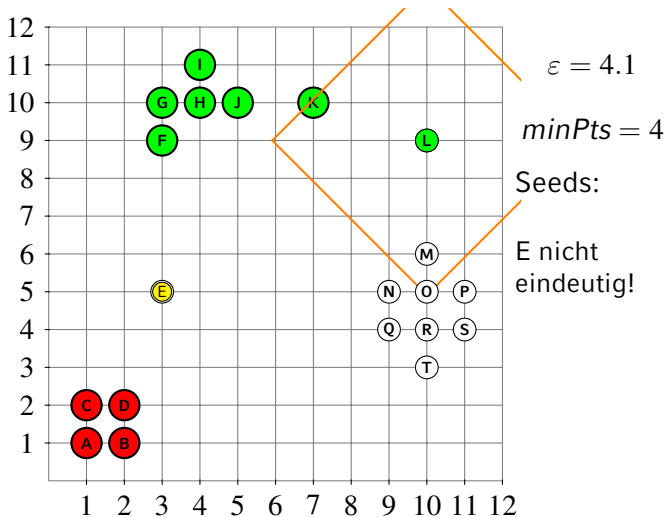
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 $\text{minPts} = 4$

$\epsilon = 2.1$
 $\text{minPts} = 4$

$\epsilon = 4.1$
 $\text{minPts} = 5$

$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



Aufgabe 5-1

$\epsilon = 1.1$
 $\text{minPts} = 2$

$\epsilon = 1.1$
 $\text{minPts} = 3$

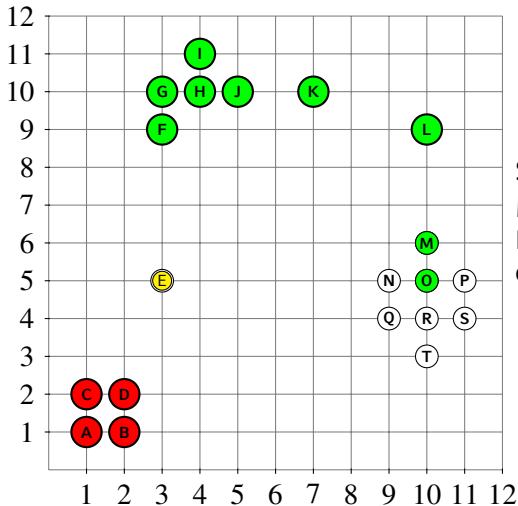
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 $\text{minPts} = 4$

$\epsilon = 2.1$
 $\text{minPts} = 4$

$\epsilon = 4.1$
 $\text{minPts} = 5$

$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 4$

Seeds:

MO

E nicht
eindeutig!

Aufgabe 5-1

$\epsilon = 1.1$
 $\text{minPts} = 2$

$\epsilon = 1.1$
 $\text{minPts} = 3$

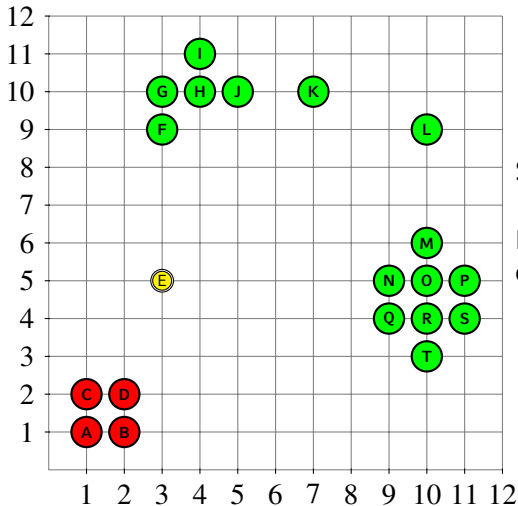
$\epsilon = 1.1$
 $\text{minPts} = 4$

$\epsilon = 2.1$
 $\text{minPts} = 4$

$\epsilon = 4.1$
 $\text{minPts} = 5$

$\epsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2



$\epsilon = 4.1$

$\text{minPts} = 4$

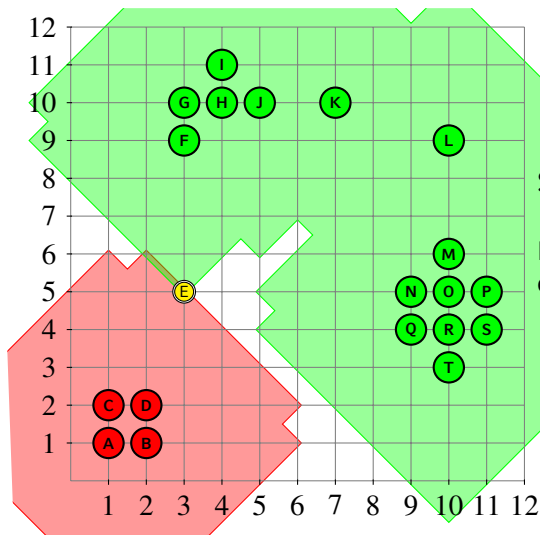
Seeds:

E nicht
eindeutig!

Aufgabe 5-1

$\varepsilon = 1.1$
 $\text{minPts} = 2$
 $\varepsilon = 1.1$
 $\text{minPts} = 3$
 $\varepsilon = 1.1$
 $\text{minPts} = 4$
 $\varepsilon = 2.1$
 $\text{minPts} = 4$
 $\varepsilon = 4.1$
 $\text{minPts} = 5$
 $\varepsilon = 4.1$
 $\text{minPts} = 4$

Aufgabe 5-2

 $\varepsilon = 4.1$ $\text{minPts} = 4$

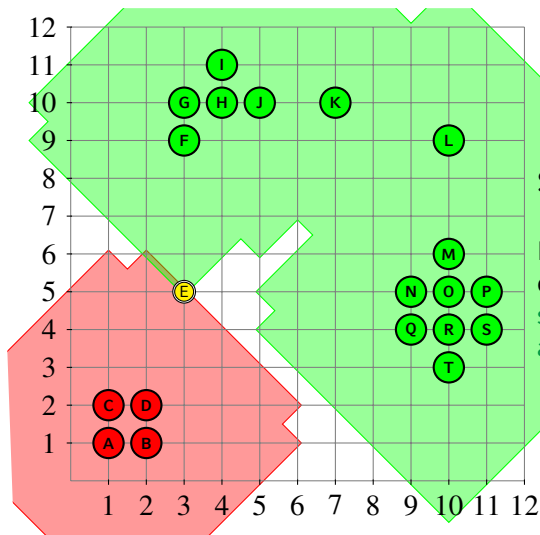
Seeds:

E nicht
eindeutig!

Aufgabe 5-1

 $\varepsilon = 1.1$ $\text{minPts} = 2$ $\varepsilon = 1.1$ $\text{minPts} = 3$ $\varepsilon = 1.1$ $\text{minPts} = 4$ $\varepsilon = 2.1$ $\text{minPts} = 4$ $\varepsilon = 4.1$ $\text{minPts} = 5$ $\varepsilon = 4.1$ $\text{minPts} = 4$

Aufgabe 5-2

 $\varepsilon = 4.1$ $\text{minPts} = 4$

Seeds:

E nicht
eindeutig!
single-link
artiger Effekt

$\epsilon = 1.1$
 $\text{minPts} = 2$
 $\epsilon = 1.1$
 $\text{minPts} = 3$
 $\epsilon = 1.1$
 $\text{minPts} = 4$
 $\epsilon = 2.1$
 $\text{minPts} = 4$
 $\epsilon = 4.1$
 $\text{minPts} = 5$
 $\epsilon = 4.1$
 $\text{minPts} = 4$

Diskutieren Sie folgende Fragen / Aussagen zu DBSCAN:

- ▶ Bei $\text{minPts} = 2$, was passiert mit Randpunkten?
 - ▶ Das Ergebnis von DBSCAN ist determiniert auf Kern- und Noise-Punkten, aber nicht Randpunkten!
 - ▶ Ein Cluster in DBSCAN kann weniger als minPts Punkte enthalten
 - ▶ Hat der Datensatz n Objekte, so stellt DBSCAN stets genau n Nachbarschaftsanfragen.
 - ▶ Auf gleichverteilten Daten wird DBSCAN in der Regel fast alles in einen Cluster clustern, oder alles als Noise klassifizieren.
- k -means hingegen wird in der Regel die Daten in k etwa gleich große Partitionen aufteilen.