

Project GPU : Path merge

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① Introduction

Introduction

Keywords

CUDA · Stream · Merging

- We have to finish the code
- Then work on the report
- Finally work on the beamer

Path merged : thread 0

		B[0]	B[1]	B[2]	B[3]	B[4]	B[5]	B[6]
		4	7	8	10	12	13	14
A[0]	1	1	1	1	1	1	1	1
A[1]	2	1	1	1	1	1	1	1
A[2]	5	0	1	1	1	1	1	1
A[3]	6	0	1	1	1	1	1	1
A[4]	6	0	1	1	1	1	1	1
A[5]	9	0	0	0	1	1	1	1
A[6]	11	0	0	0	0	1	1	1
A[7]	15	0	0	0	0	0	0	0
A[8]	16	0	0	0	0	0	0	0

Diagram illustrating a merged path for thread 0. A red vertical line labeled 'y' and a red horizontal line labeled 'x' intersect at the cell (A[0], B[0]). Dashed diagonal lines represent the path of the thread.

1 Calcul de P et K :

Path merged : thread 0

		B[0]	B[1]	B[2]	B[3]	B[4]	B[5]	B[6]
		4	7	8	10	12	13	14
A[0]	1	1	1	1	1	1	1	1
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A[4]	6	0	1	1	1	1	1	1
A[5]	9	0	0	0	1	1	1	1
A[6]	11	0	0	0	0	1	1	1
A[7]	15	0	0	0	0	0	0	0
A[8]	16	0	0	0	0	0	0	0

Diagram illustrating a merged path for thread 0. A red vertical line is drawn between the first column (A indices) and the second column (B indices). A red horizontal line is drawn between the second row (B indices) and the third row (A indices). A red 'X' is placed at the intersection of these lines. A red 'y' is placed at the bottom of the vertical line, and a red 'x' is placed at the right end of the horizontal line. Dashed diagonal lines are drawn across the grid.

1 Calcul de P et K :
→ $P=(0,0)$

Path merged : thread 0

		B[0]	B[1]	B[2]	B[3]	B[4]	B[5]	B[6]
		4	7	8	10	12	13	14
A[0]	1	1	1	1	1	1	1	1
A[1]	2	1	1	1	1	1	1	1
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A[4]	6	0	1	1	1	1	1	1
A[5]	9	0	0	0	1	1	1	1
A[6]	11	0	0	0	0	1	1	1
A[7]	15	0	0	0	0	0	0	0
A[8]	16	0	0	0	0	0	0	0

Diagram illustrating a path merged for thread 0. A red vertical line labeled 'y' and a red horizontal line labeled 'x' intersect at the cell (A[0], B[0]). Dashed diagonal lines represent the path of the thread.

1 Calcul de P et K :
 → $P=(0,0)$
 → $K=(0,0)$

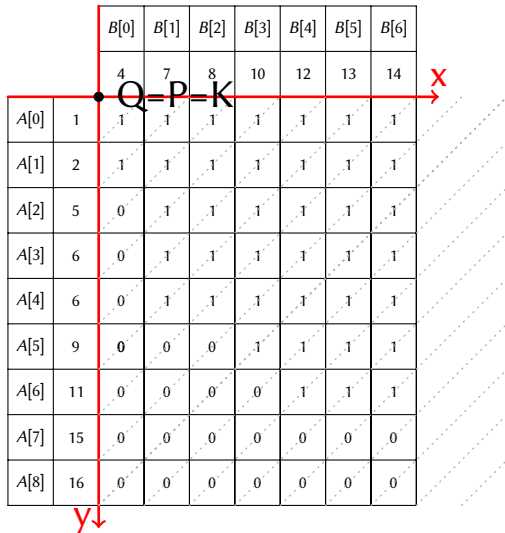
Path merged : thread 0

		B[0]	B[1]	B[2]	B[3]	B[4]	B[5]	B[6]
		4	7	8	10	12	13	14
A[0]	1	1	1	1	1	1	1	1
A[1]	2	1	1	1	1	1	1	1
A[2]	5	0	1	1	1	1	1	1
A[3]	6	0	1	1	1	1	1	1
A[4]	6	0	1	1	1	1	1	1
A[5]	9	0	0	0	1	1	1	1
A[6]	11	0	0	0	0	1	1	1
A[7]	15	0	0	0	0	0	0	0
A[8]	16	0	0	0	0	0	0	0

Diagram illustrating the merged path for thread 0. A red vertical line marks the start of the path at column B[0]. A red horizontal line marks the start of the path at row A[0]. A red 'X' marks the intersection at (A[0], B[0]). Dashed diagonal lines represent the path of the thread.

- 1 Calcul de P et K :
→ $P=(0,0)$
→ $K=(0,0)$
- 2 offset = 0

Path merged : thread 0



1 Calcul de P et K :

→ $P=(0,0)$

→ $K=(0,0)$

2 offset = 0

3 $Q = (0,0)$

Path merged : thread 0



- 1 Calcul de P et K :
→ $P=(0,0)$
→ $K=(0,0)$
- 2 offset = 0
- 3 $Q = (0,0)$
- 4 $A[Q_y] < B[Q_x]$

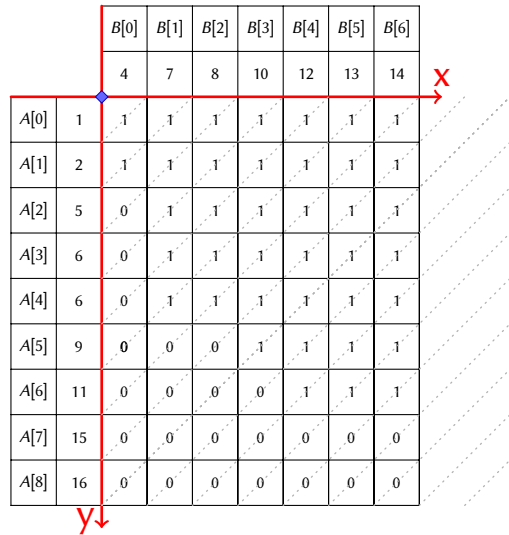
Path merged : thread 0

		B[0]	B[1]	B[2]	B[3]	B[4]	B[5]	B[6]
		4	7	8	10	12	13	14
A[0]	1	1	1	1	1	1	1	1
A[1]	2	1	1	1	1	1	1	1
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A[6]	11	0	0	0	0	1	1	1
A[7]	15	0	0	0	0	0	0	0
A[8]	16	0	0	0	0	0	0	0

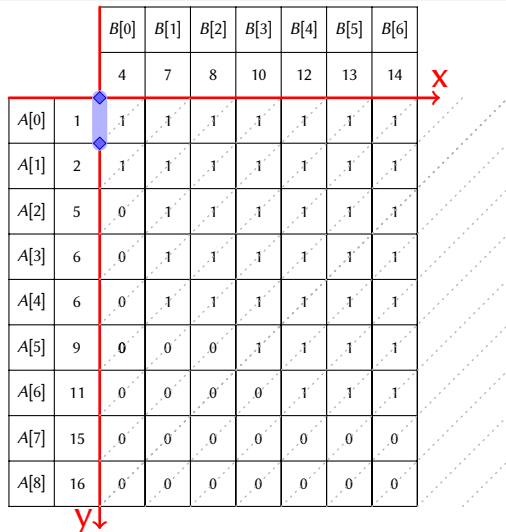
Diagram showing a path merged for thread 0. A red dot marks the starting point at A[0][0]. A red arrow labeled 'X' points right from the dot, and a red arrow labeled 'Y' points down from the dot. The path is labeled 'Q=P=K'.

- 1 Calcul de P et K :
→ $P=(0,0)$
→ $K=(0,0)$
- 2 offset = 0
- 3 $Q = (0,0)$
- 4 $A[Q_y] < B[Q_x]$
- 5 $M[i] = A[Q_y]$

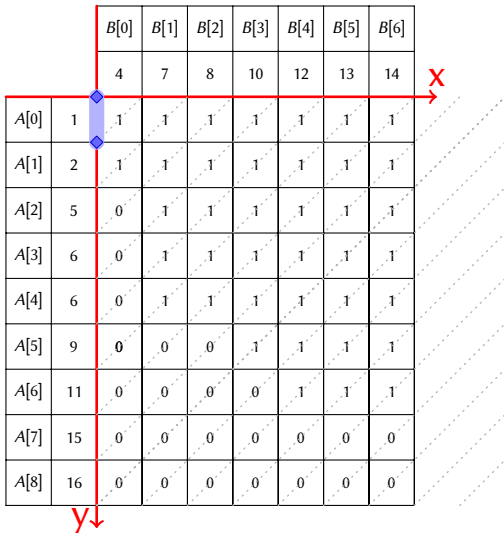
Path merged : thread 0,path



Path merged : thread 0,path

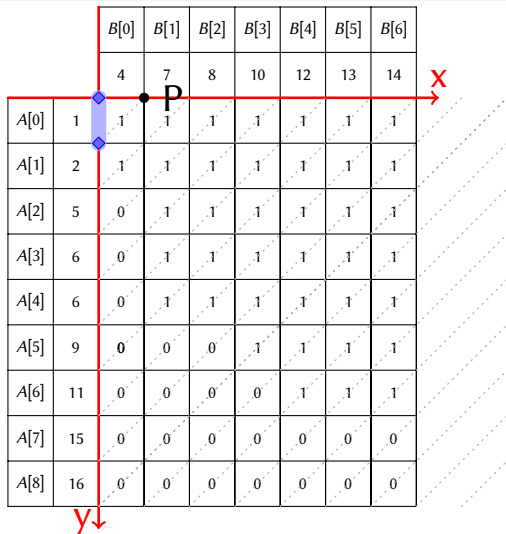


Path merged : thread 1



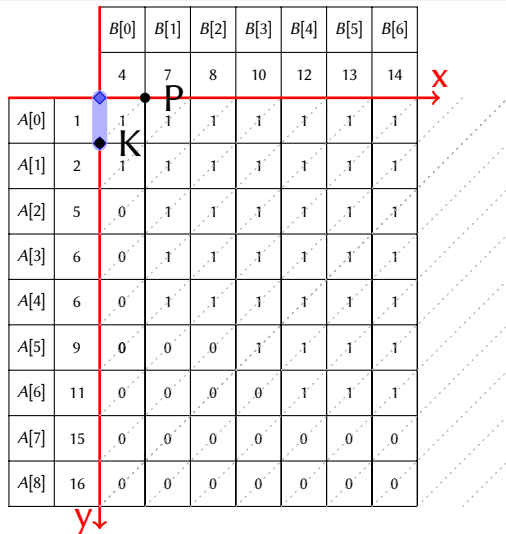
1 Calcul de P et K :

Path merged : thread 1



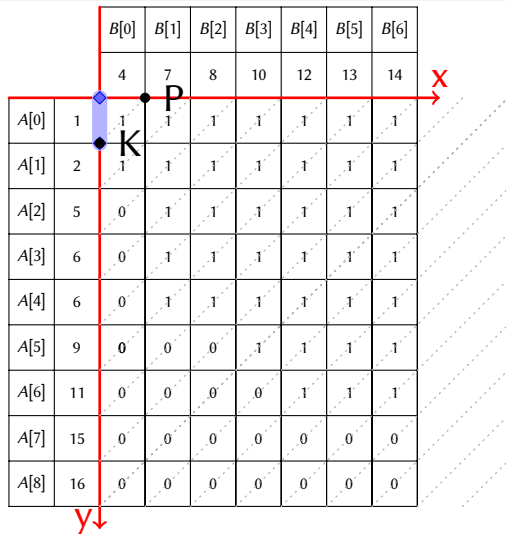
1 Calcul de P et K :
→ $P=(1,0)$

Path merged : thread 1



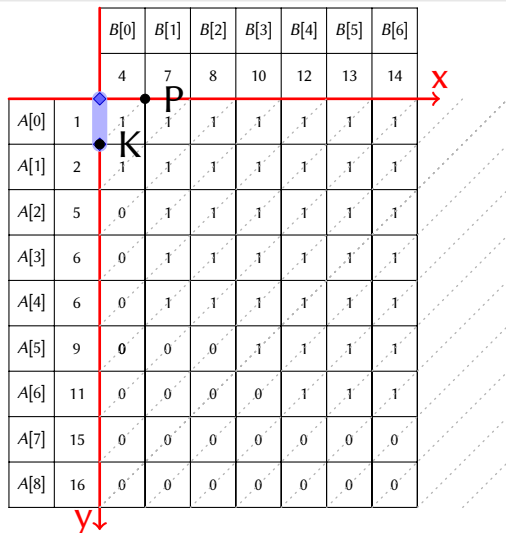
- 1 Calcul de P et K :
→ $P=(1,0)$
→ $K=(0,1)$

Path merged : thread 1



- 1 Calcul de P et K :
→ $P=(1,0)$
→ $K=(0,1)$
- 2 offset = 0

Path merged : thread 1



1 Calcul de P et K :

→ $P=(1,0)$

→ $K=(0,1)$

2 offset = 0

3 $Q = (0,1)$

Path merged : thread 1



1 Calcul de P et K :

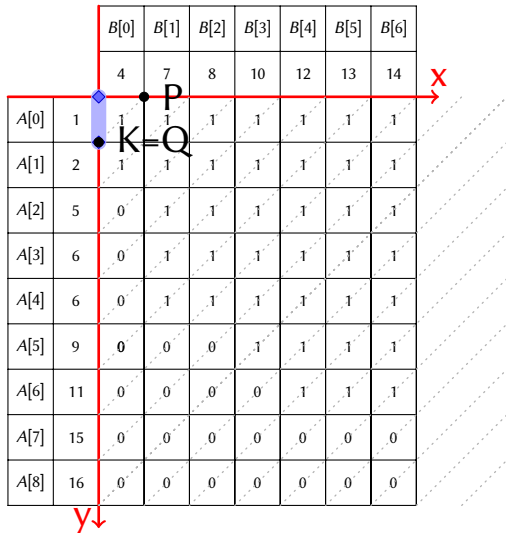
→ $P=(1,0)$

→ $K=(0,1)$

2 offset = 0

3 $Q = (0,1)$

Path merged : thread 1



1 Calcul de P et K :

→ $P=(1,0)$

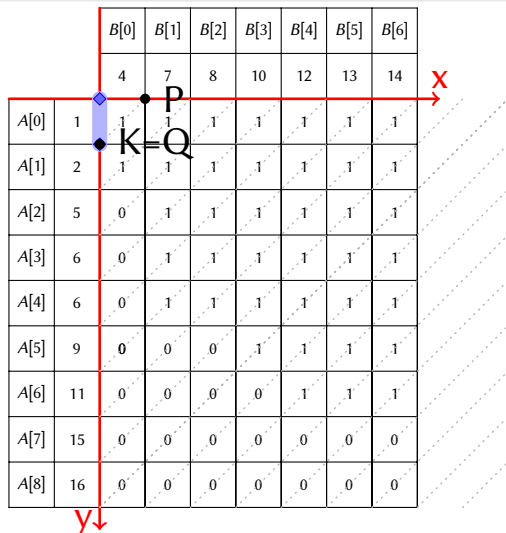
→ $K=(0,1)$

2 offset = 0

3 $Q = (0,1)$

4 $A[Q_y] < B[Q_x]$

Path merged : thread 1



1 Calcul de P et K :

→ $P=(1,0)$

→ $K=(0,1)$

2 offset = 0

3 $Q = (0,1)$

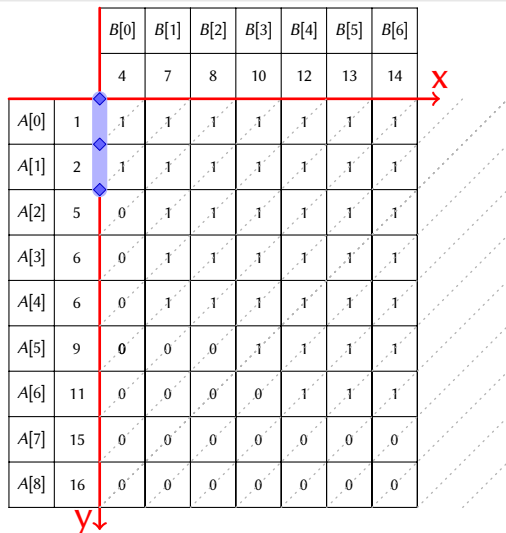
4 $A[Q_y] < B[Q_x]$

5 $M[i] = A[Q_y]$

Path merged : thread 1, path



Path merged : thread 1, path

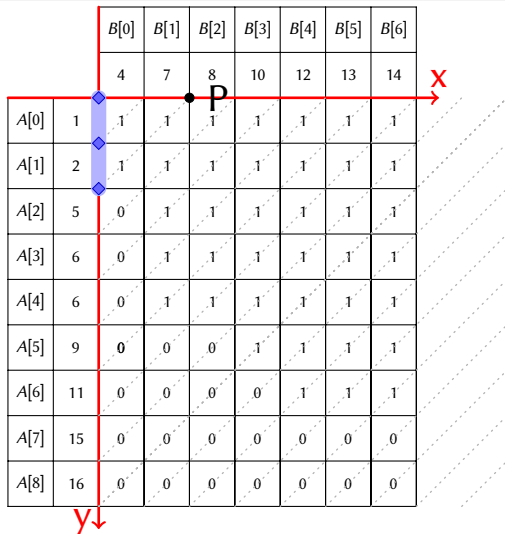


Path merged : thread 2



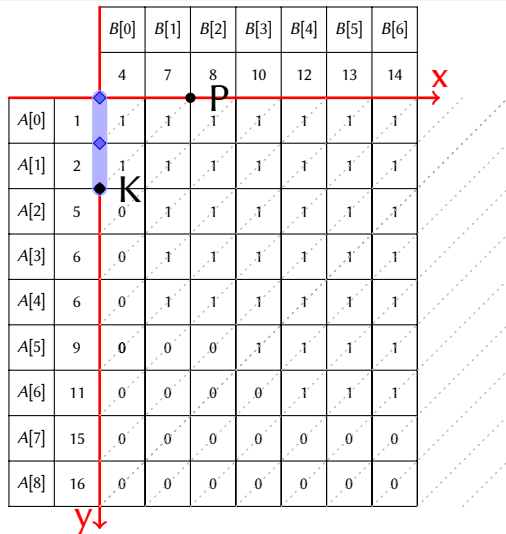
1 Calcul de P et K :

Path merged : thread 2



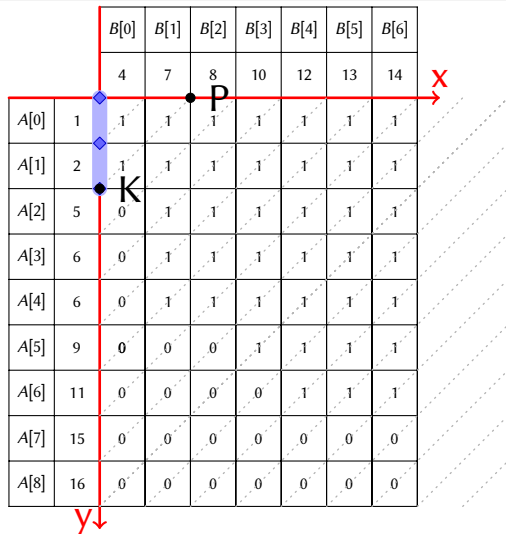
1 Calcul de P et K :
→ $P=(2,0)$

Path merged : thread 2



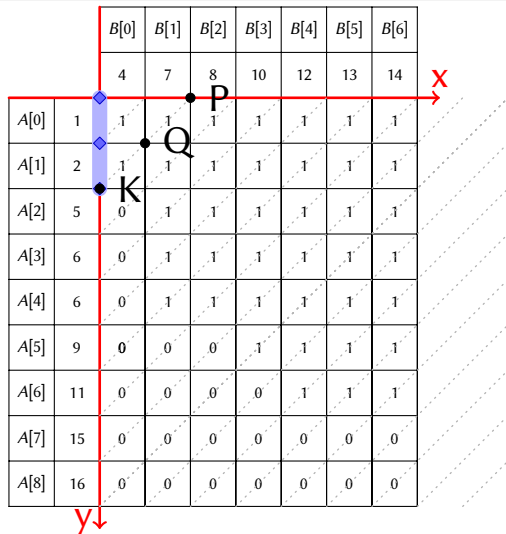
- Calcul de P et K :
 $\rightarrow P=(2,0)$
 $\rightarrow K=(0,2)$

Path merged : thread 2



- 1 Calcul de P et K :
→ $P=(2,0)$
→ $K=(0,2)$
- 2 offset = 1

Path merged : thread 2



1 Calcul de P et K :

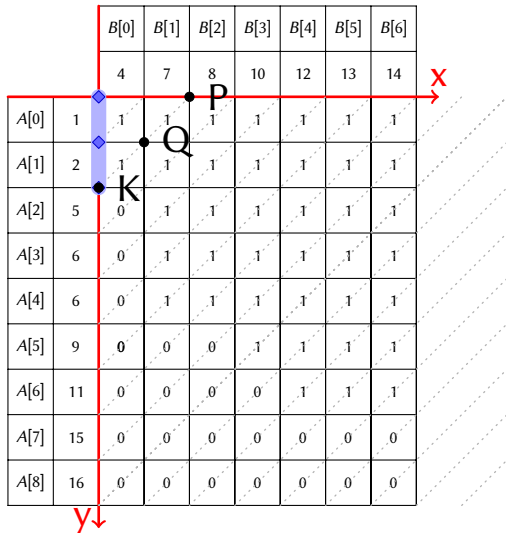
→ $P=(2,0)$

→ $K=(0,2)$

2 offset = 1

3 $Q = (1,1)$

Path merged : thread 2



1 Calcul de P et K :

→ $P=(2,0)$

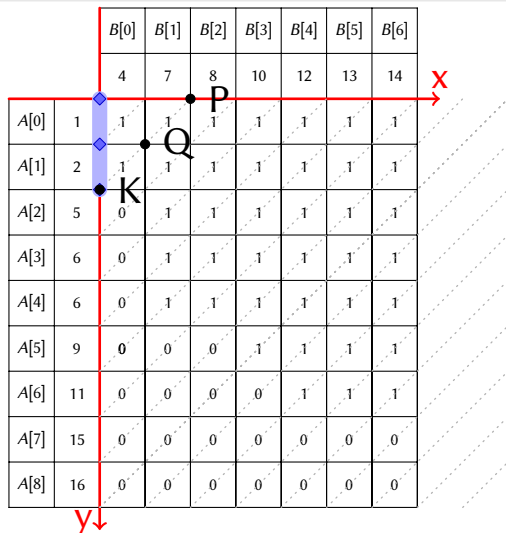
→ $K=(0,2)$

2 offset = 1

3 $Q = (1,1)$

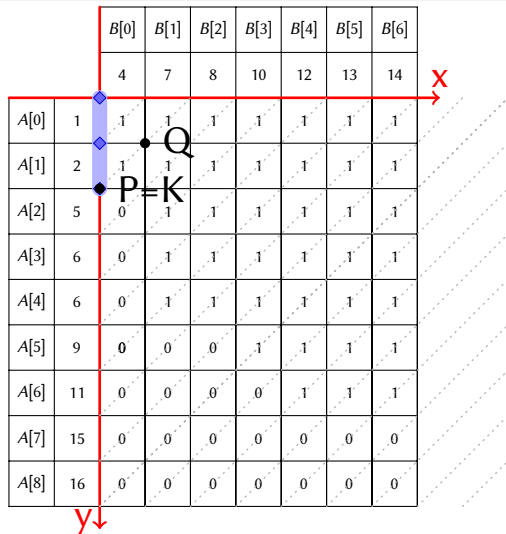
4 $P = (Q_x-1, Q_y+1)=(0,2)$

Path merged : thread 2



- 1 Calcul de P et K :
→ $P=(2,0)$
→ $K=(0,2)$
- 2 offset = 1
- 3 $Q = (1,1)$
- 4 $P = (Q_x-1, Q_y+1)=(0,2)$

Path merged : thread 2



1 Calcul de P et K :

→ $P=(2,0)$

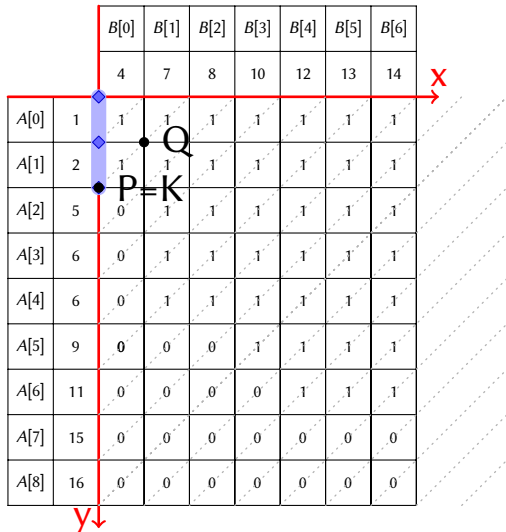
→ $K=(0,2)$

2 offset = 1

3 $Q = (1,1)$

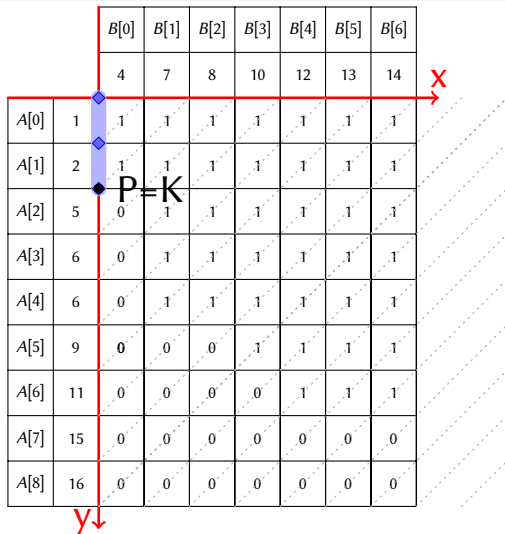
4 $P = (Q_x-1, Q_y+1)=(0,2)$

Path merged : thread 2



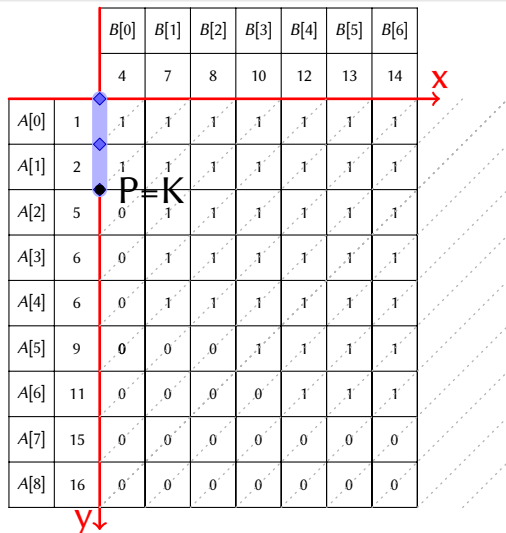
- 1 Calcul de P et K :
 $\rightarrow P=(2,0)$
 $\rightarrow K=(0,2)$
- 2 offset = 1
- 3 $Q = (1,1)$
- 4 $P = (Q_x-1, Q_y+1)=(0,2)$
- 5 On recommence

Path merged : thread 2



$P=K=(0,2)$
6 offset = 0

Path merged : thread 2

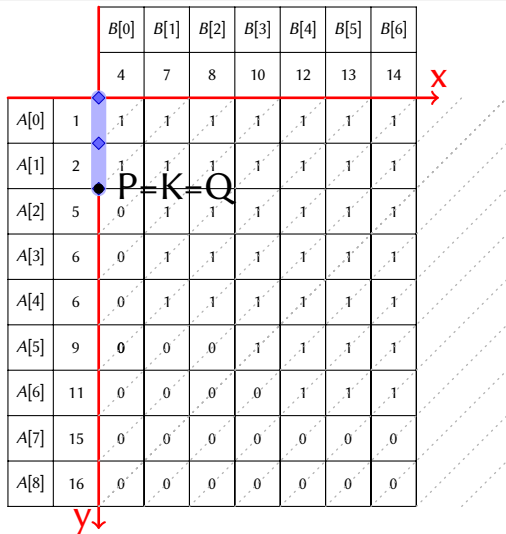


$P=K=(0,2)$

6 offset = 0

7 $Q = (0,2)$

Path merged : thread 2



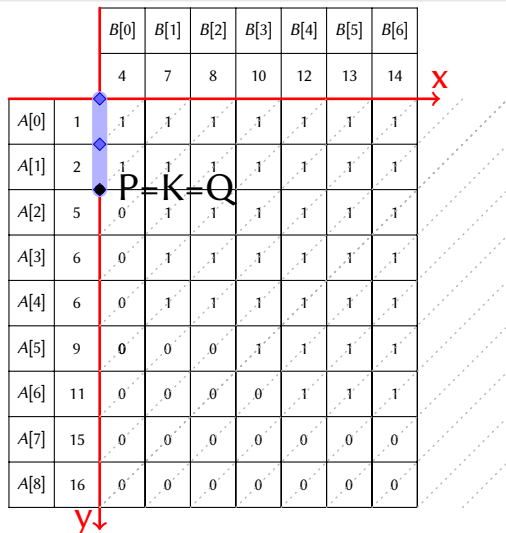
$$P=K=(0,2)$$

$$6 \text{ offset} = 0$$

$$7 \text{ } Q = (0,2)$$

$$8 \text{ } A[Q_y] > B[Q_x]$$

Path merged : thread 2



$$P=K=(0,2)$$

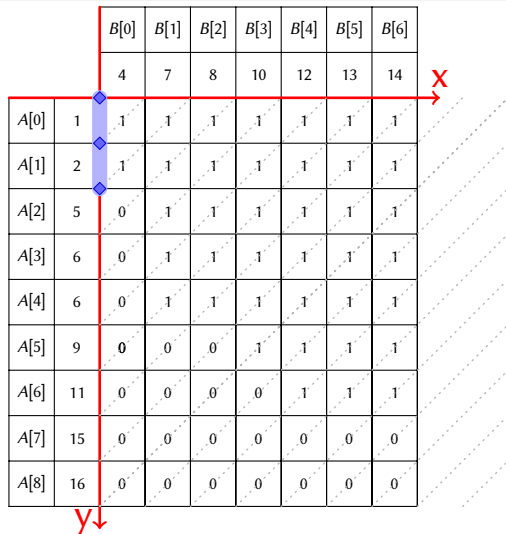
$$6 \text{ offset} = 0$$

$$7 \text{ } Q = (0,2)$$

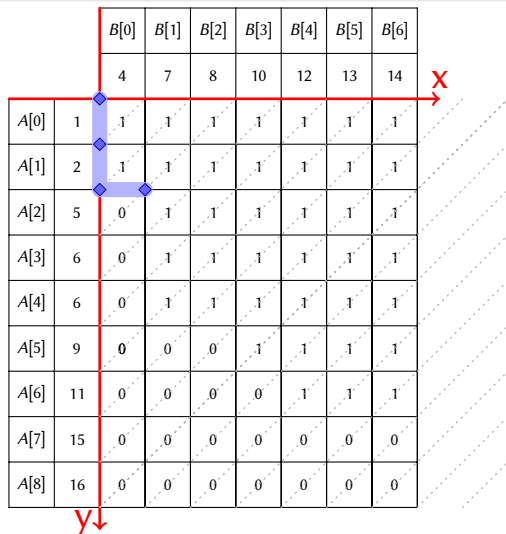
$$8 \text{ } A[Q_y] > B[Q_x]$$

$$9 \text{ } M[i] = B[Q_x]$$

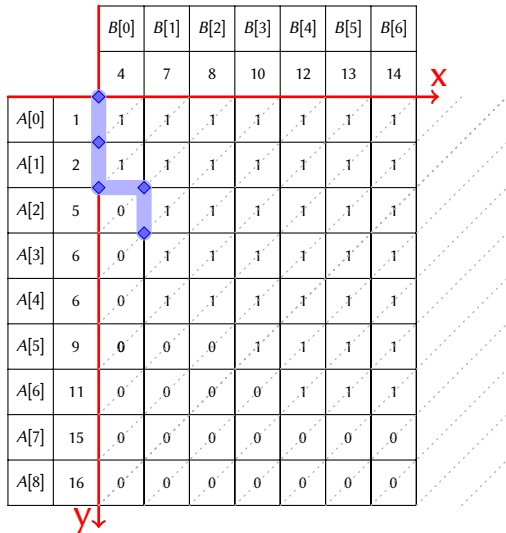
Path merged : thread 2, path



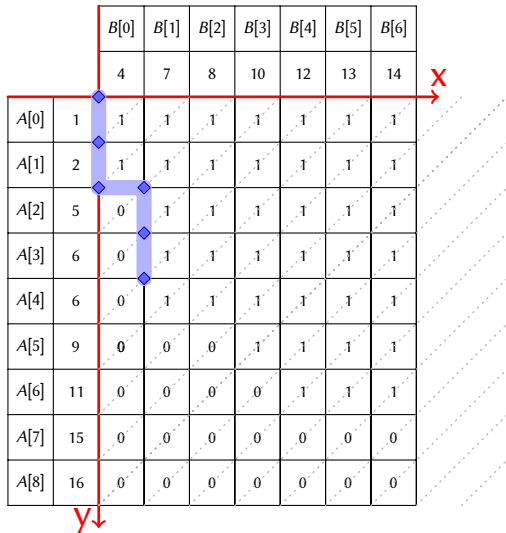
Path merged : thread 2, path



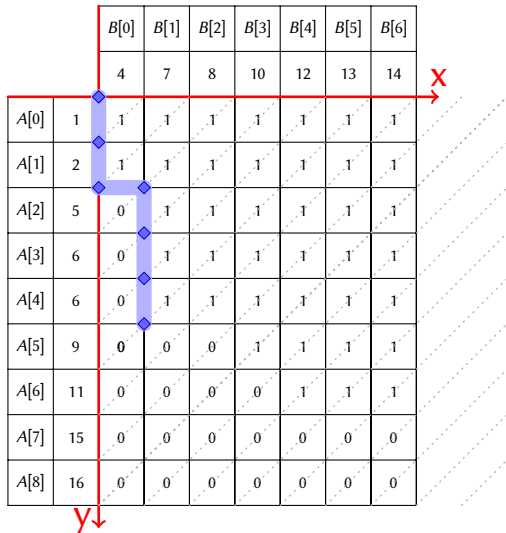
Skipping to thread 9



Skipping to thread 9



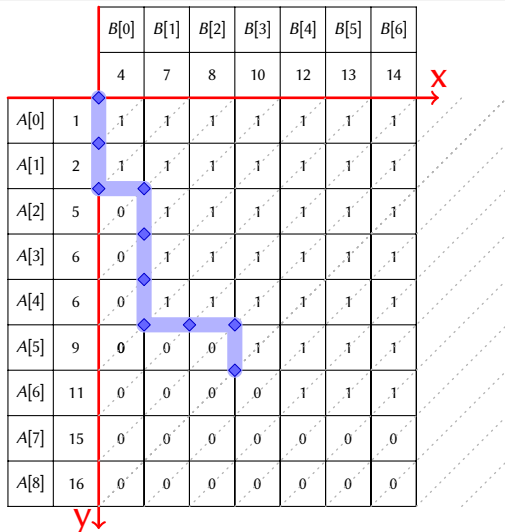
Skipping to thread 9



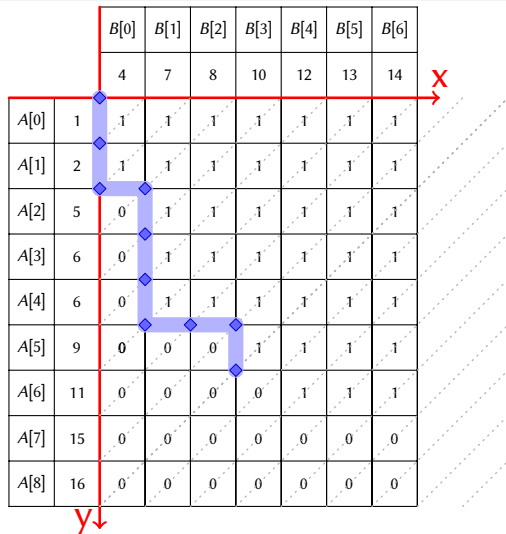
Skipping to thread 9

		B[0]	B[1]	B[2]	B[3]	B[4]	B[5]	B[6]
		4	7	8	10	12	13	14
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A[2]	5	0	1	1	1	1	1	1
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Skipping to thread 9

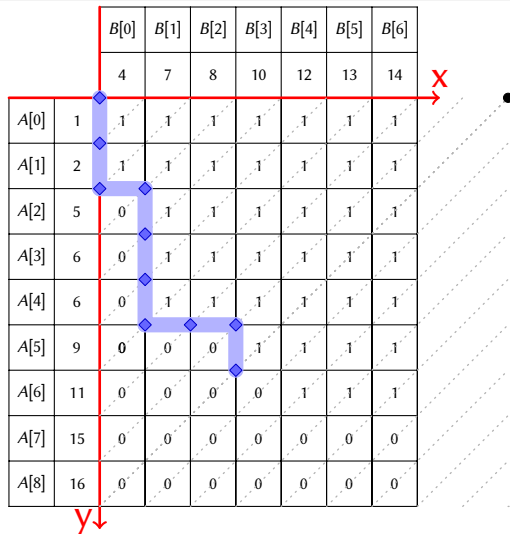


Path merged : thread 9



1 Calcul de P et K :

Path merged : thread 9



• P

1 Calcul de P et K :
→ P=(9,0)

Diagram illustrating a memory access pattern on a 2D array A (rows $A[0]$ to $A[8]$, columns $B[0]$ to $B[6]$). The array contains values, and a blue path of diamonds indicates the sequence of memory accesses. The path starts at $A[0][0]$ and proceeds vertically down to $A[7][0]$, then horizontally right to $A[7][4]$, and finally vertically down to $A[7][7]$. A red 'X' marks the starting point, and a red 'y' marks the ending point. A black dot and 'P' are at the top right, and a black dot and 'K' are at the bottom left.

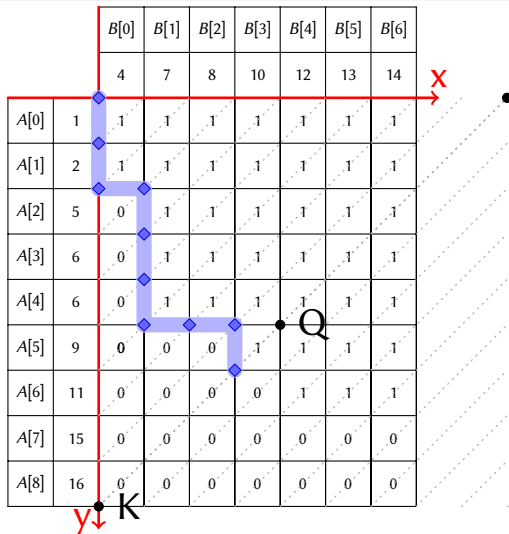
1 Calcul de P et K :

- $P=(9,0)$
- $K=(0,9)$

[illegible]

- 1 Calcul de P et K :
 - $P=(9,0)$
 - $K=(0,9)$
- 2 offset = 3

Path merged : thread 9



• P

1 Calcul de P et K :

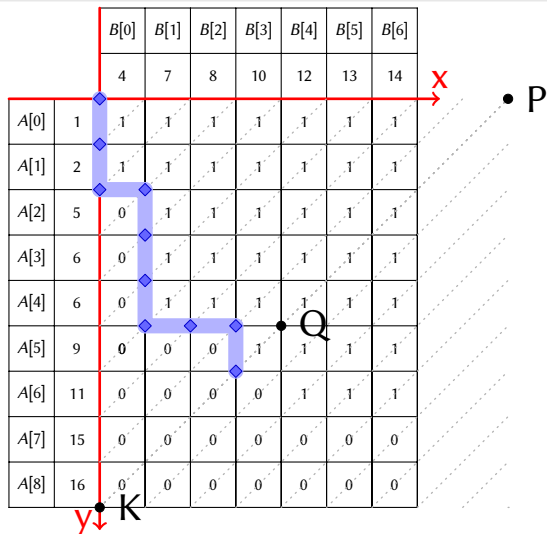
→ $P=(9,0)$

→ $K=(0,9)$

2 offset = 3

3 $Q = (5,4)$

Path merged : thread 9

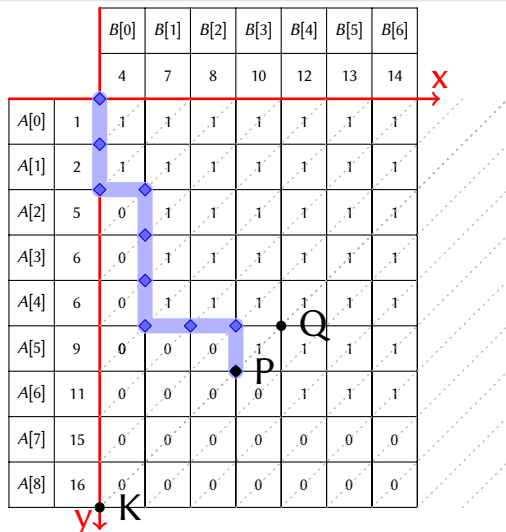


- 1 Calcul de P et K :
→ $P=(9,0)$
→ $K=(0,9)$
- 2 offset = 3
- 3 $Q = (5,4)$
- 4 $P = (Q_x-1, Q_y+1)=(4,5)$

[illegible]

- 1 Calcul de P et K :
→ $P=(9,0)$
→ $K=(0,9)$
- 2 offset = 3
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Path merged : thread 9



1 Calcul de P et K :

→ $P=(9,0)$

→ $K=(0,9)$

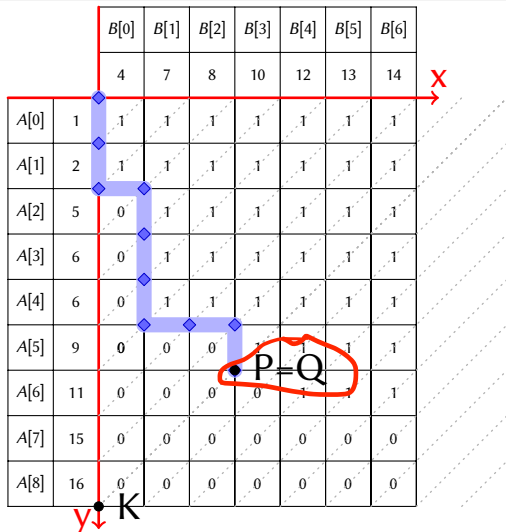
2 offset = 3

3 $Q = (5,4)$

4 $P = (Q_x-1, Q_y+1)=(4,5)$

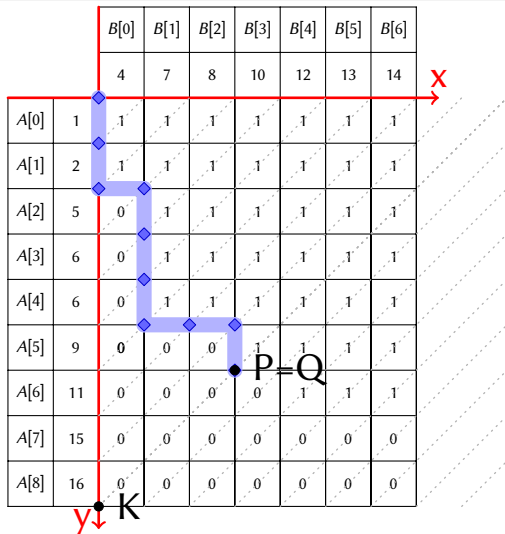
5 $Q = P =(4,5)$

Path merged : thread 9



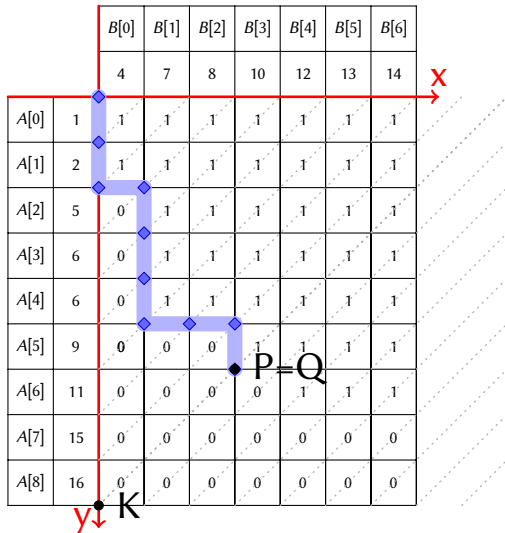
- 1 Calcul de P et K :
→ $P=(9,0)$
→ $K=(0,9)$
- 2 offset = 3
- 3 $Q = (5,4)$
- 4 $P = (Q_x-1, Q_y+1)=(4,5)$
- 5 $Q = P =(4,5)$

Path merged : thread 9



7 $A[Q_y > B[Q_x]$

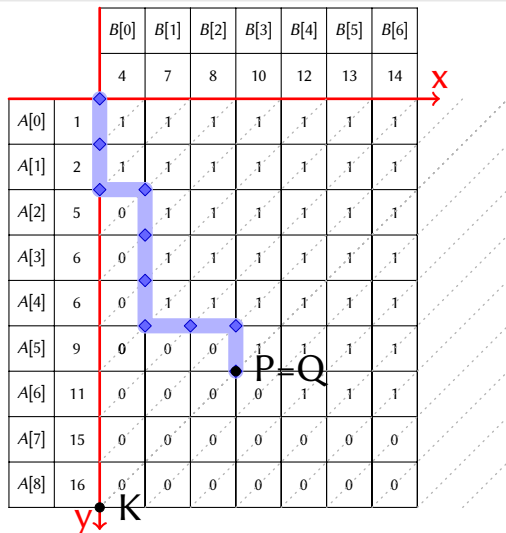
Path merged : thread 9



7 $A[Q_y > B[Q_x]$

8 $M[9] = B[Q_x]$

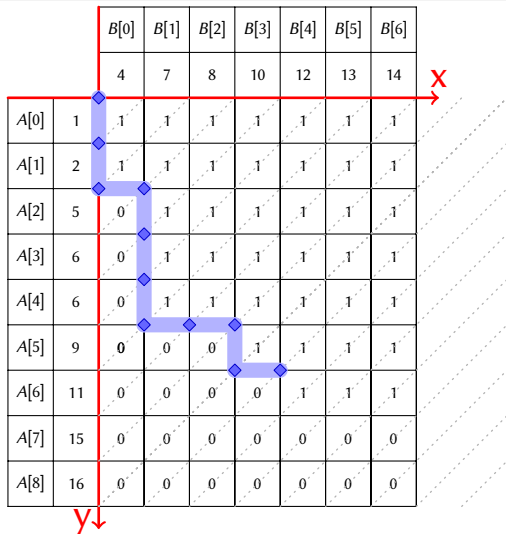
Path merged : thread 9



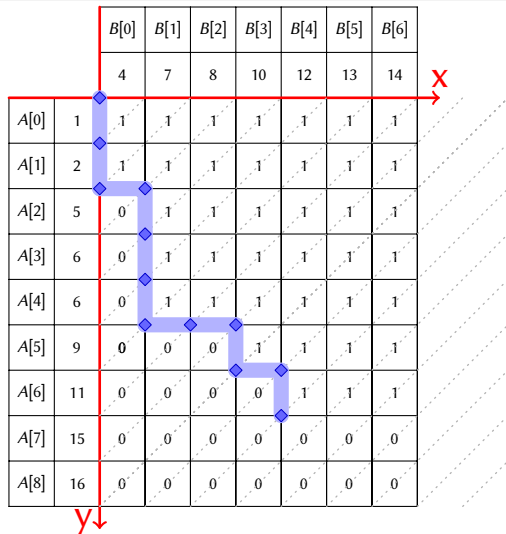
7 $A[Q_y > B[Q_x]$

8 $M[9] = B[Q_x]$

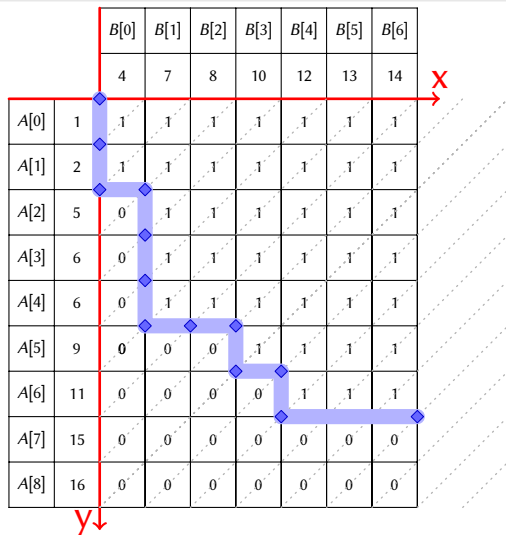
Path merged : thread 9, path



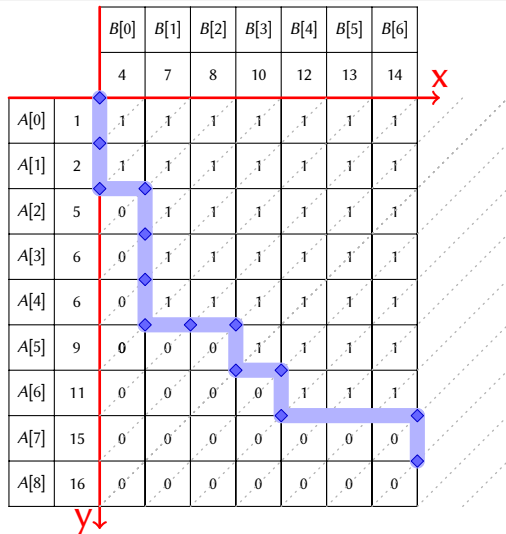
Path merged : thread 9, path



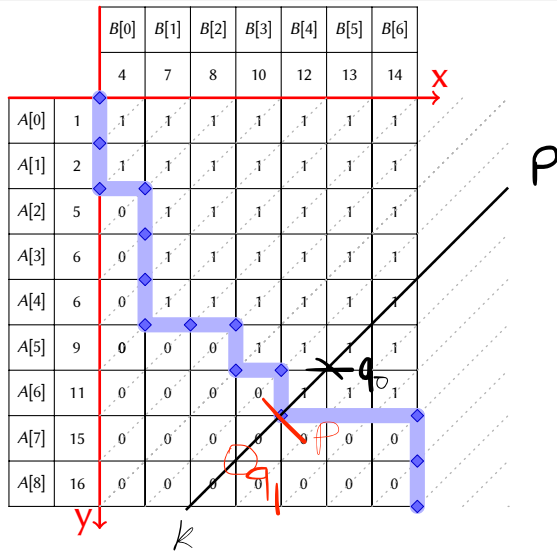
Path merged : thread 9, path



Path merged : thread 9, path



Path merged : thread 9, path



Path merged : thread 9, path

