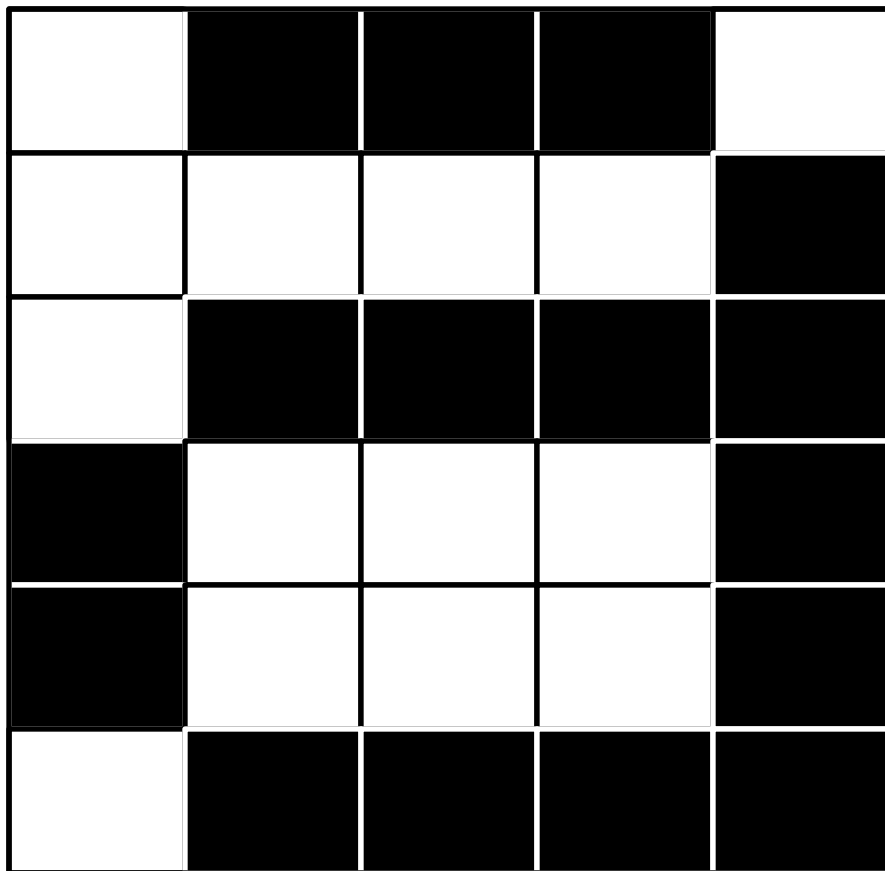


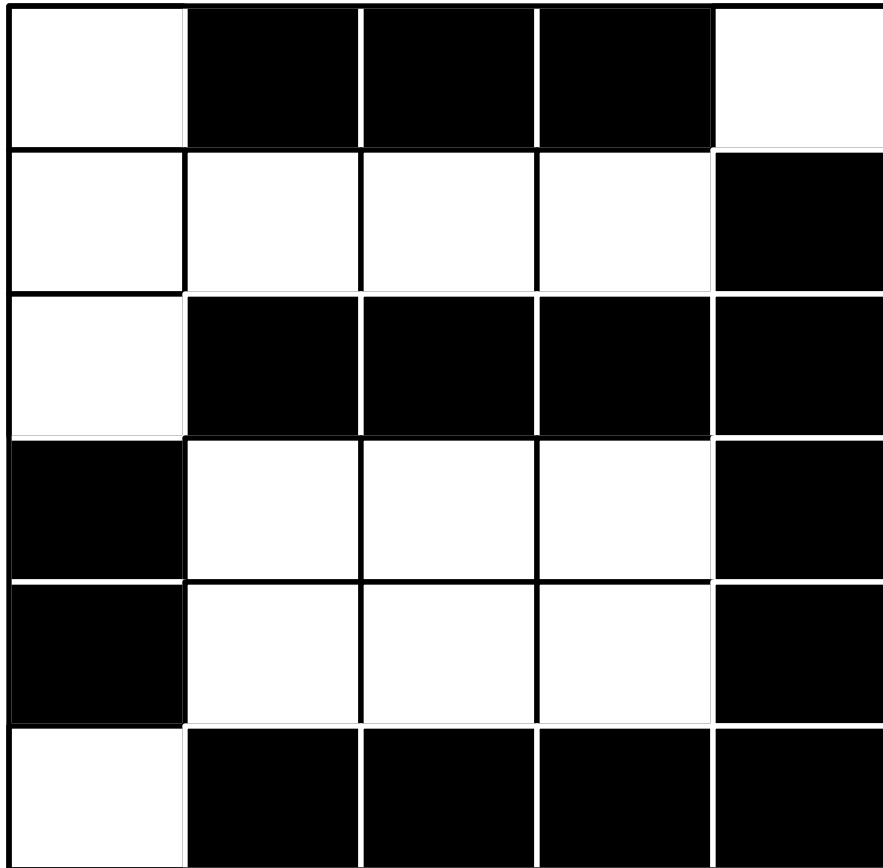
COMPUTER SCIENCE  
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Image Representation



# COMPUTER SCIENCE *Unplugged*

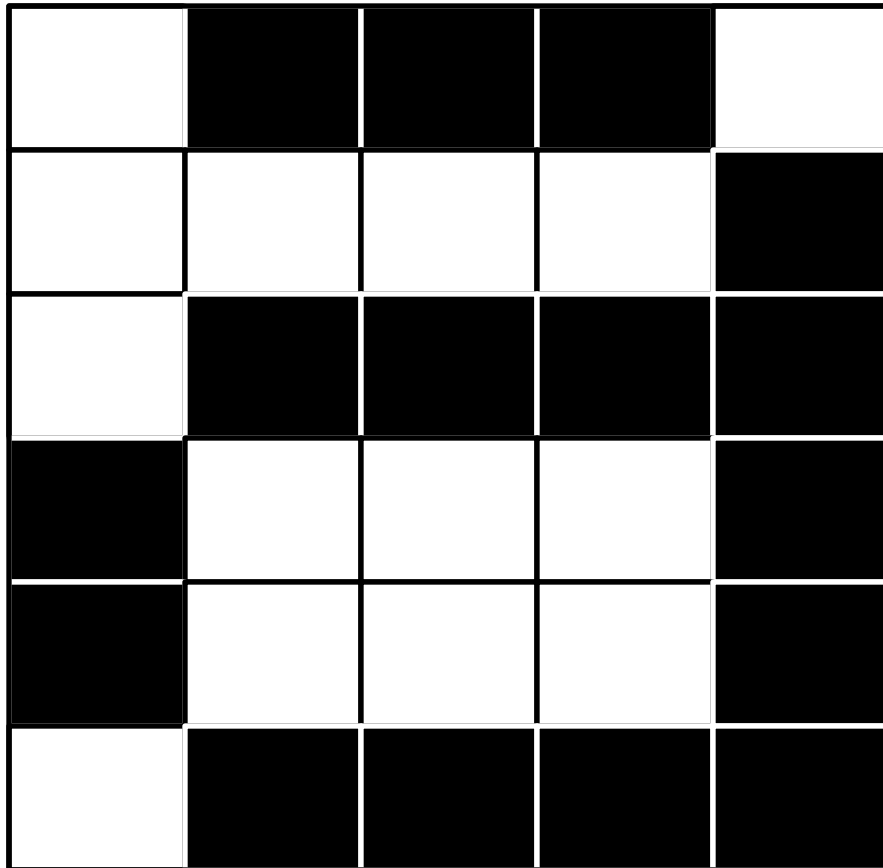
## Image Representation



- Do you know how the computer screen displays images?

# COMPUTER SCIENCE *Unplugged*

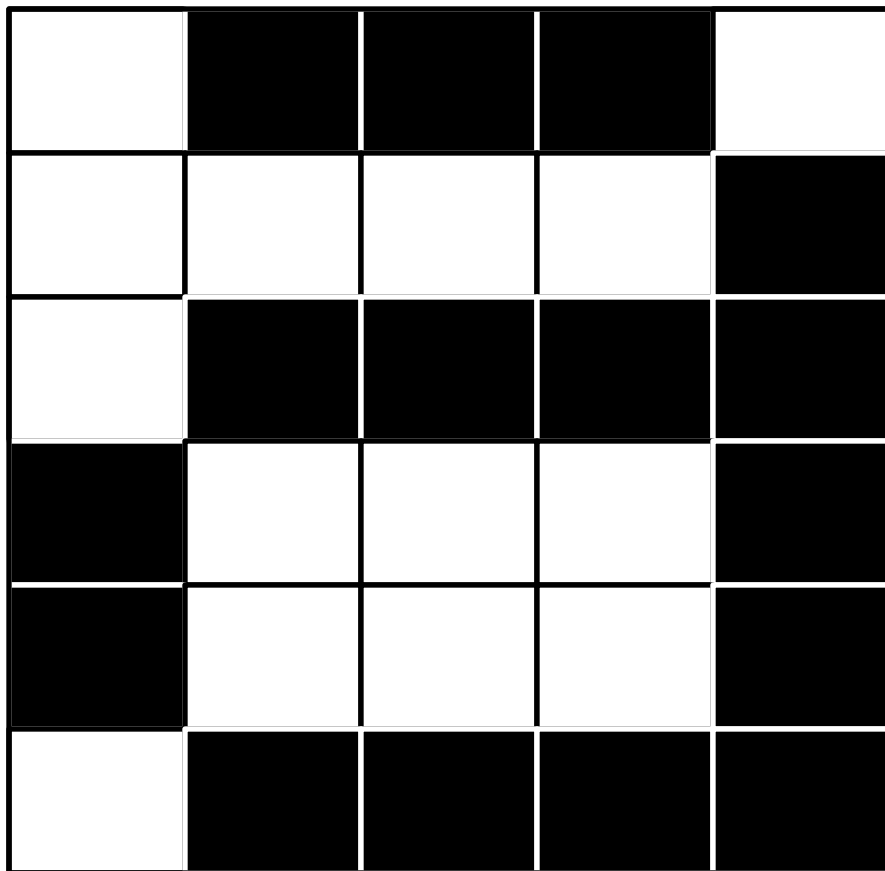
## Image Representation



- Do you know how the computer screen displays images?
  - Computer screens are divided up into a grid of small dots called picture elements or pixels.

# COMPUTER SCIENCE *Unplugged*

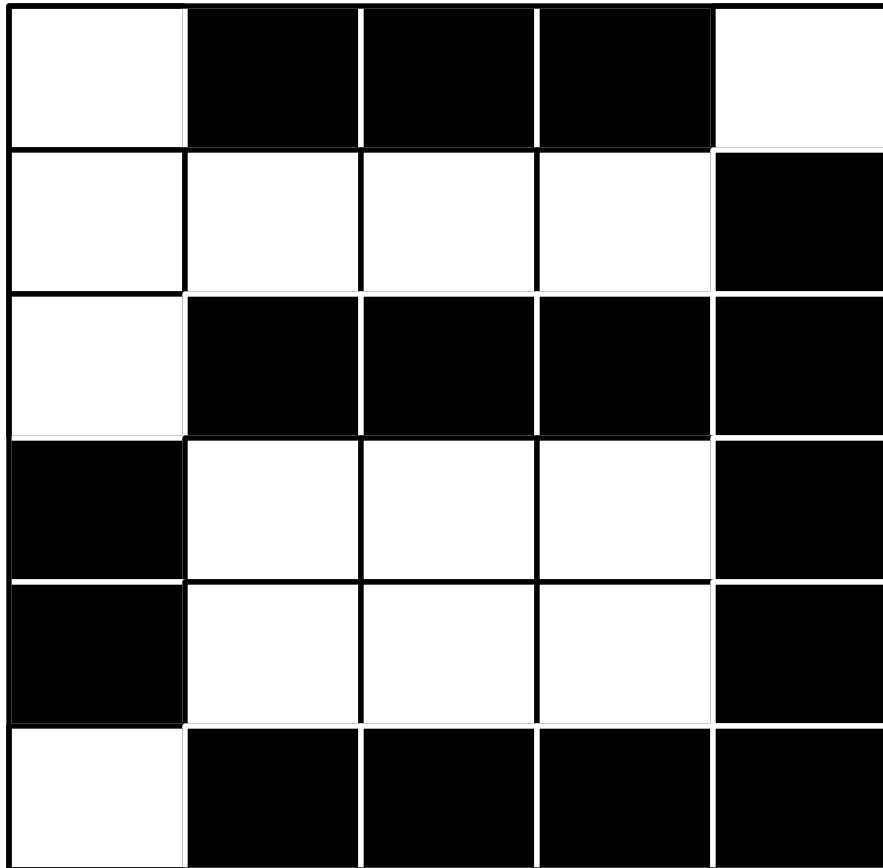
## Image Representation



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  - Computer screens are divided up into a grid of small dots called picture elements or pixels.
- Has anyone heard of binary numbers or digits?

# COMPUTER SCIENCE *Unplugged*

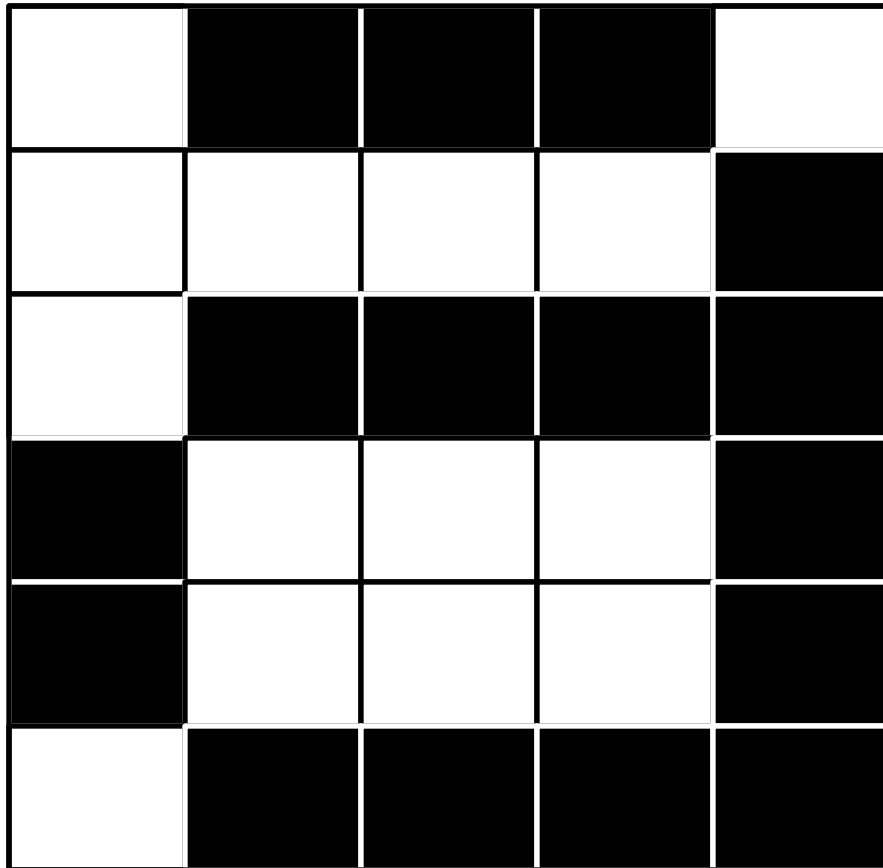
## Image Representation



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  - We call these bits – represented with a 0 or 1
  - For a black and white image we use 0 – black and 1 – white.

# COMPUTER SCIENCE *Unplugged*

## Image Representation



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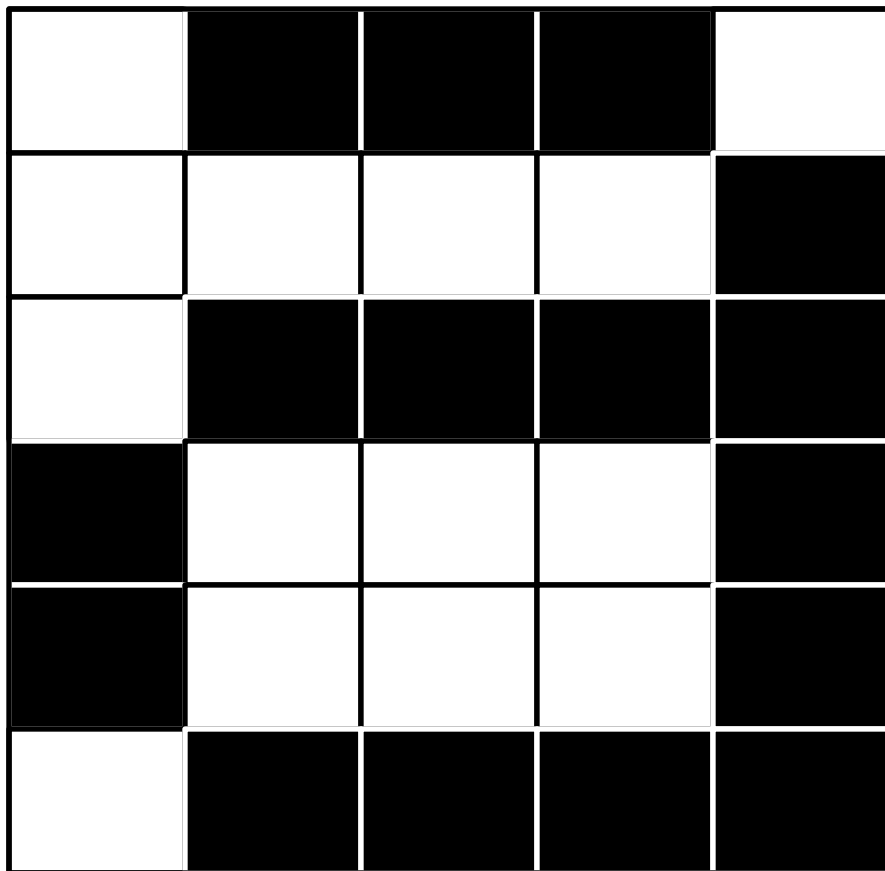
# COMPUTER SCIENCE *Unplugged*

## Image Representation


0	1	1	1	0
0	0	0	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	0	1
0	1	1	1	1

# COMPUTER SCIENCE *Unplugged*

## Image Compression

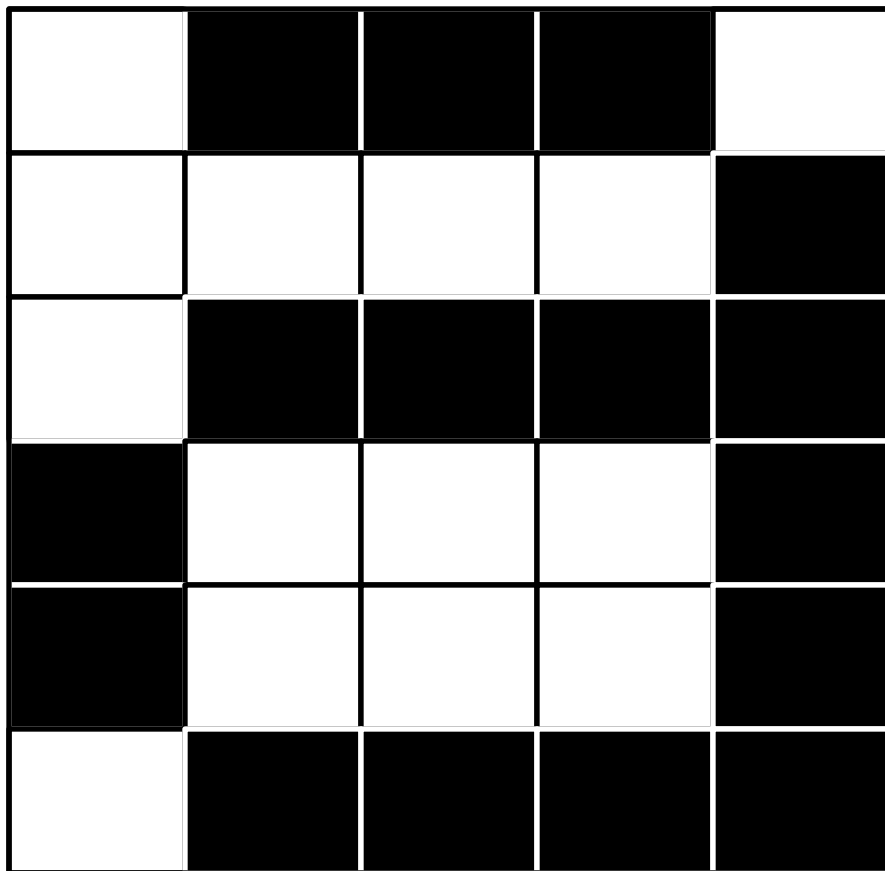


- If one number is used to represent each pixel or grid space, how many numbers does it take for this grid?
- That is a lot of data ... does anyone have an idea of how we could decrease the amount of numbers needed to represent this image?



# COMPUTER SCIENCE *Unplugged*

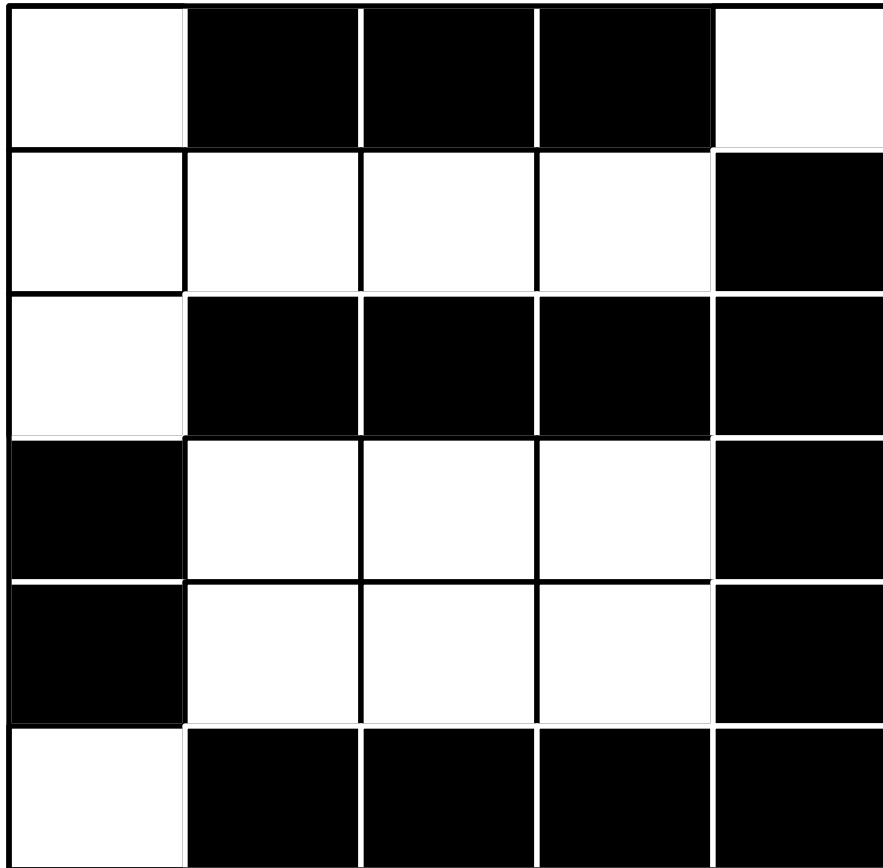
## Image Compression



- If one number is used to represent each pixel or grid space, how many numbers does it take for this grid?
  - $6 \text{ rows} * 5 \text{ pixels/row} = 30$
- That is a lot of data ... does anyone have an idea of how we could decrease the amount of numbers needed to represent this image?

# COMPUTER SCIENCE *Unplugged*

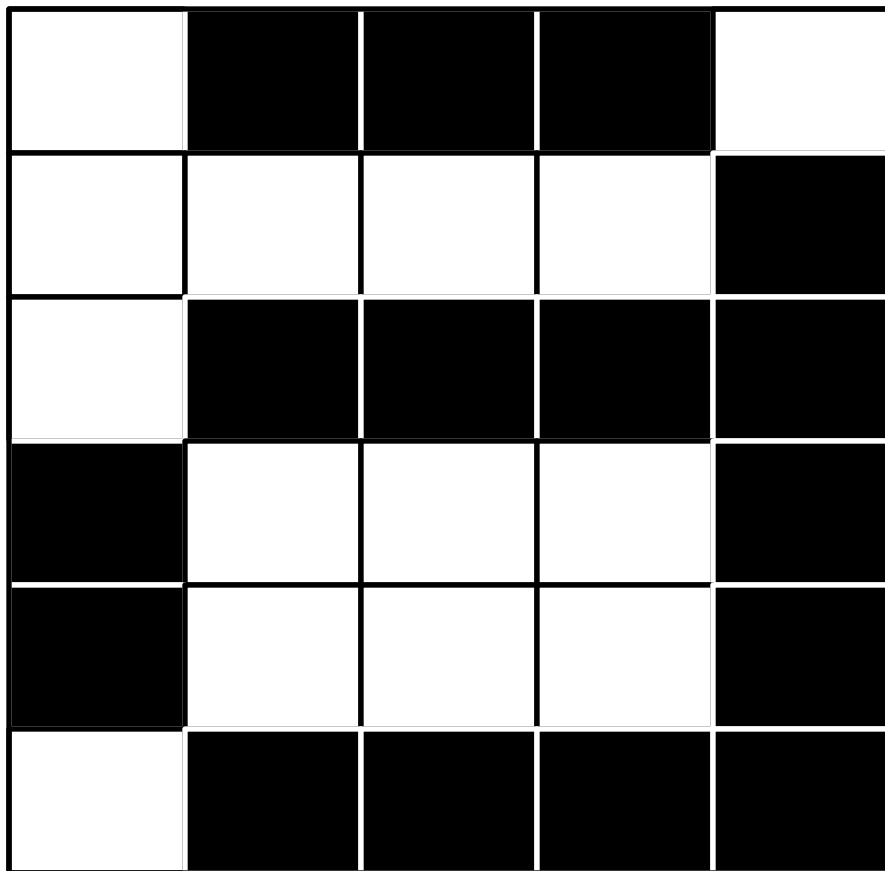
## Image Compression



- We call this an encoding scheme or compression technique – all the computer needs to store is which pixels are black and which are white.
  - The first number is always the number of white (even if zero)
  - this is followed by the number of black
  - then the number of white,
  - and so on until the end of that line.

# COMPUTER SCIENCE *Unplugged*

## Compressed Image Numbers



1, 3, 1

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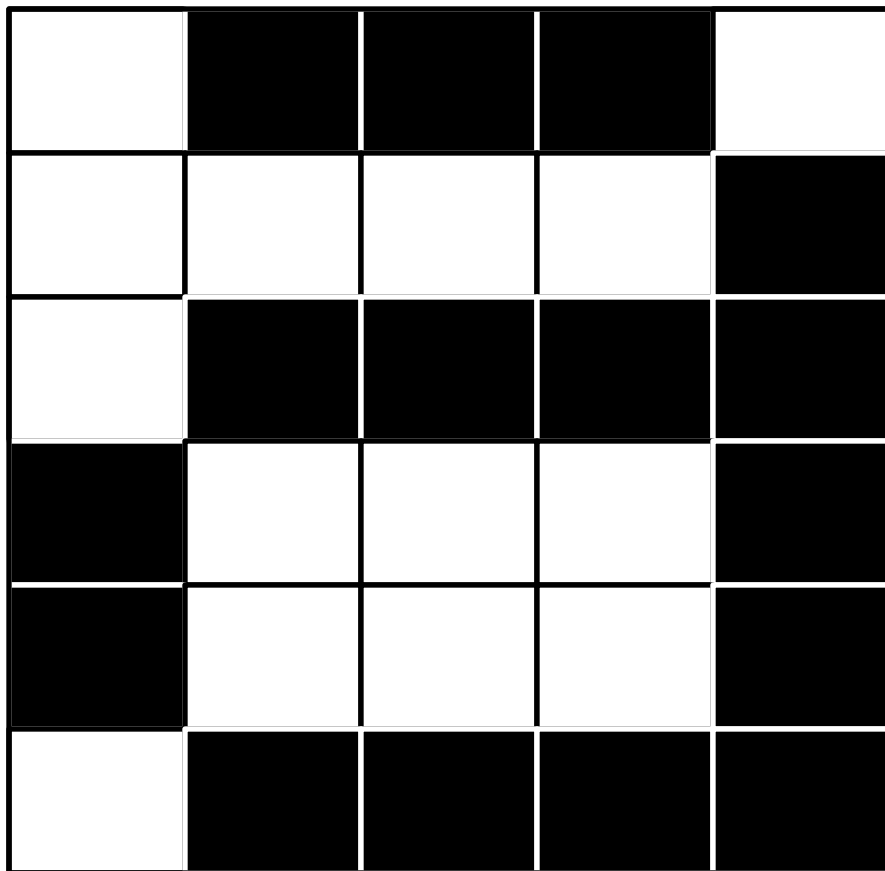
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# COMPUTER SCIENCE *Unplugged*

## Compressed Image Numbers



1, 3, 1

---

4, 1

---

---

---

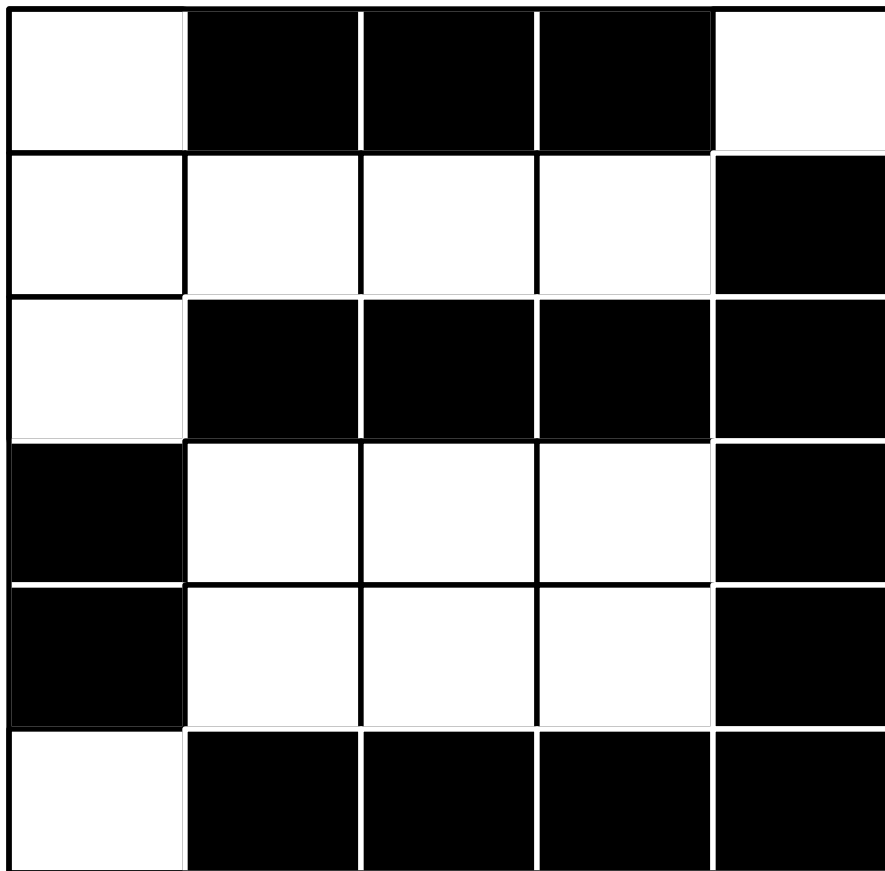
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---

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# COMPUTER SCIENCE *Unplugged*

## Compressed Image Numbers



1, 3, 1

---

4, 1

---

1, 4

---

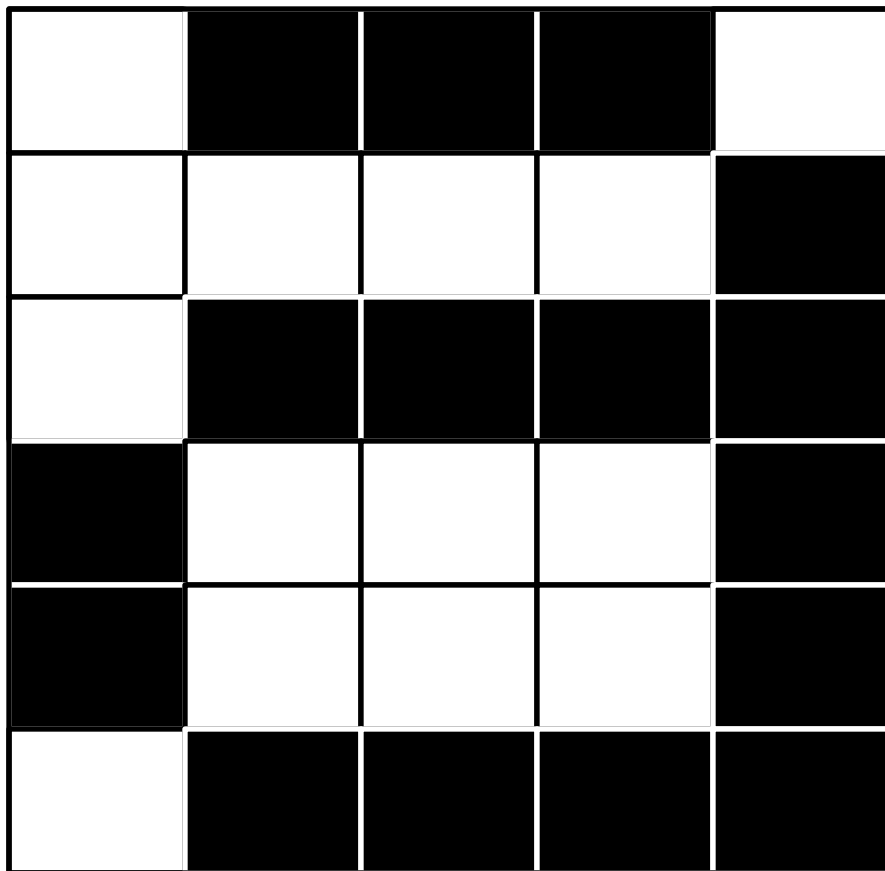
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# COMPUTER SCIENCE *Unplugged*

## Compressed Image Numbers



1, 3, 1

---

4, 1

---

1, 4

---

0, 1, 3, 1

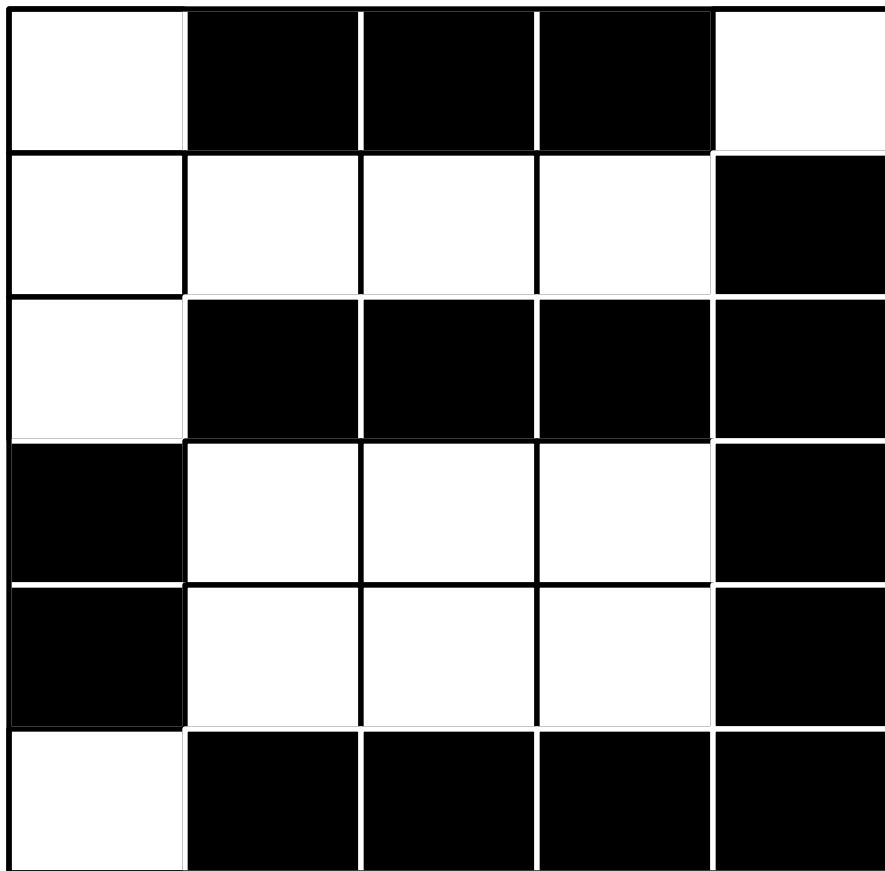
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---

---

# COMPUTER SCIENCE *Unplugged*

## Compressed Image Numbers



1, 3, 1

---

4, 1

---

1, 4

---

0, 1, 3, 1

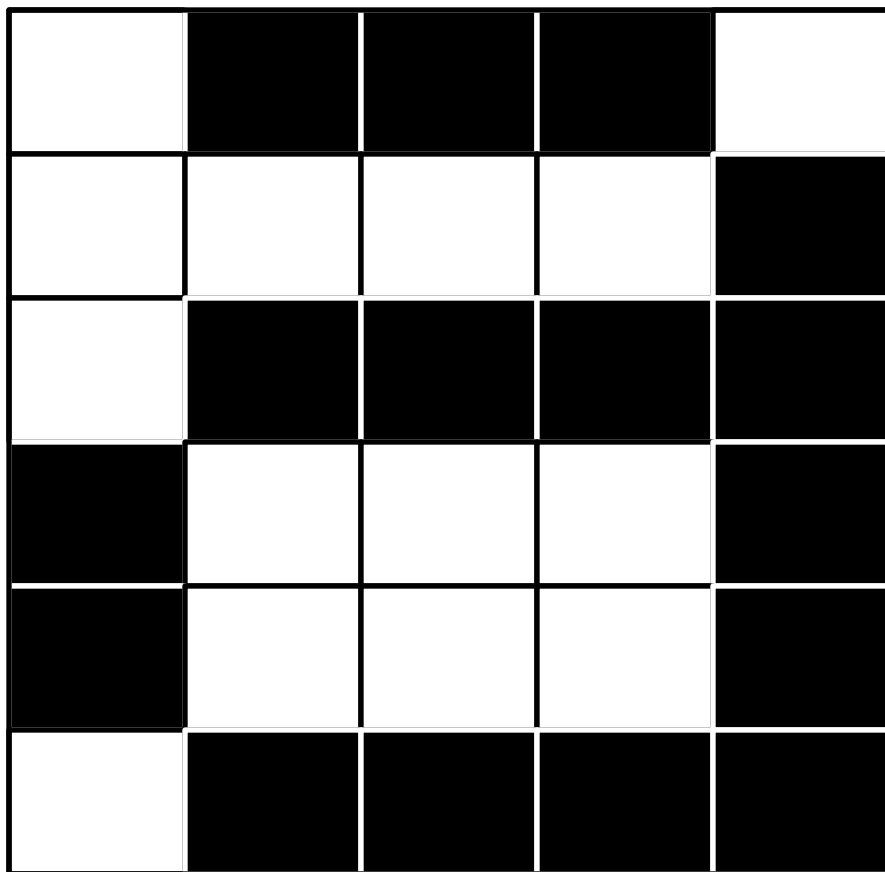
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0, 1, 3, 1

---

# COMPUTER SCIENCE *Unplugged*

## Compressed Image Numbers



1, 3, 1

---

4, 1

---

1, 4

---

0, 1, 3, 1

---

0, 1, 3, 1

---

1, 4

---





COMPUTER SCIENCE  
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Let's do the worksheets!

# COMPUTER SCIENCE *Unplugged*

Movies and film are actually made up of lots of pictures shown one after another very quickly. Let's say that our movie is made up of 120 images that make up a 'moving picture.'

If it would take 10 seconds for one image to download uncompressed, how many seconds would it take to download the entire **uncompressed** movie?

How many minutes is that?

# COMPUTER SCIENCE *Unplugged*

If the compression rate was 50% (so one image downloads twice as fast, 5 seconds instead of 10), how many seconds would it now take to download the movie with 120 images?

And how many minutes is that?

# COMPUTER SCIENCE *Unplugged*

To produce greyscale images you can use a number, from the simplified scale below, to represent the “intensity” or shade of grey (e.g. black is 0 and white is now 9). Two numbers are used to represent a run of pixels: the first gives the length of the run as before, and the second specifies intensity.

512x512 CT Scan Image of Rhino



5x5 Zoom from the Rhino Image

9	8	6	6	8
9	0	0	0	0
8	0	0	0	0
8	5	0	0	5
9	5	5	5	9

Compressed Image Numbers

1 9 1 8 2 6 1 8

1 9 4 0

1 8 4 0

1 8 1 5 2 0 1 5

1 9 3 5 1 9