

Space and Write Overhead Are Inversely Proportional in Flash Memory

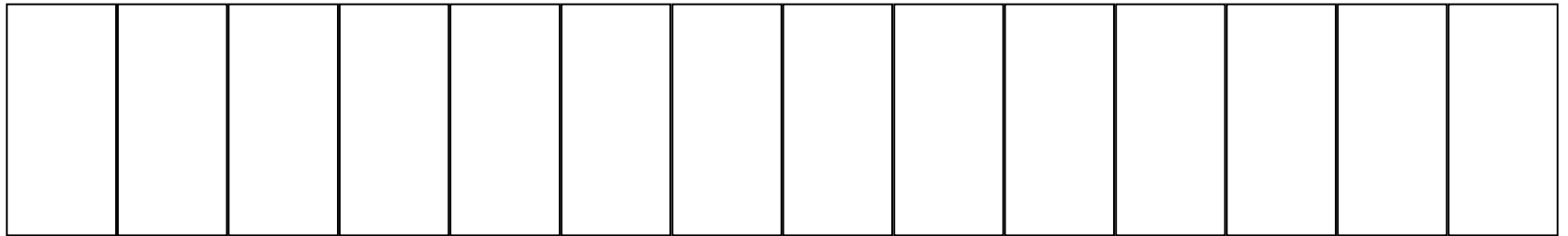


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Motivation

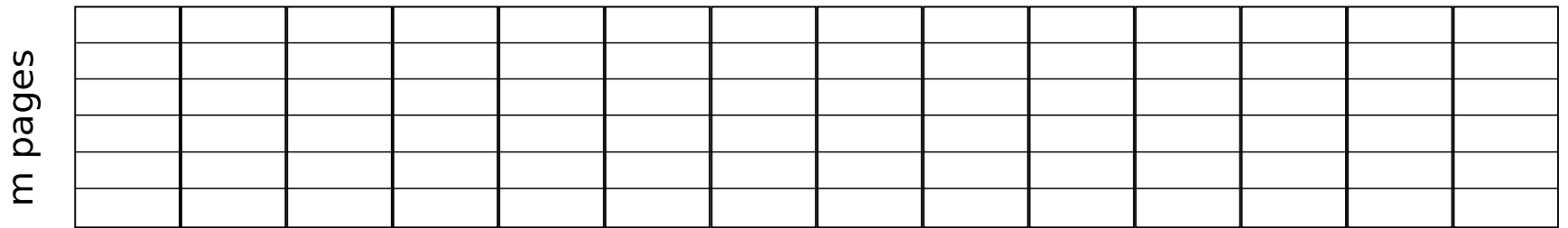


Motivation



n blocks

Motivation



n blocks

Block

Free
Valid
Invalid

Block



A 6x2 grid of cells, all of which are filled with a bright green color. The grid has a black border around the entire structure and individual black borders between the rows and columns.

Free
Valid
Invalid

A vertical stack of three colored boxes with black borders. The top box is green and contains the word "Free" in white text. The middle box is blue and contains the word "Valid" in white text. The bottom box is red and contains the word "Invalid" in white text.

Block

systor.tex

Free
Valid
Invalid

Block



systor.tex	

Free
Valid
Invalid

Block

systor.tex

systor.tex	

Free
Valid
Invalid

Block

systor.tex

Blue	Green
Red	Green
Blue	Green
Green	Green
Green	Green
Green	Green

Free
Valid
Invalid

Block



systor.tex	

Free
Valid
Invalid

Block



Blue	Red
Red	Blue
Blue	Red
Red	Red
Blue	systor.tex
Red	Free

Free
Valid
Invalid

Block

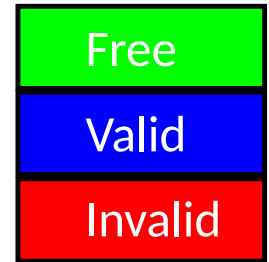
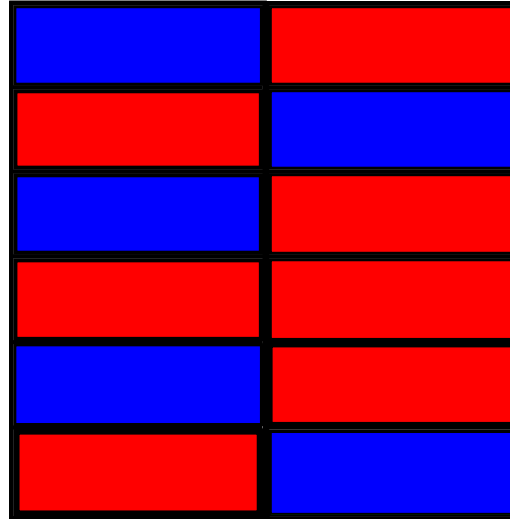
systor.tex

Blue	Red
Red	Blue
Blue	Red
Red	Red
Blue	systor.tex
Red	Blue

Free
Valid
Invalid

Block

systor.tex



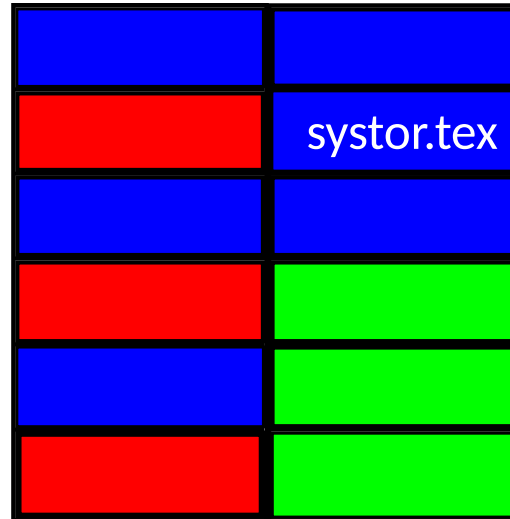
Block



	systor.tex

Free
Valid
Invalid

Write Overhead



- Write Overhead ω
- $15 / 13 - 1 = 0.154$

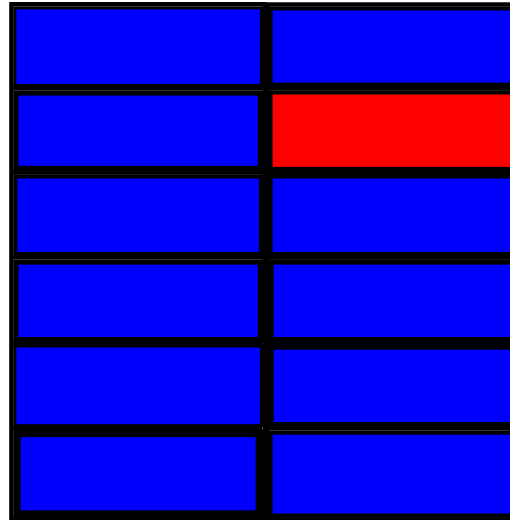
Space Overhead

systor.tex

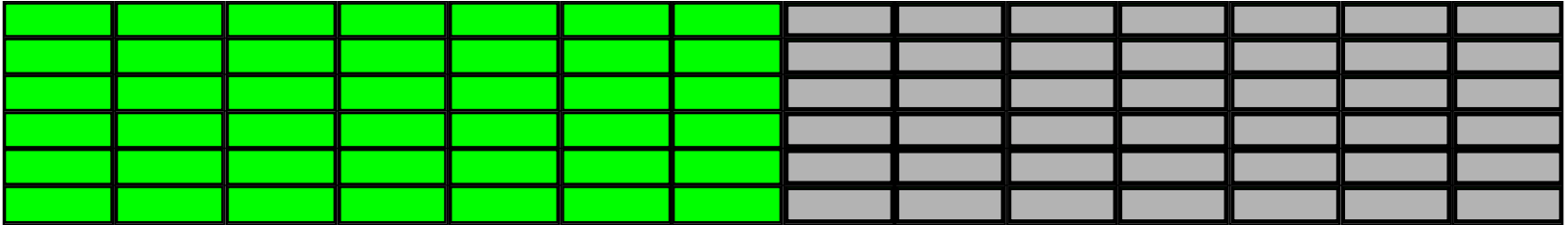
	systor.tex

Space Overhead

systor.tex



Space Overhead



- Space Overhead σ
- $14 / 7 - 1 = 1$

Result

- Space Overhead σ
- Write Overhead ω

$$\sigma \cdot \omega \geq 1$$

- A tight bound

Cycling Algorithm

Blue	Blue	Blue	Blue	Blue	Blue	Blue	Red	Blue	Blue	Blue	Blue	Blue	Blue
Red	Red	Red	Blue	Blue	Blue	Red	Red	Red	Red	Red	Red	Red	Blue
Red	Red	Red	Red	Red	Blue	Red	Red	Red	Blue	Red	Blue	Blue	Blue
Red	Blue	Blue	Red	Red	Red	Red	Red	Red	Blue	Red	Red	Blue	Blue
Red	Red	Red	Blue	Red	Red	Blue	Red	Red	Red	Red	Red	Blue	Blue
Red	Blue	Blue	Blue	Blue	Blue	Blue	Red	Blue	Blue	Blue	Blue	Blue	Green

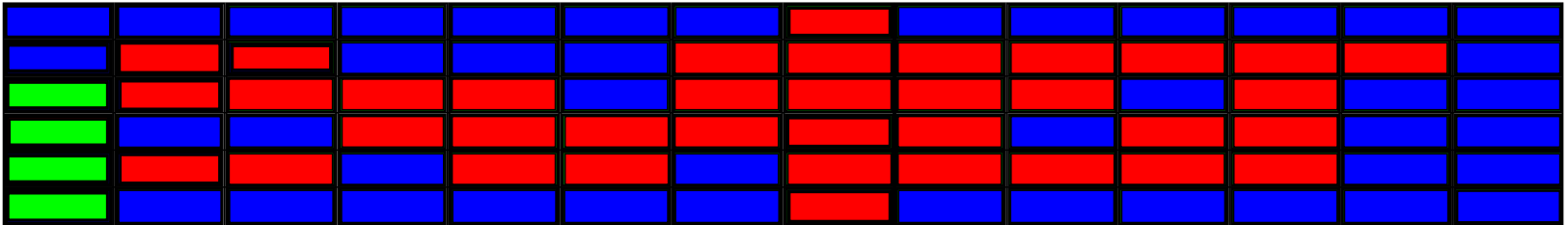
Cycling Algorithm

Blue	Blue	Blue	Blue	Blue	Blue	Blue	Red	Blue	Blue	Blue	Blue	Blue	Blue
Red	Red	Red	Blue	Blue	Blue	Red	Red	Red	Red	Red	Red	Red	Blue
Red	Red	Red	Red	Red	Blue	Red	Red	Red	Red	Blue	Red	Blue	Blue
Red	Blue	Blue	Red	Red	Red	Red	Red	Red	Blue	Red	Red	Blue	Blue
Red	Red	Red	Blue	Red	Red	Blue	Red	Red	Red	Red	Red	Blue	Blue
Red	Blue	Blue	Blue	Blue	Blue	Blue	Red	Blue	Blue	Blue	Blue	Blue	Blue

Cycling Algorithm

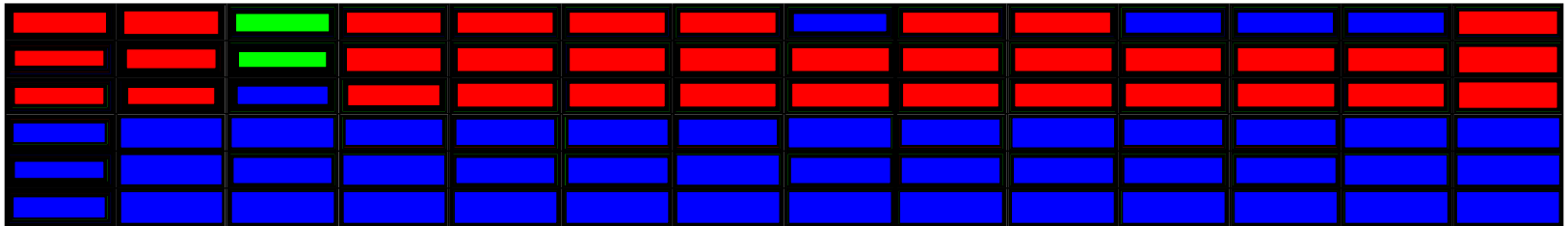
Blue	Blue	Blue	Blue	Blue	Blue	Blue	Red	Blue	Blue	Blue	Blue	Blue	Blue
Blue	Red	Red	Blue	Blue	Blue	Red	Red	Red	Red	Red	Red	Red	Blue
Green	Red	Red	Red	Red	Blue	Red	Red	Red	Blue	Red	Blue	Blue	Blue
Green	Blue	Blue	Red	Red	Red	Red	Red	Red	Blue	Red	Red	Blue	Blue
Green	Red	Red	Blue	Red	Red	Blue	Red	Red	Red	Red	Red	Blue	Blue
Green	Blue	Blue	Blue	Blue	Blue	Blue	Red	Blue	Blue	Blue	Blue	Blue	Blue

Cycling Algorithm



$$\sigma \cdot \omega \leq 1$$

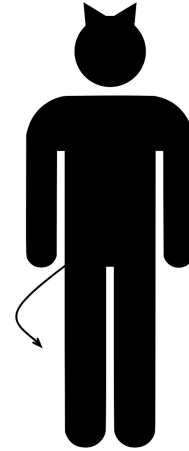
Lower Bound



$$\sigma \cdot \omega \geq 1$$

Conclusion

$$\sigma \cdot \omega \geq 1$$



- The user should not be your adversary.