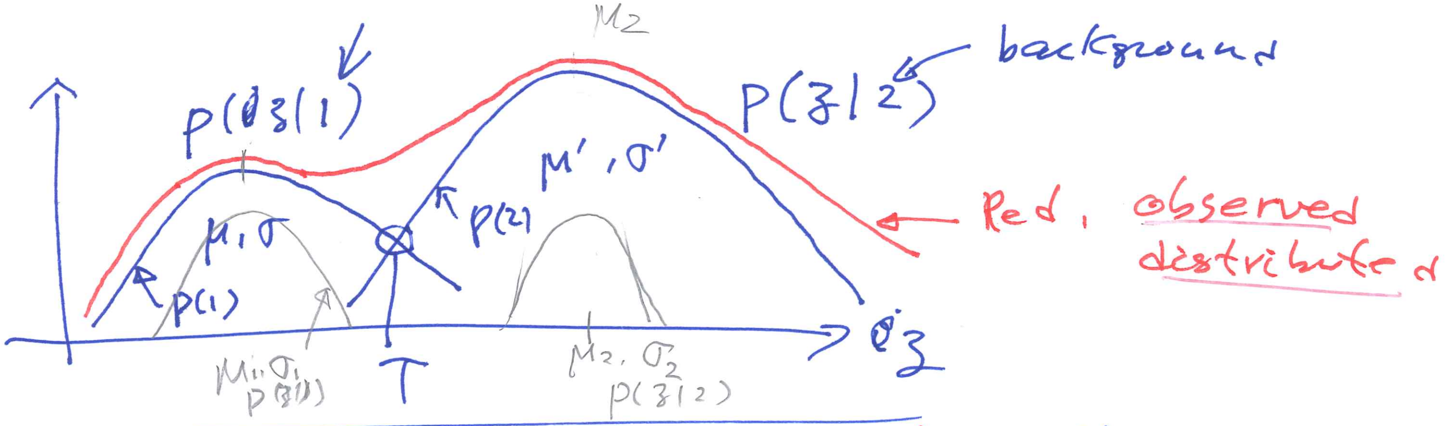
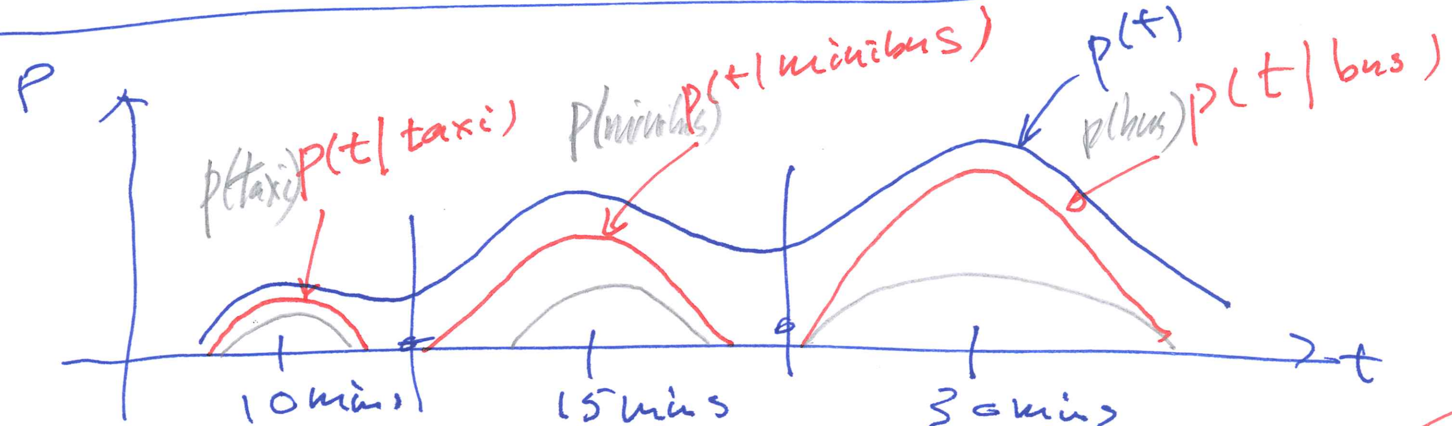




$$\frac{1}{\sqrt{2\pi}\,\sigma} e^{-\frac{(t-\mu)^2}{2\sigma^2}}$$

$$p(t) = p(\text{taxi})\,p(t|\text{taxi}) + p(\text{minibus})\,p(t|\text{minibus}) + p(\text{bus})\,p(t|\text{bus})$$

0.4

prior

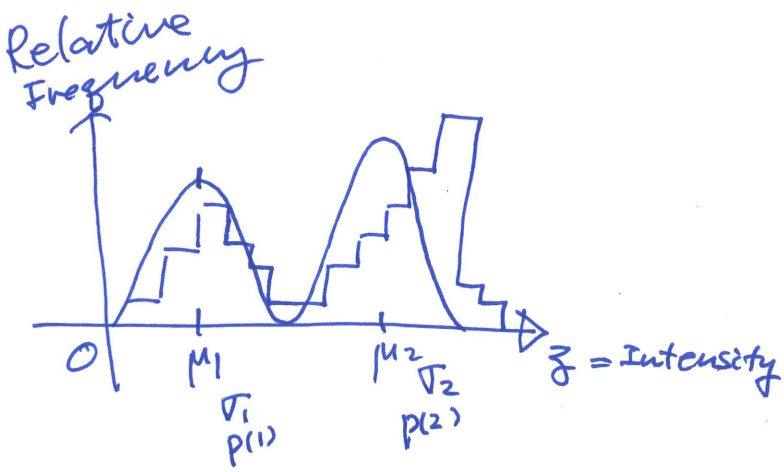
t = time to take to travel. (travel time)

$$\underset{0.2}{p(\text{taxi})} + \underset{0.4}{p(\text{minibus})} + \underset{0.4}{p(\text{bus})} = 1$$

E.g.

z^1	z^2	z^3
z^4	z^5	z^6
z^7	z^8	z^9

$\boxed{\text{Example}}$



Iteration 0 (2 classes)

$$\mu_1,\ \sigma_1,\ p(1),\ \mu_2,\ \sigma_2,\ p(2)$$

Iteration 1

posterior

likelihood

prior

E step:

$$p(1|z) = \frac{p(z|1)\,p(1)}{p(z)}$$

where $p(z) = p(z|1)p(1) + p(z|2)p(2)$

$$p(2|z) = \frac{p(z|2)\,p(2)}{p(z)}$$

mixing parameter

where $p(z) = p(1)\,p(z|1) + p(2)\,p(z|2)$ basis function

likelihood or basis fcn

$$p(z|1) = \frac{1}{\sqrt{2\pi}\,\sigma_1^2}\, e^{-\frac{(z-\mu_1)^2}{2\sigma_1^2}}$$

$$p(z|2) = \frac{1}{\sqrt{2\pi}\,\sigma_2^2}\, e^{-\frac{(z-\mu_2)^2}{2\sigma_2^2}}$$

posterior probability

M step:

$$\mu_1^{new} = \frac{\sum_{n=1}^{9} p(1|z^n)\cdot z^n}{\sum_{m=1}^{9} p(1|z^m)},$$

z^n = intensity value at nth pixel

$$= \frac{p(1|z^1)z^1 + p(1|z^2)z^2 + \dots + p(1|z^9)z^9}{p(1|z^1) + p(1|z^2) + \dots + p(1|z^9)}$$

$$(\sigma_1^{new})^2 = \frac{\sum_{n=1}^{9} p(1|z^n)(z^n - \mu_1^{new})^2}{\sum_{m=1}^{9} p(1|z^m)}$$

$$p(1)^{new} = \frac{1}{9} \sum_{n=1}^{9} p(1 \mid z^n)$$

Find μ_1^{new}, $\cancel{p}(\sigma_1^{new})^2$, $p(1)^{new}$

μ_2^{new}, $(\sigma_2^{new})^2$, $p(2)^{new}$

---

update all parameters

$\mu_1 = \mu_1^{new}$

$\sigma_1 = \sigma_1^{new}$

$p(1) = p(1)^{new}$

$\mu_2 = \mu_2^{new}$

$\sigma_2 = \sigma_2^{new}$

$p(2) = p(2)^{new}$

<u>iteration 2</u>

E step : find $p(1 \mid z)$ & $p(2 \mid z)$

M step : find μ_1^{new}, $(\sigma_1^{new})^2$, $p(1)^{new}$

μ_2^{new}, $(\sigma_2^{new})^2$, $p(2)^{new}$

⋮

Stops when

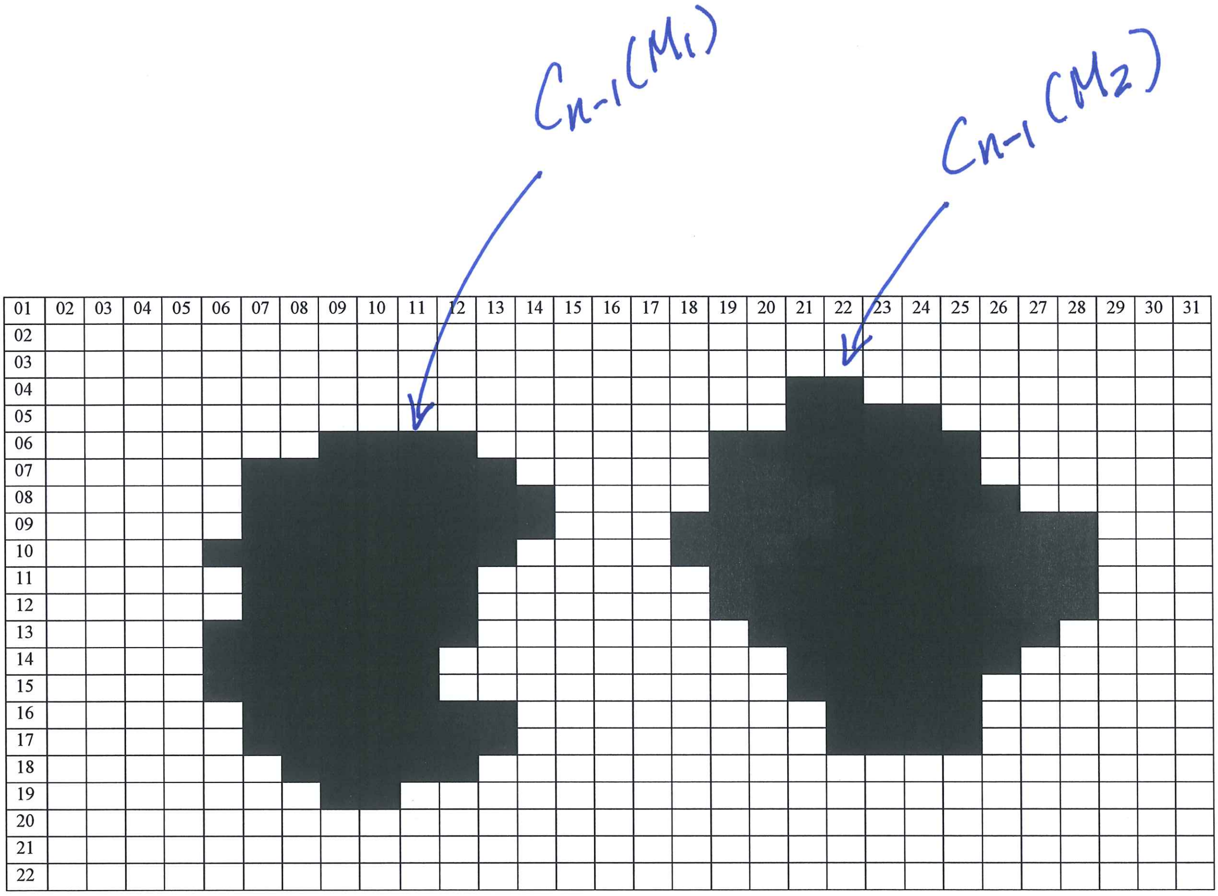
$\Delta\mu_1$, $\Delta\sigma_1$, $\Delta p(1)$

$\Delta\mu_2$, $\Delta\sigma_2$, $\Delta p(2)$

are significantly small.

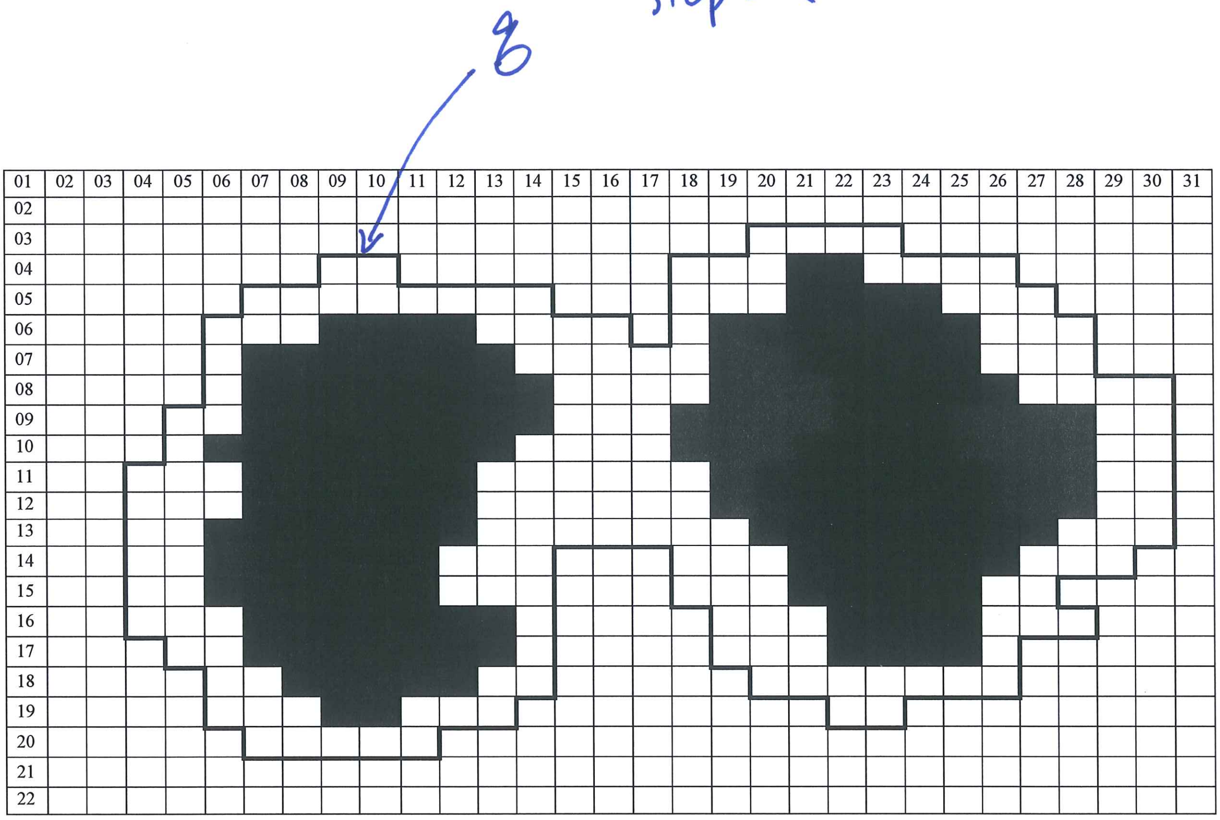
for step = min+1 to max+1

↳ step = n-1

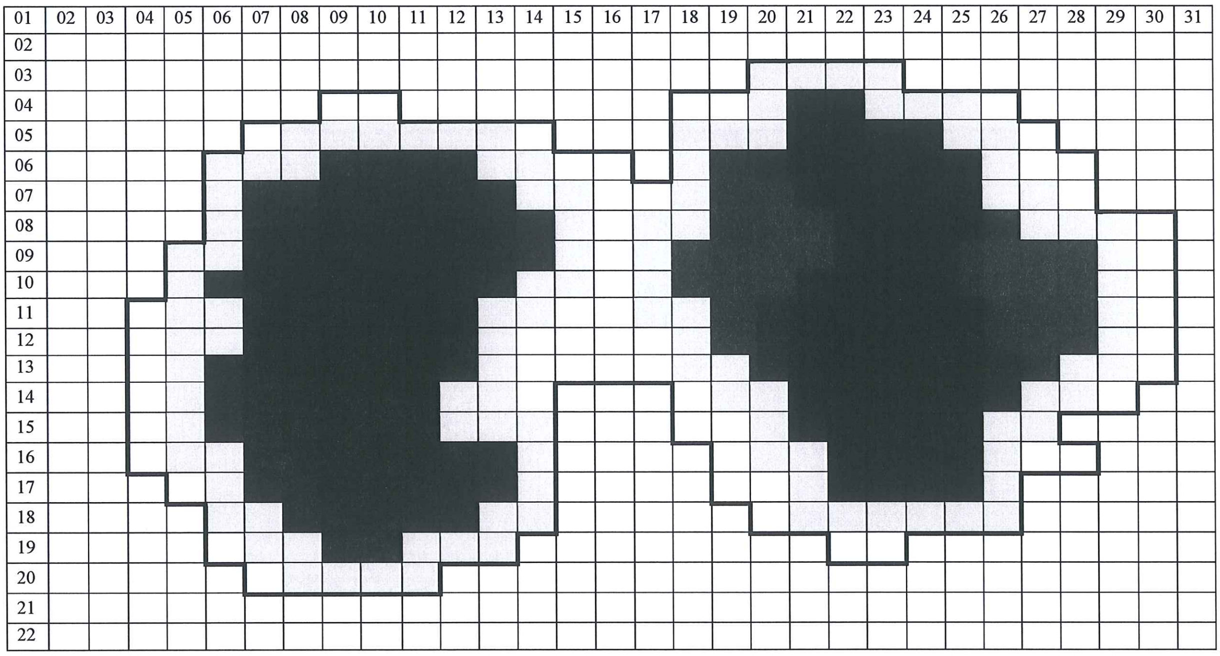


Two connected components $C[n-1] = C_{n-1}(M_1) \cup C_{n-1}(M_2)$ (two solid black regions).

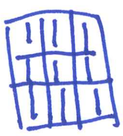
Step = n

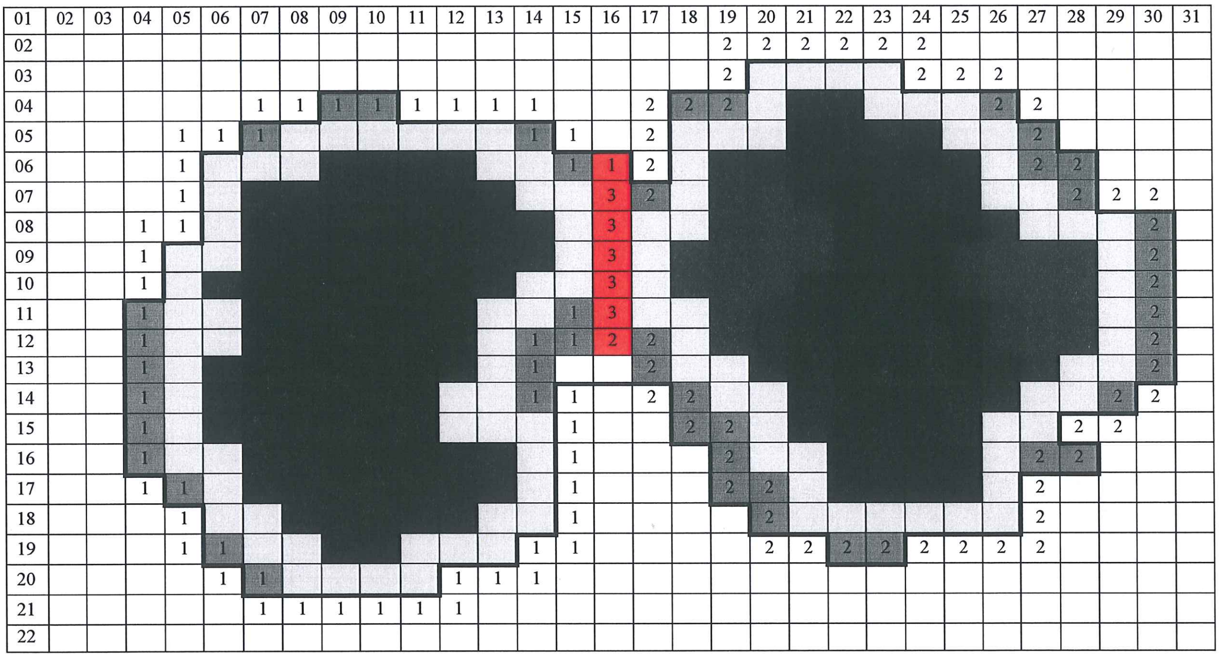


Two connected components C[n-1] (two solid black regions). q = connected component obtained from rising the water level by one (enclosed by a solid line).



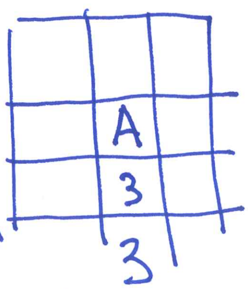
Two connected components C[n-1] (two solid black regions). q = connected component obtained from rising the water level by one (enclosed by a solid line). It shows the results after the first dilation. Light grey boxes represent the extra boxes added after the first dilation.
The structuring element is [1 1 1;1 1 1;1 1 1].

B 



Two connected components C[n-1] (two solid black regions). q = connected component obtained from rising the water level by one (enclosed by a solid line). Light grey boxes represent the extra boxes added after the first dilation. It shows the results after the second dilation. Medium (deep) grey boxes represent the extra boxes added after the second dilation and within q. Red boxes represent dam points, which would cause the sets being dilated to merge.

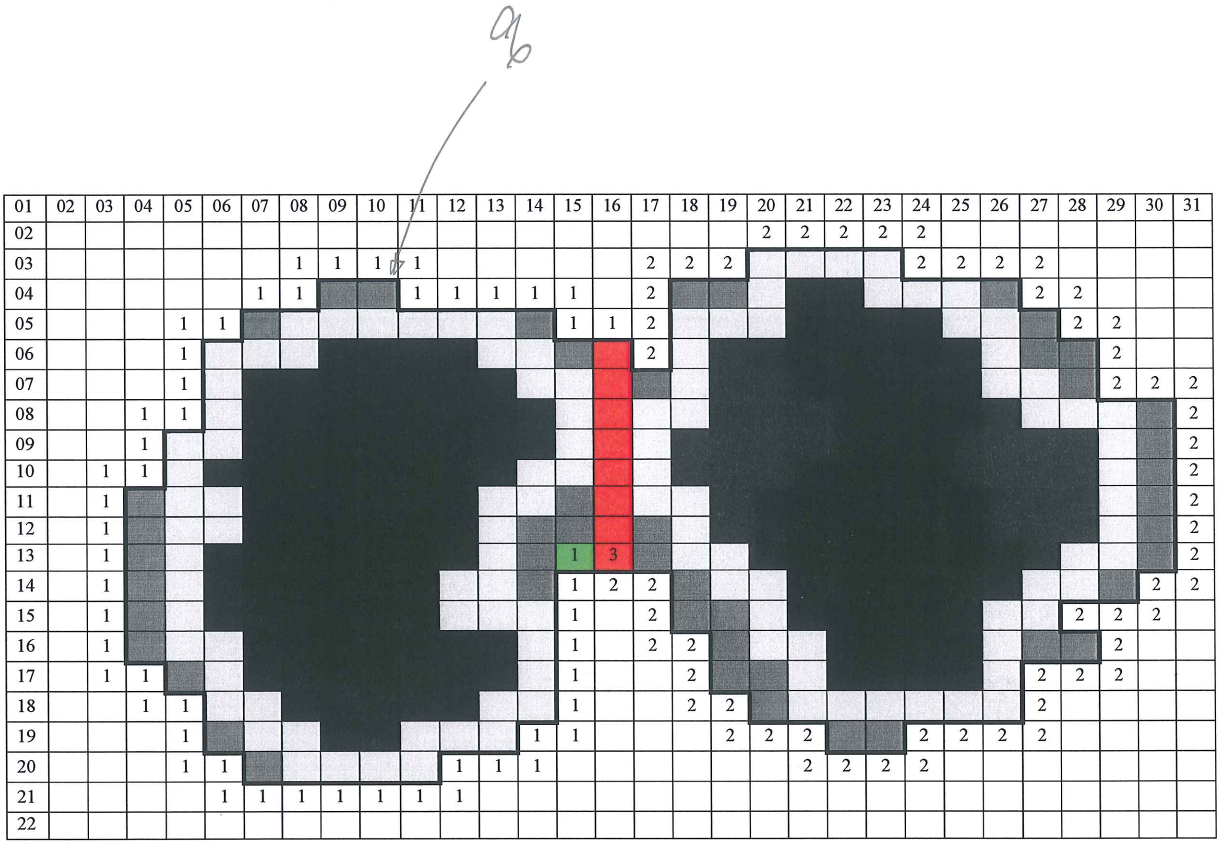
① A should be either region 1 or 2



A is a dam point because it can connect two dilated objects/regions (1 & 2).

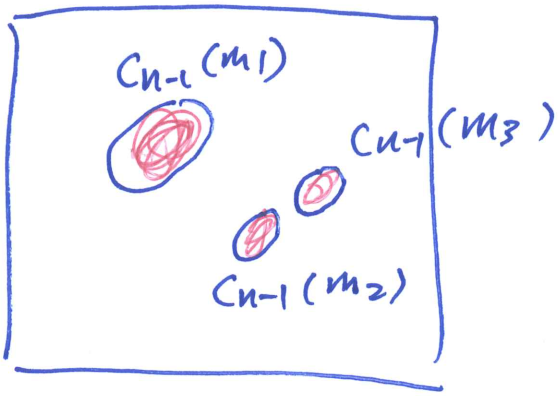
② A is extended from the current dam along dam direction

Existing dam point is not viewed as either region 1 or 2.



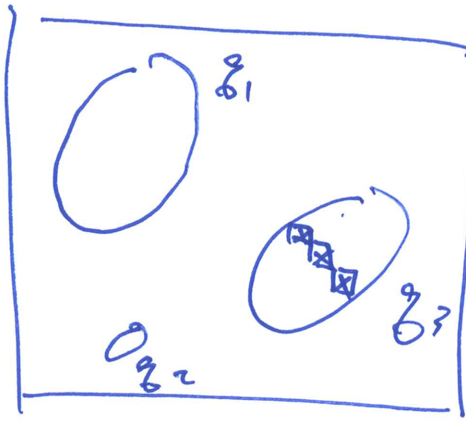
It shows the results after the third dilation. Green boxes represent the extra boxes added after the third dilation and within q. Red boxes represent dam points, which would cause the sets being dilated to merge. After three dilations, dam has been built and there are still two components $C_{n-1}(M_1) \cup C_{n-1}(M_2)$.

$n-1$



$$C[n-1] = C_{n-1}(m_1) \cup C_{n-1}(m_2) \cup C_{n-1}(m_3)$$

n



$$Q[n] = q_1 \cup q_2 \cup q_3$$

$C_n(m_1)$ $\quad$ $C_n(m_4)$

$C_n(m_2) \cup C_n(m_3)$