HOW QR CODES WORK

EMERALD HEIGHTS INTERNATIONAL SCHOOL, INDORE
NOVEMBER 8, 2024

L O V E O N E A N O T H E R


0 36000 29145 2

Manufacturer's Identification Number

Item Number

Manufacturer's Identification Number

Item Number

Manufacturer's Identification Number

Item Number


8
1
2
2
5
3
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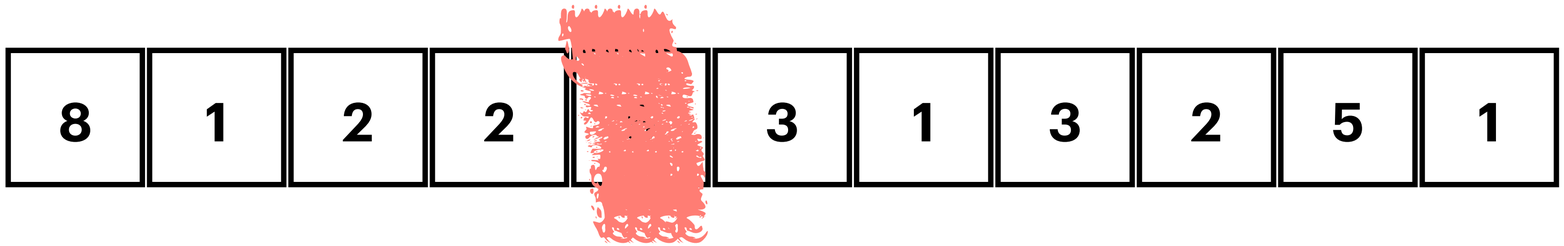
1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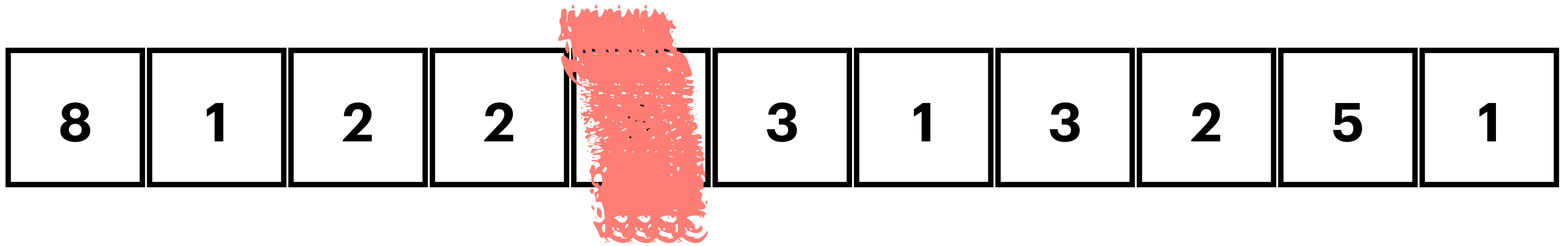

How do you protect against missing information?

8	1	2	2	5	3	1	3	2	5	1
8	1	2	2	5	3	1	3	2	5	1


8
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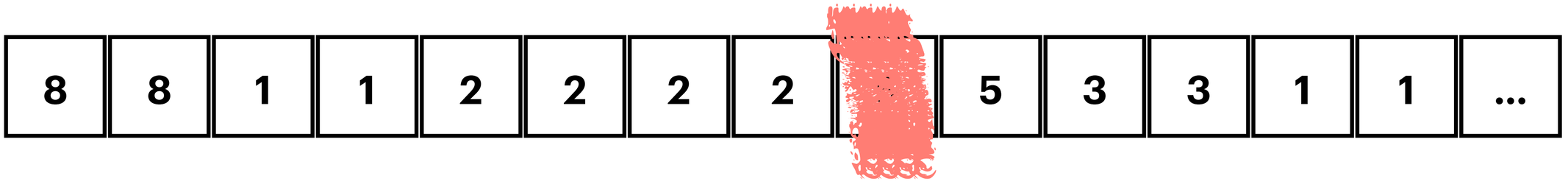
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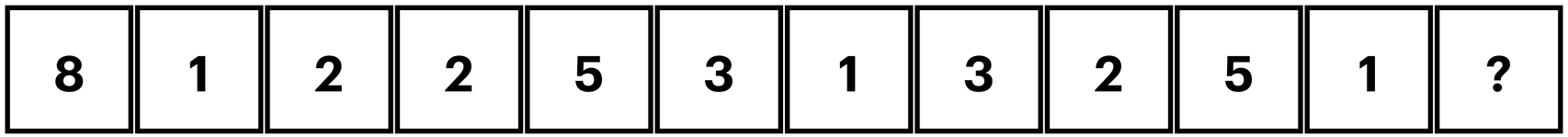
8
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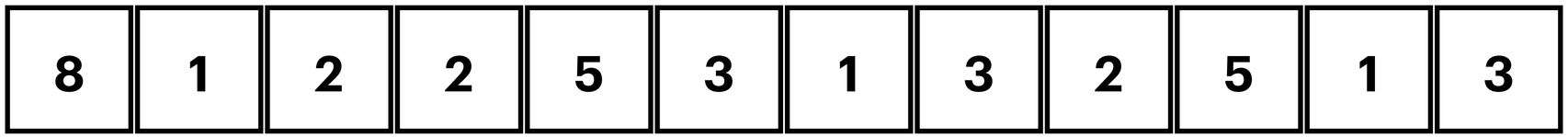
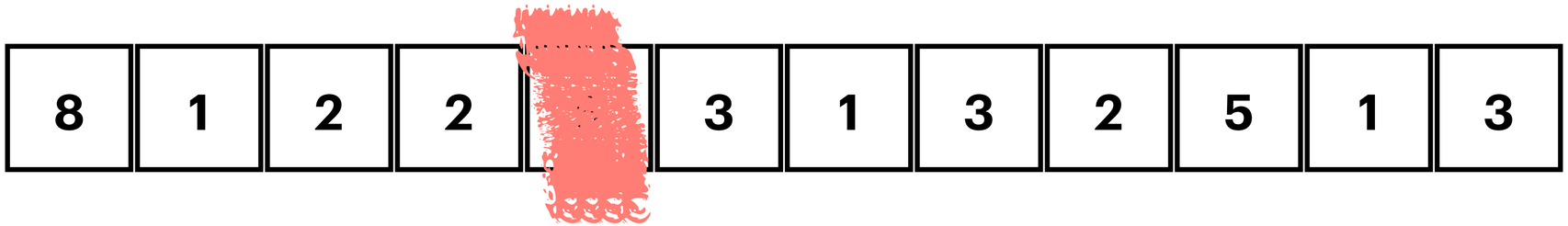
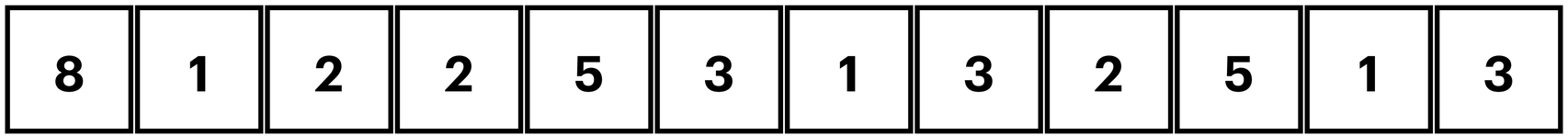


$$\sum x_i \equiv 0 \mod 9$$



$$\sum x_i \equiv 0 \mod 9$$



$$\sum x_i \equiv 0 \mod 9$$


0 36000 29145 2
Check Digit

$$\left(\sum_{i \text{ is odd}} x_i \right) \times 3 + \left(\sum_{i \text{ is even}} x_i \right) \equiv 0 \mod 10$$

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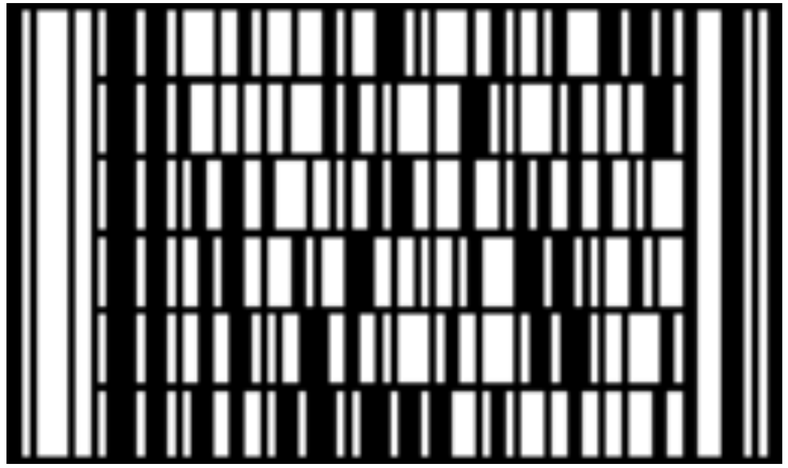
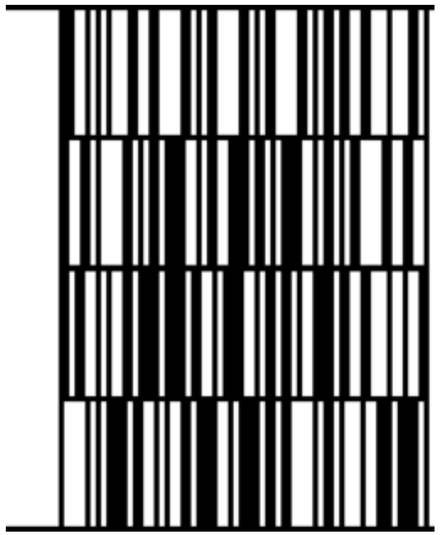
$$\left(\sum_{i \text{ is odd}} x_i \right) \times 3 + \left(\sum_{i \text{ is even}} x_i \right) \equiv 0 \mod 10$$

Error Correcting Codes

Limited Information



Coda Block

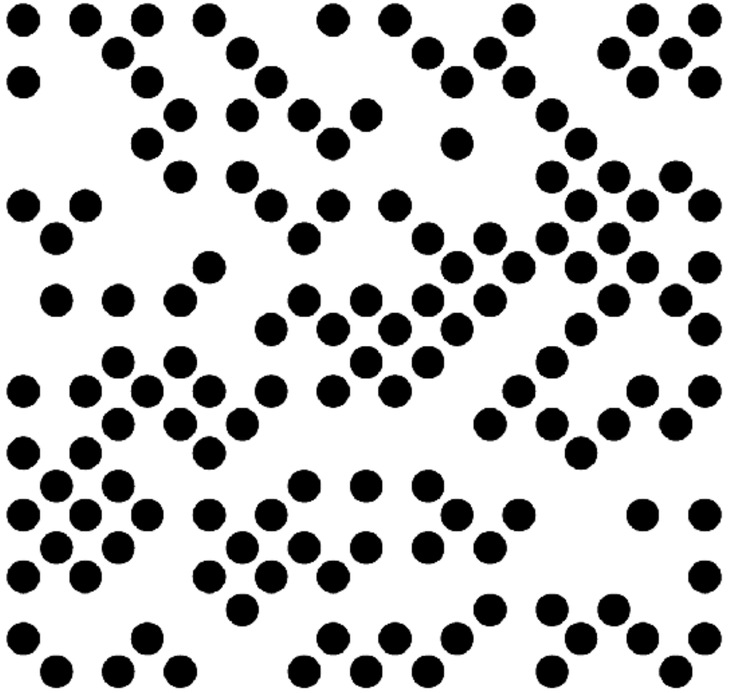


Coda 16K

Coda 49

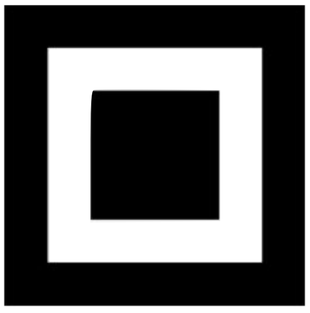
PDF 417

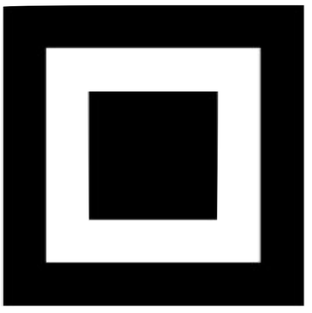
Colour Code

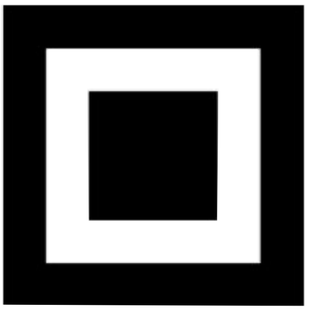


Dot Code

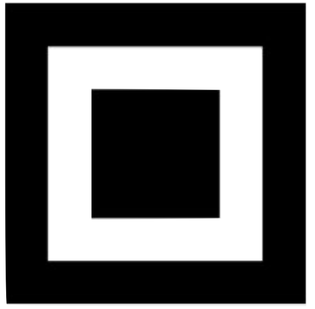
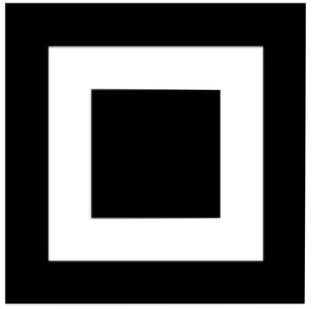
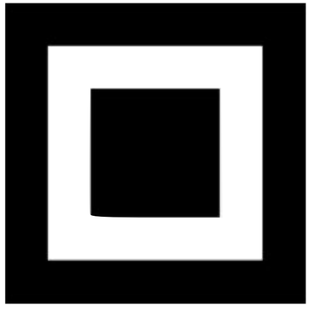
Finder Pattern



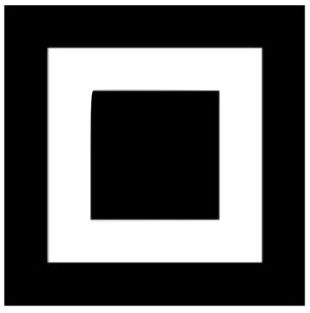


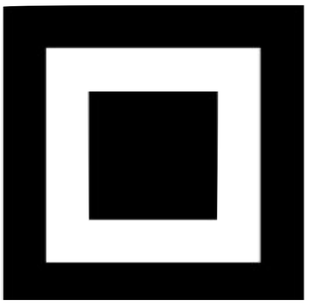


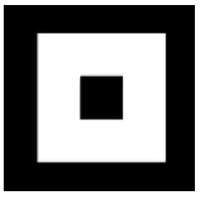
Rotation or Tilt

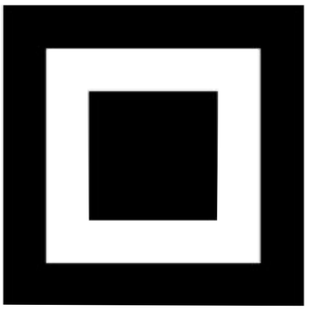




Alignment Pattern

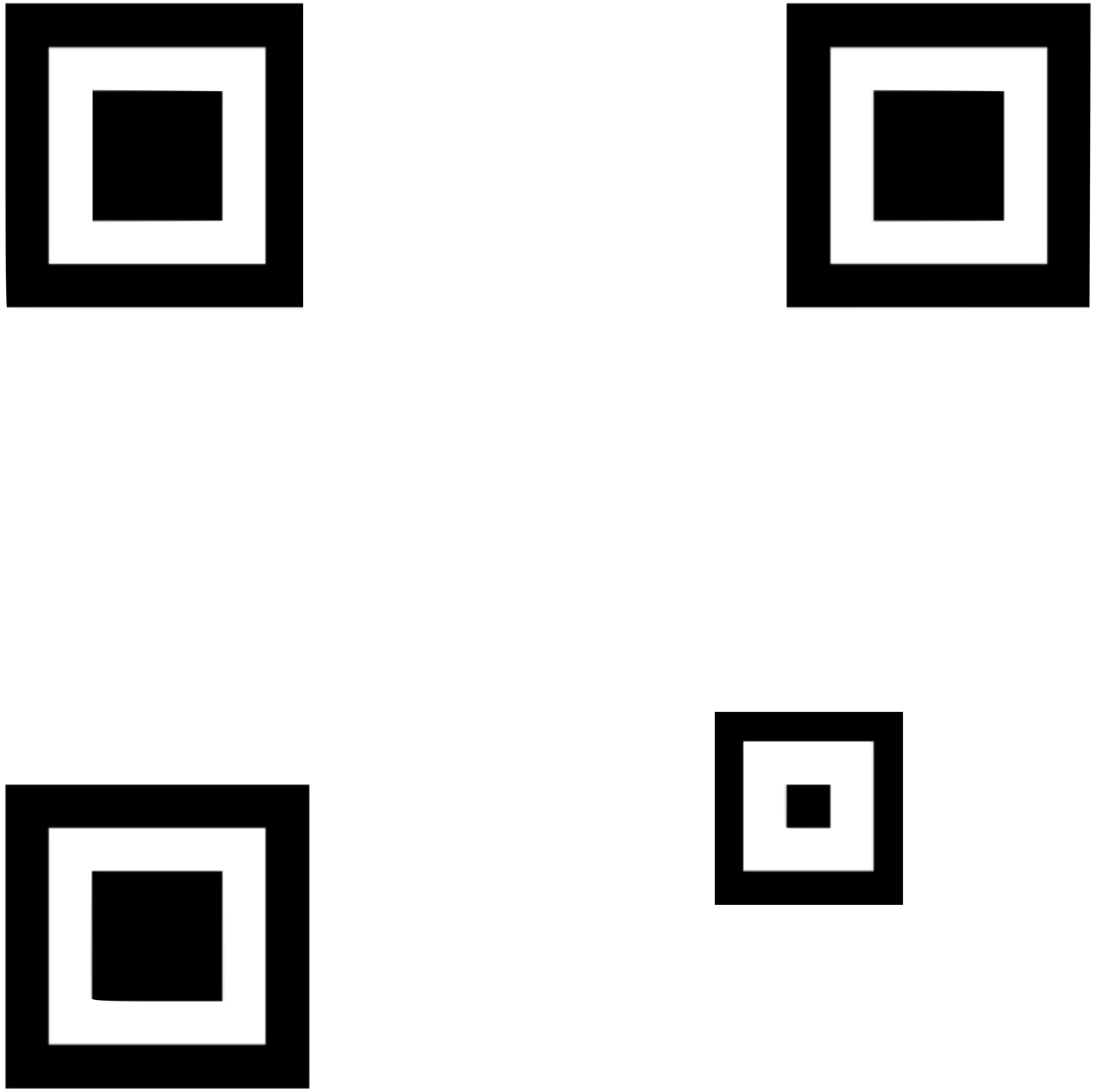






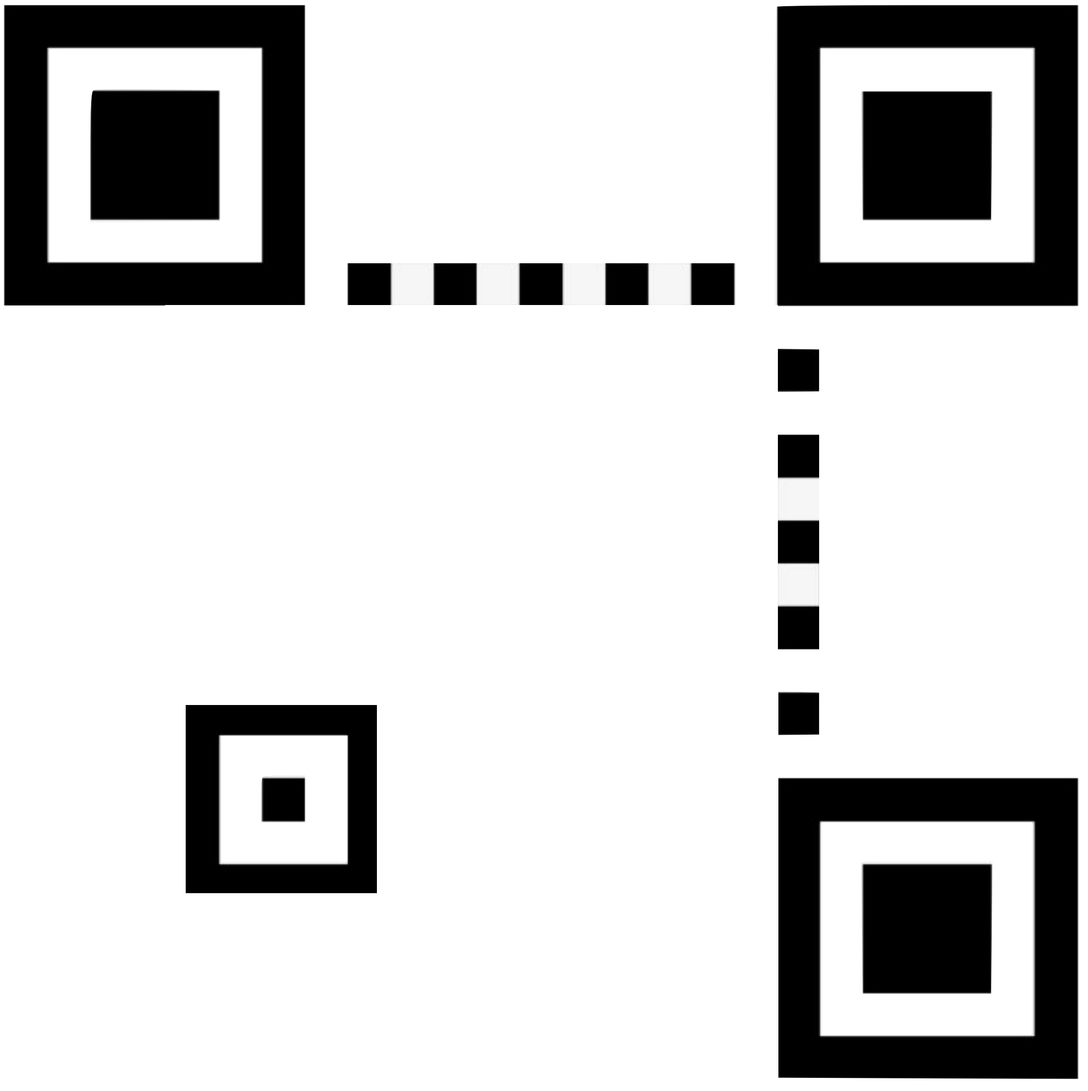


Alignment Pattern

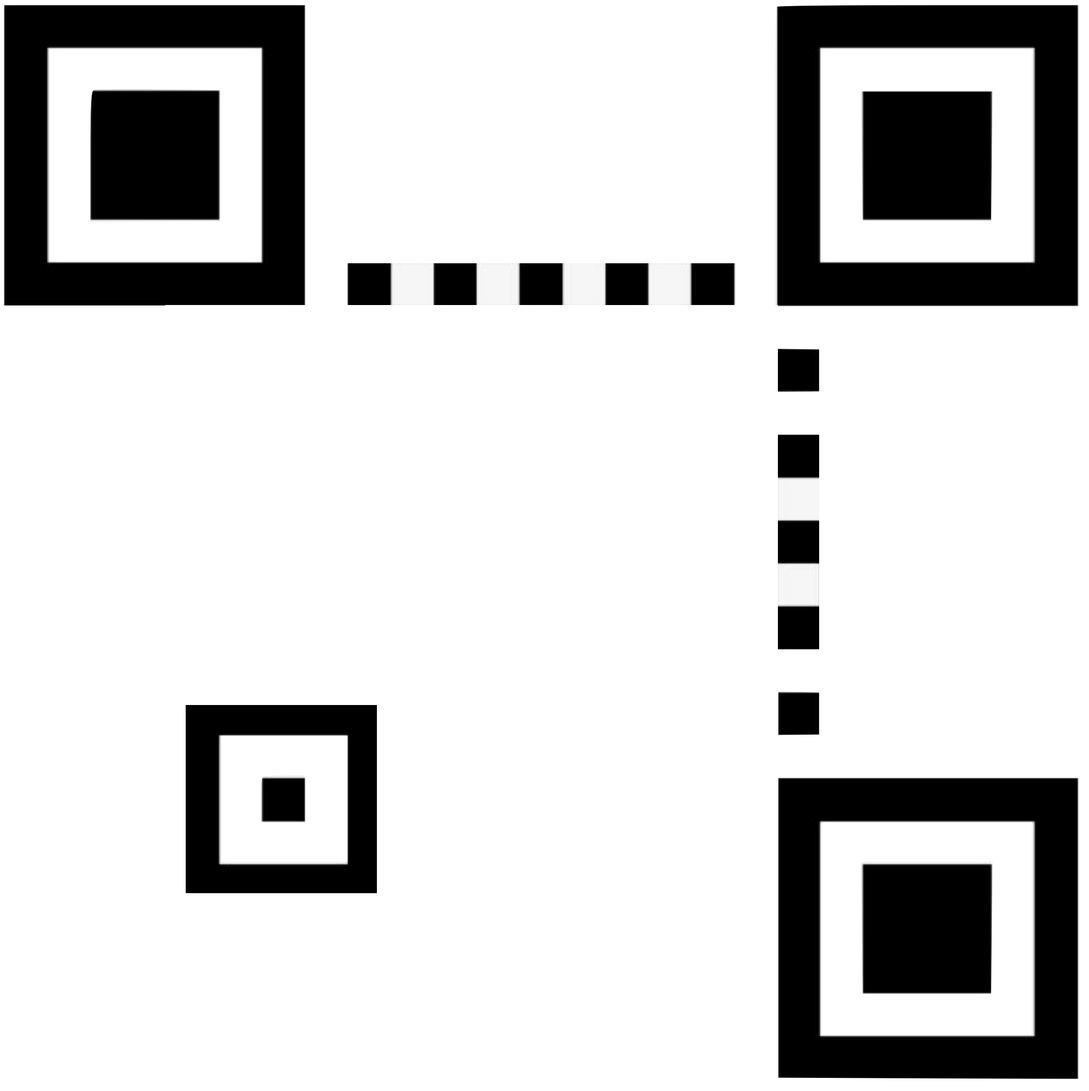


Alignment, Bending

Timing Pattern



Timing Pattern

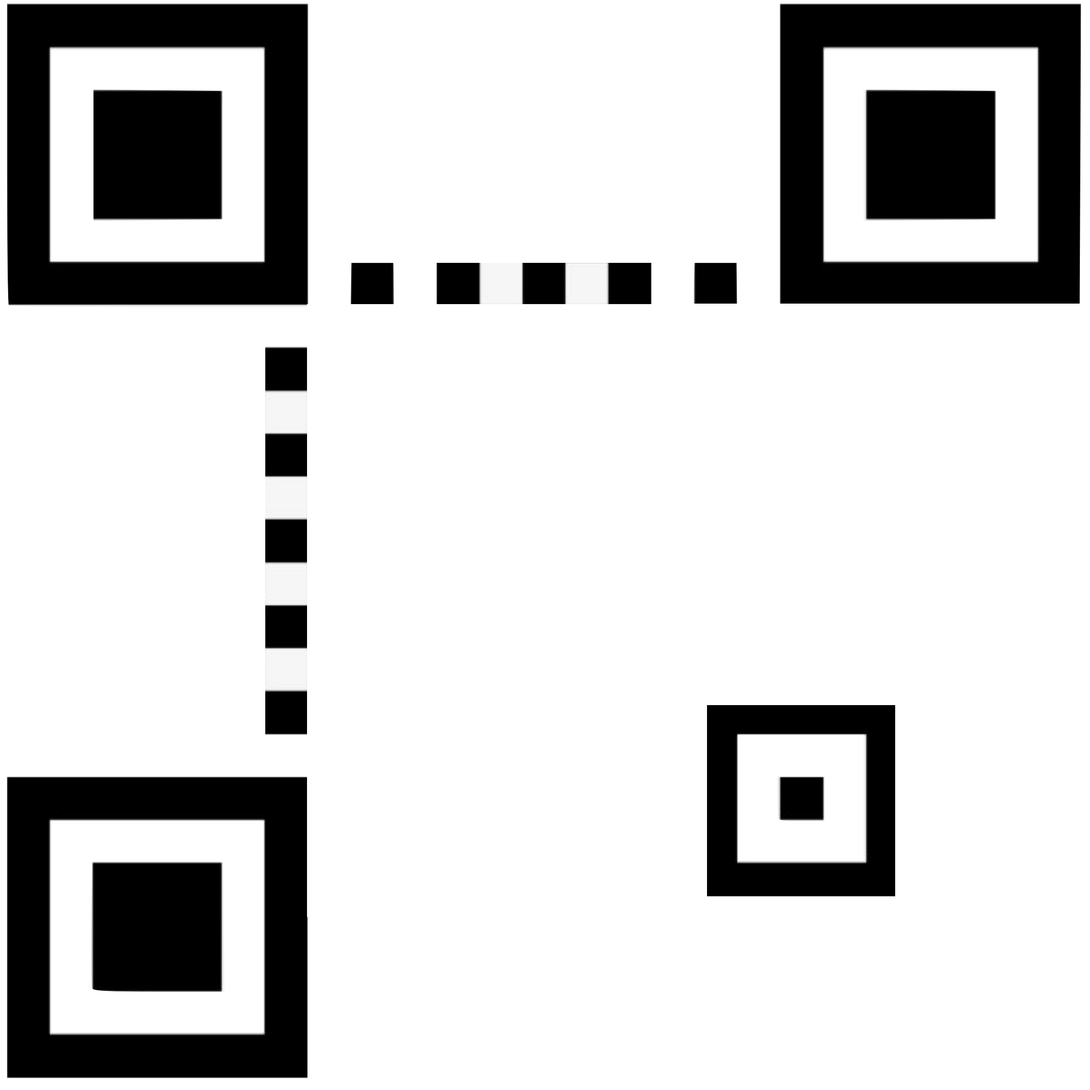


Size

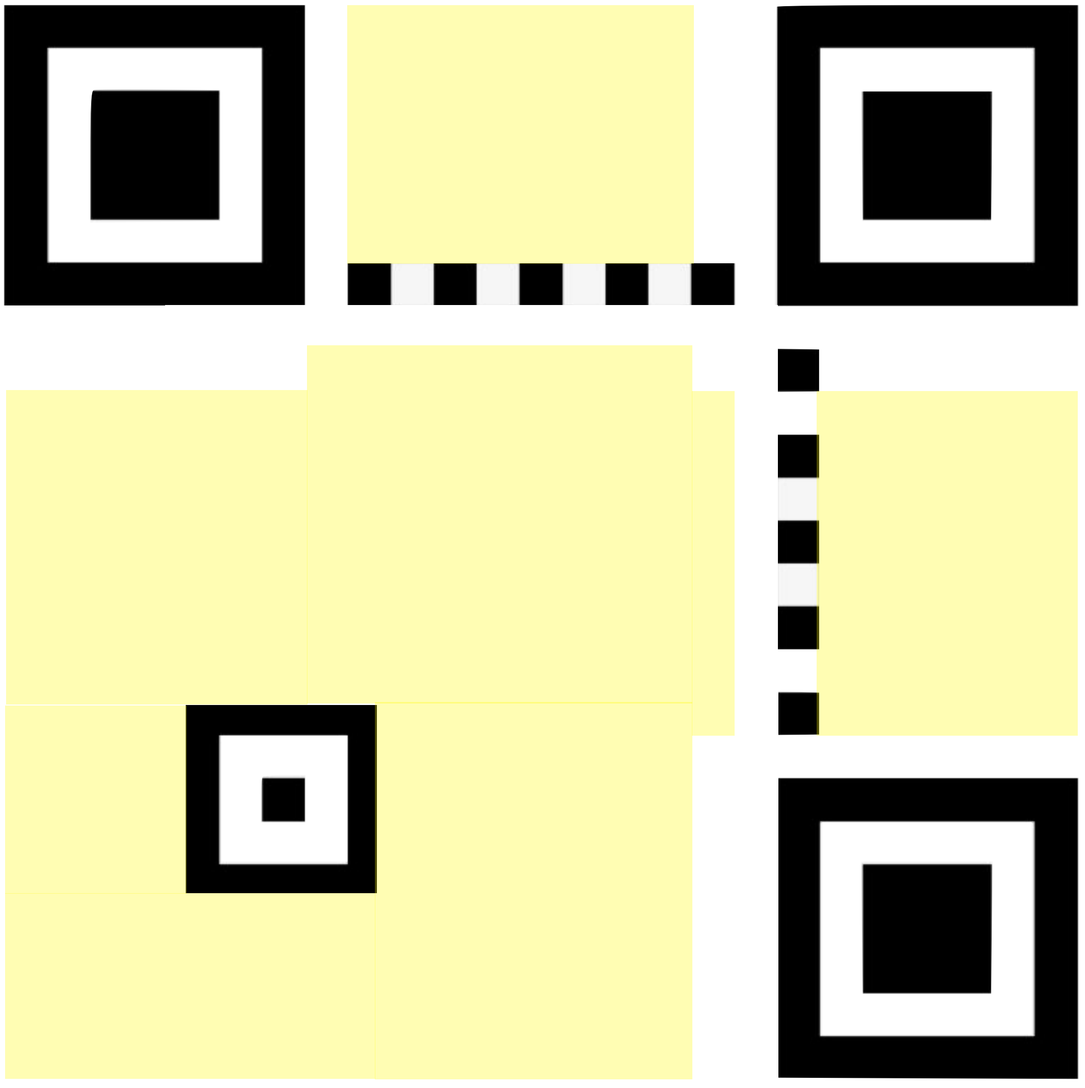
Version 1

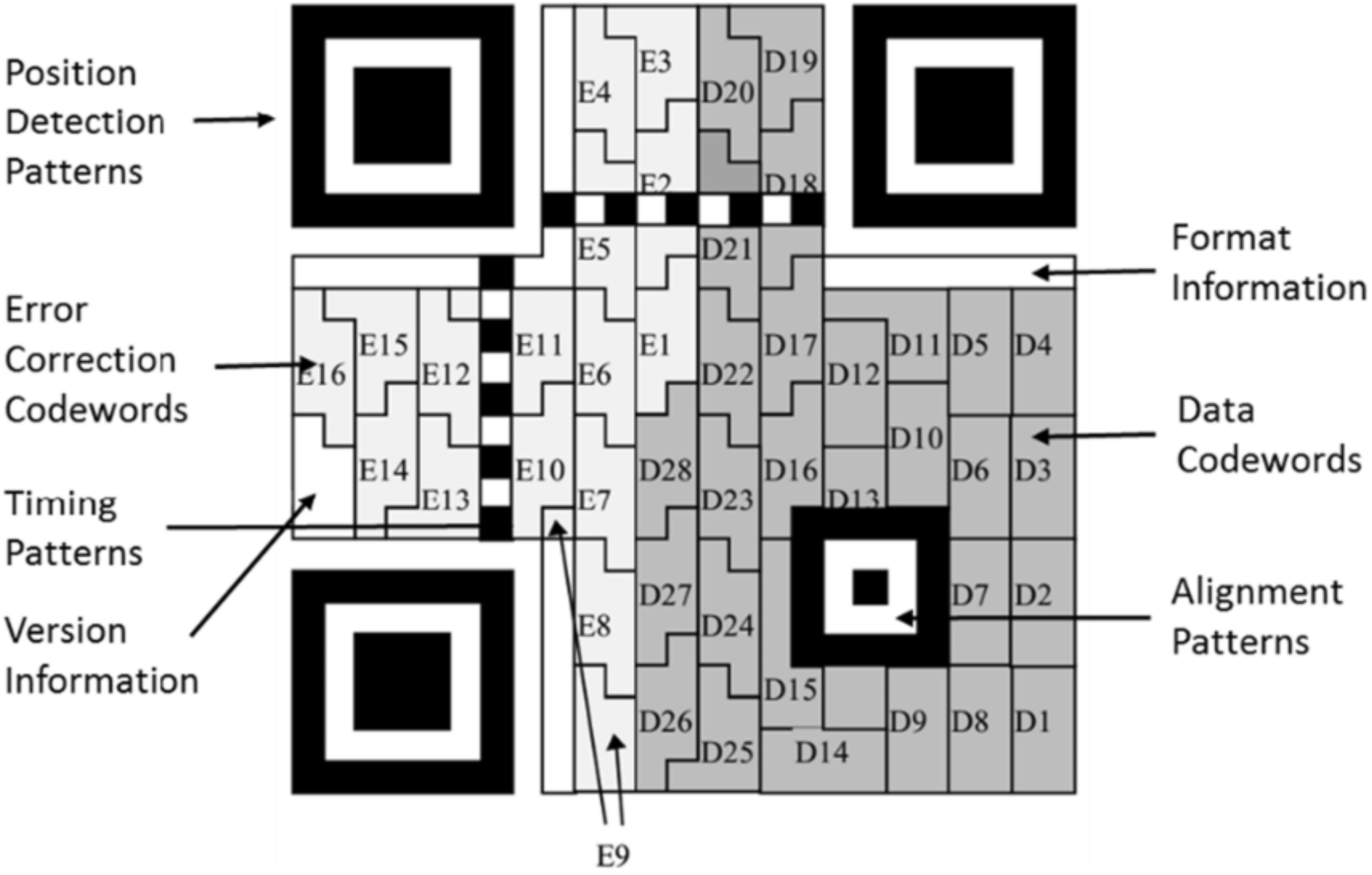
Version 10

Version 40



Data




Position Detection Patterns
Error Correction Codewords
Timing Patterns
Version Information
Format Information
Data Codewords
Alignment Patterns
E4
E3
D20
D19
E2
D18
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D21
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D14
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D8
D1
E9

L O V E O N E A N O T H E R

A	65	N	78	a	97	n	110
B	66	O	79	b	98	o	111
C	67	P	80	c	99	p	112
D	68	Q	81	d	100	q	113
E	69	R	82	e	101	r	114
F	70	S	83	f	102	s	115
G	71	T	84	g	103	t	116
H	72	U	85	h	104	u	117
I	73	V	86	i	105	v	118
J	74	W	87	j	106	w	119
K	75	X	88	k	107	x	120
L	76	Y	89	l	108	y	121
M	77	Z	90	m	109	z	122

A	65	N	78	a	97	n	110
B	66	O	79	b	98	o	111
C	67	P	80	c	99	p	112
D	68	Q	81	d	100	q	113
E	69	R	82	e	101	r	114
F	70	**S**	**83**	f	102	s	115
G	71	T	84	g	103	t	116
H	72	U	85	h	104	u	117
I	73	V	86	i	105	v	118
J	74	W	87	j	106	w	119
K	75	X	88	k	107	x	120
L	76	Y	89	l	108	y	121
M	77	Z	90	m	109	z	122

83

83

$$1010011 = 1 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 1 \times 2 + 1$$

83

$$1010011 = 1 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 1 \times 2 + 1$$

2^6 2^4 2^1 2^0

83

$$1010011 = 1 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 1 \times 2 + 1$$

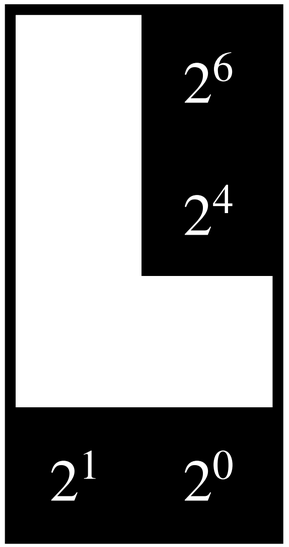
2^6

2^4

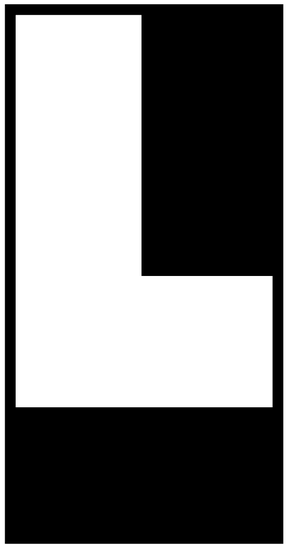
2^1 2^0

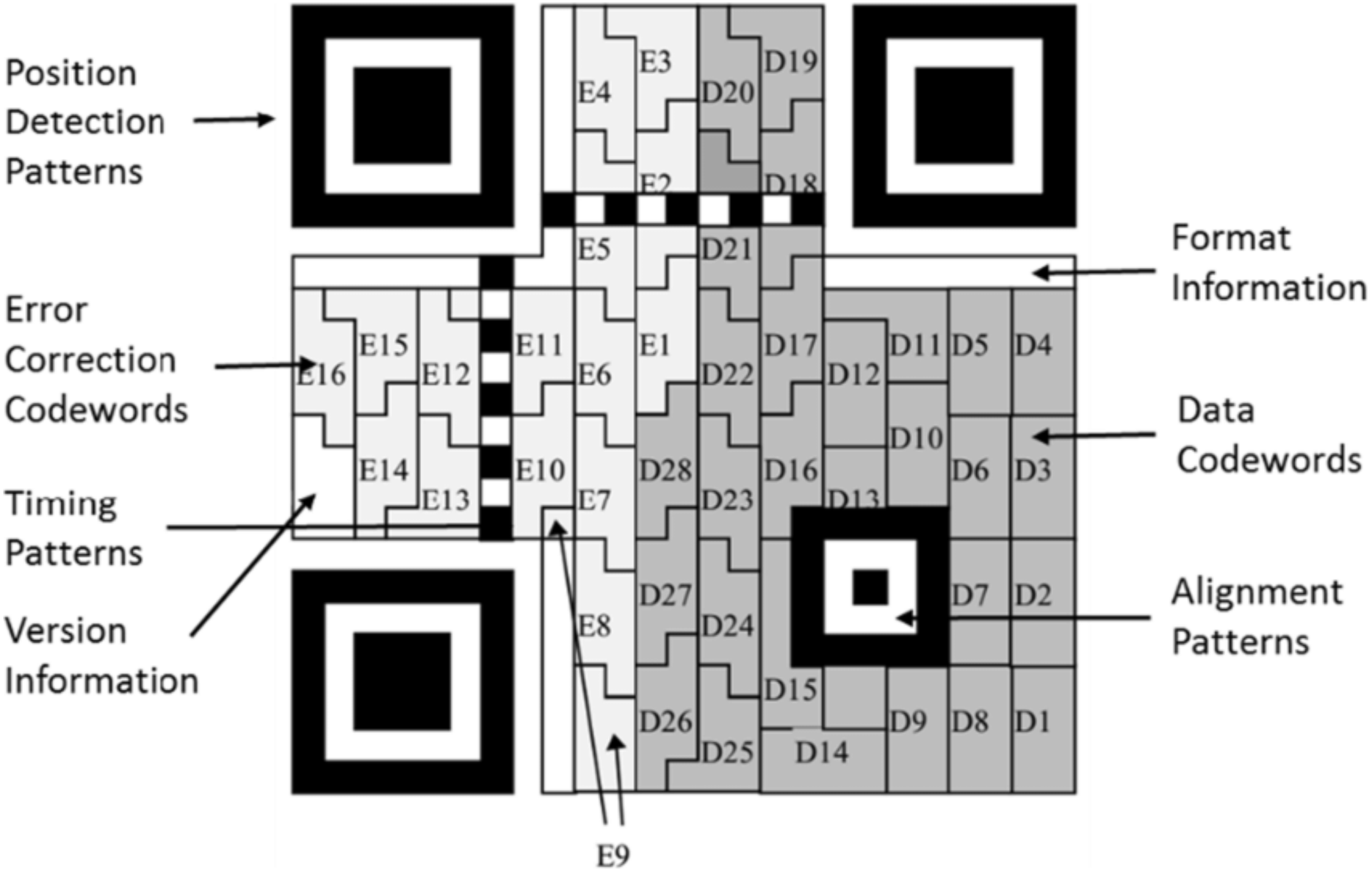
83

$$1010011 = 1 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 1 \times 2 + 1$$



$$1010011 = 1 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 1 \times 2 + 1$$




Position Detection Patterns
Error Correction Codewords
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Version Information
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E9

SCAN QR CODE HERE FOR UTS ON MOBILE TICKE

QR Booking மூலம் பயணச்சீட்டு பெறுவது எப்படி

मोबाइल पर यू टी एस एप रखनेवाले यात्रियों के लिए क्यू आर कोड द्वारा बुकिंग के लिए

For Booking through QR CODE

நிலை 1. மடிகல் செயலியில் பதிவு டிக்கெட்(Book Ticket) ஐ தேர்வு செய்யவும்

நிலை 2. க்யூ ஆர் பக்கில் (QR Booking) ஐ தேர்வு செய்யவும்.

நிலை 3. Journey by QR வாய்ப்பை தேர்ந்தெடுக்கவும்.

நிலை 4. மேலே கொடுக்கப்பட்டிருக்கும் க்யூ ஆர் கோடை ஸ்கேன் செய்யவும்.

(To Station) வாய்ப்பில் நீங்கள் செல்லவிருக்கும் ரயில் நிலையத்தை தேர்வு செய்து பயணச்சீட்டை மொபைலில் பெறலாம்.

அல்லது பிளாட் க்யூ ஆர் முறை

चरण -1. "बुक टिकट" का विकल्प चुनें.

चरण -2. "क्यू आर बुकिंग" विकल्प चुनें.

चरण -3. "क्यू आर द्वारा यात्रा" चुनें.

चरण -4. ऊपर दिख रहे क्यू आर कोड का स्केन करें.

चरण -5. "स्टेशन का नाम "चुनें

चरण -6. साधारण मोबाइल टिकट जैसे एप में दिए गए अन्य अनुदेशों का पालन करें.

गाड़ी में या प्लेटफार्म पर अनुमेय नहीं है.

Step -1 Select "Book Ticket" Option.

Step-2 Select "QR Booking" Option.

Step-3 Select "Journey by QR"

Step-4 Scan the QR Code above

Step-5 Select "To Station" Name

Step-6 Follow instructions in the app further as per normal mobile ticket.

Not permitted on train or on the Platform

$$\left(\sum_{i \text{ is odd}} x_i \right) \times 3 + \left(\sum_{i \text{ is even}} x_i \right) \equiv 0 \mod 10$$

$$\left(\sum_{i \text{ is odd}} x_i \right) \times 3 + \left(\sum_{i \text{ is even}} x_i \right) \equiv 0 \mod 10$$

Reed-Solomon Codes

Reed-Solomon Codes

INDORE

A	65	**N**	**78**	a	97	n	110
B	66	**O**	**79**	b	98	o	111
C	67	P	80	c	99	p	112
D	**68**	Q	81	d	100	q	113
E	**69**	**R**	**82**	e	101	r	114
F	70	S	83	f	102	s	115
G	71	T	84	g	103	t	116
H	72	U	85	h	104	u	117
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J	74	W	87	j	106	w	119
K	75	X	88	k	107	x	120
L	76	Y	89	l	108	y	121
M	77	Z	90	m	109	z	122

Reed-Solomon Codes

INDORE

73 – 78 – 68 – 79 – 82 – 69

Reed-Solomon Codes

INDORE

73 – 78 – 68 – 79 – 82 – 69

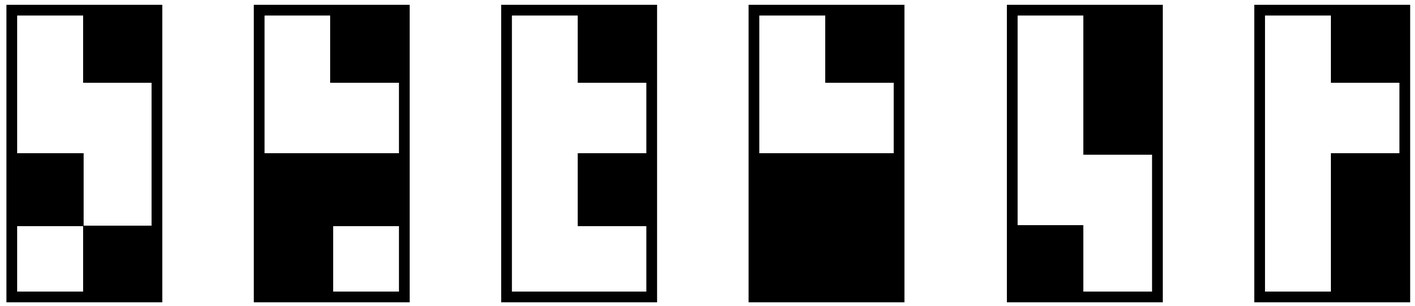
1001001 – 1001110 – 1000100 – 1001111 – 1010010 – 1000101

Reed-Solomon Codes

INDORE

73 – 78 – 68 – 79 – 82 – 69

1001001 – 1001110 – 1000100 – 1001111 – 1010010 – 1000101



Reed-Solomon Codes

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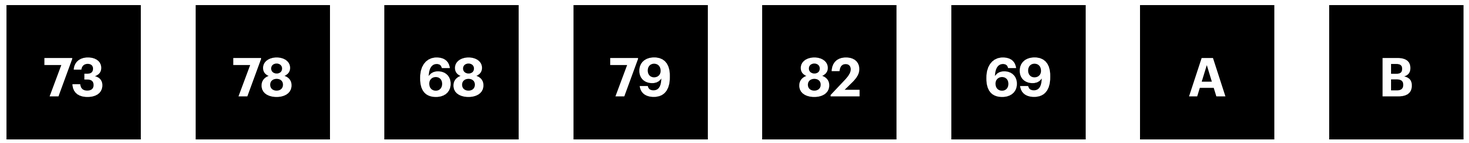
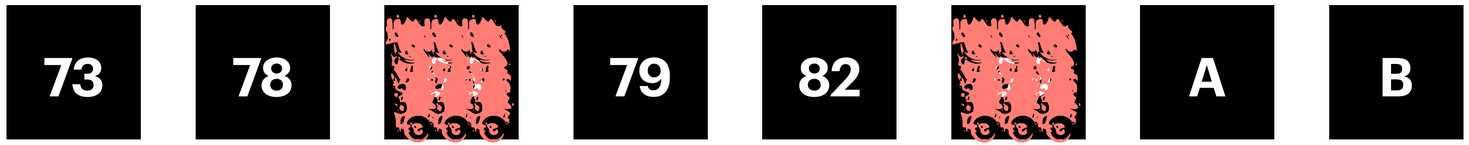
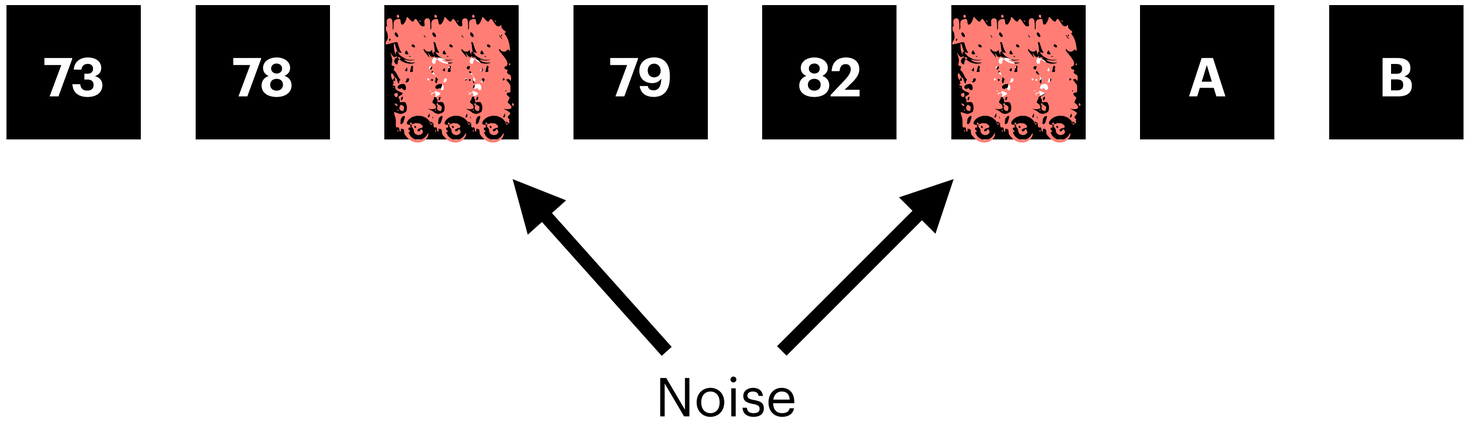


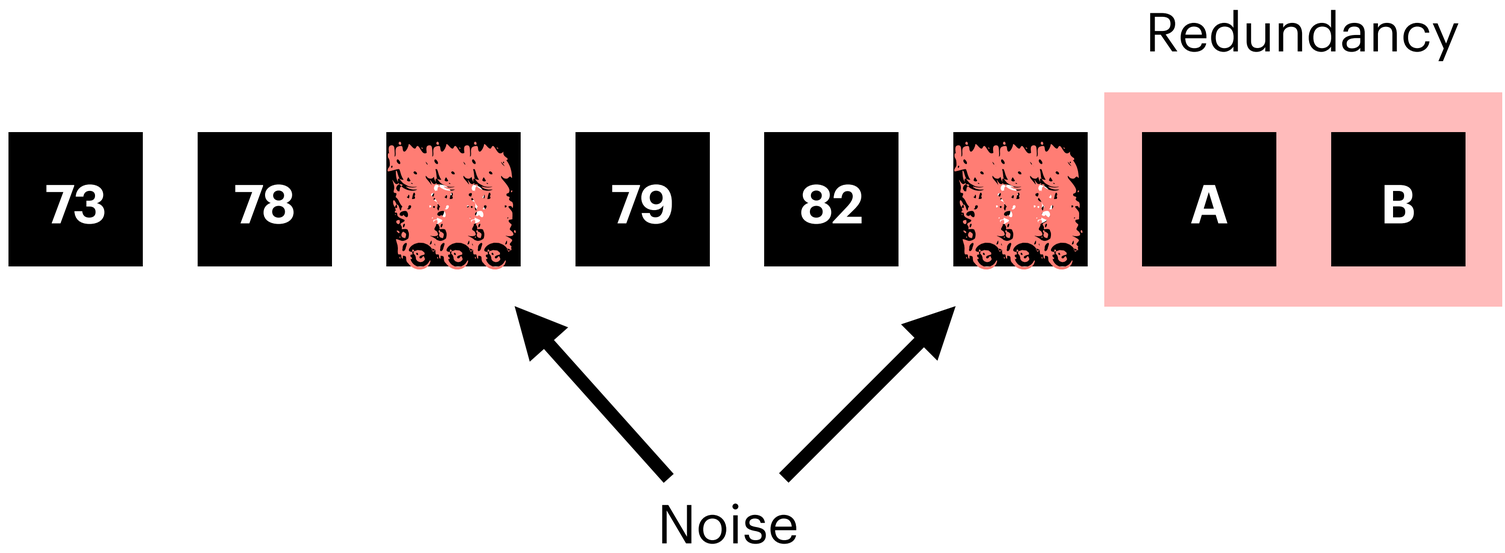
Reed-Solomon Codes

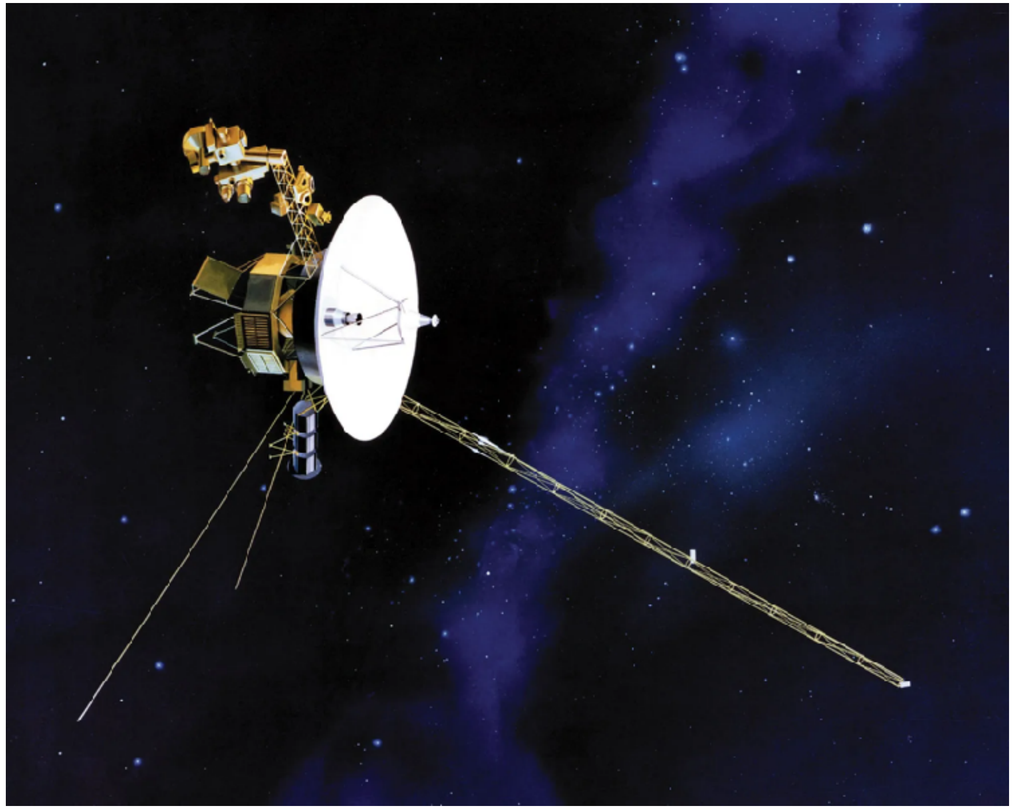


Reed-Solomon Codes



Reed-Solomon Codes





Preliminaries:

$$1 \equiv 6 \mod 5$$

Preliminaries:

$$1 \equiv 6 \mod 5$$

$$1 \equiv 3 + 3 \mod 5$$

$$1 \equiv 2 \times 3 \mod 5$$

Preliminaries:

$$1 \equiv 6 \mod 5$$

$$1 \equiv 3 + 3 \mod 5$$

$$1 \equiv 2 \times 3 \mod 5$$


12
1
2
3
4
5
6
7
8
9
10
11

$$a + b \equiv b + a \mod m \qquad ab \equiv ba \mod m$$

$$(a + b) + c \equiv a + (b + c) \mod m \qquad (ab)c \equiv a(bc) \mod m$$

$$0 + a \equiv a \mod m \qquad 1a \equiv a \mod m$$

$$a + (-a) \equiv 0 \mod m \qquad aa^{-1} \equiv 1 \mod m$$

$$c(a + b) \equiv ca + cb \mod m$$

$$a + b \equiv b + a \mod m$$

$$(a + b) + c \equiv a + (b + c) \mod m$$

$$0 + a \equiv a \mod m$$

$$a + (-a) \equiv 0 \mod m$$

$$ab \equiv ba \mod m$$

$$(ab)c \equiv a(bc) \mod m$$

$$1a \equiv a \mod m$$

$$aa^{-1} \equiv 1 \mod m$$

$$c(a + b) \equiv ca + cb \mod m$$

$$a + b \equiv b + a \mod p \qquad ab \equiv ba \mod p$$

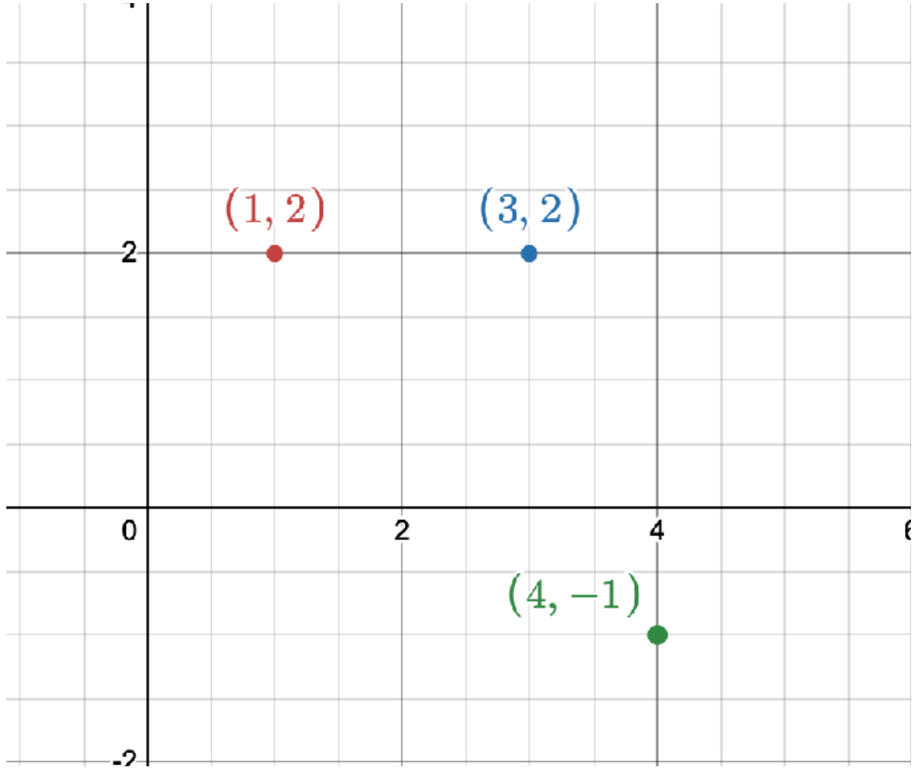
$$(a + b) + c \equiv a + (b + c) \mod p \qquad (ab)c \equiv a(bc) \mod p$$

$$0 + a \equiv a \mod p \qquad 1a \equiv a \mod p$$

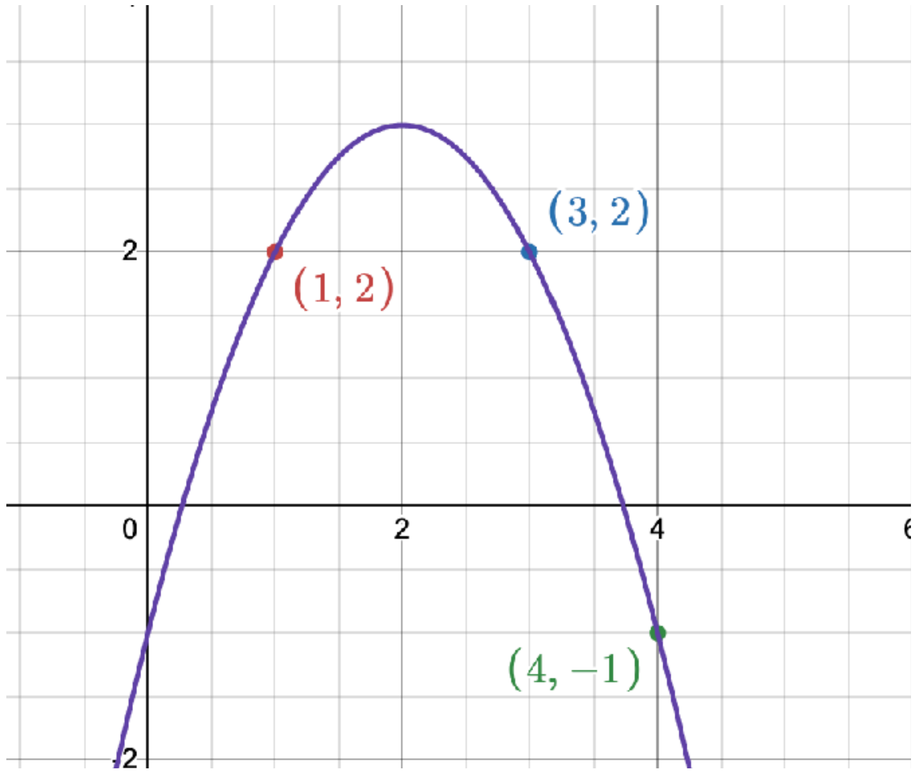
$$a + (-a) \equiv 0 \mod p \qquad aa^{-1} \equiv 1 \mod p$$

$$c(a + b) \equiv ca + cb \mod p$$

Preliminaries:



Preliminaries:



$$f(x) = -x^2 + 4x + 1$$

Lagrange Interpolation:

$(1,2)$ $(3,2)$ $(4,-1)$

Lagrange Interpolation:

$$(1,2) \qquad (3,2) \qquad (4,-1)$$

$$h_1(3) = h_1(4) = 0$$

Lagrange Interpolation:

$(1,2) \qquad (3,2) \qquad (4,-1)$

$$h_1(3) = h_1(4) = 0$$

$$h_2(1) = h_1(4) = 0$$

Lagrange Interpolation:

$(1,2) \qquad (3,2) \qquad (4,-1)$

$$h_1(3) = h_1(4) = 0$$

$$h_2(1) = h_1(4) = 0$$

$$h_2(1) = h_1(3) = 0$$

Lagrange Interpolation:

$$(1,2) \qquad (3,2) \qquad (4,-1)$$

$$h_1(3) = h_1(4) = 0$$

Lagrange Interpolation:

$(1,2) \qquad (3,2) \qquad (4,-1)$

$$h_1(3) = h_1(4) = 0$$

$$h_1(x) = (x-3)(x-4)$$

Lagrange Interpolation:

$(1,2)$ $(3,2)$ $(4,-1)$

$$h_1(3) = h_1(4) = 0$$

$$h_1(x) = (x-3)(x-4)$$

What is $h_1(1)$?

Lagrange Interpolation:

$(1,2)$ $(3,2)$ $(4,-1)$

$$h_1(3) = h_1(4) = 0$$

$$h_1(x) = (x-3)(x-4)$$

What is $h_1(1)$?

$$f_1(x) = 2 \times \frac{h_1(x)}{h_1(1)}$$

Lagrange Interpolation:

$$(1,2) \qquad (3,2) \qquad (4,-1)$$

$$f_1(x) = 2 \times \frac{h_1(x)}{h_1(1)}$$

Lagrange Interpolation:

$(1,2) \qquad (3,2) \qquad (4,-1)$

$$f_1(x) = 2 \times \frac{h_1(x)}{h_1(1)}$$

$$f_1(x) = y_1 \times \frac{(x - x_2)(x - x_3)}{(x_1 - x_2)(x_1 - x_3)}$$

Lagrange Interpolation:

$$(1,2) \qquad (3,2) \qquad (4,-1)$$

$$f_1(x) = 2 \times \frac{h_1(x)}{h_1(1)} \qquad f_2(x) = 2 \times \frac{h_2(x)}{h_2(3)} \qquad f_3(x) = -\frac{h_3(x)}{h_1(4)}$$

Lagrange Interpolation:

$$(1,2) \qquad (3,2) \qquad (4,-1)$$

$$f_1(x) = 2 \times \frac{h_1(x)}{h_1(1)} \qquad f_2(x) = 2 \times \frac{h_2(x)}{h_2(3)} \qquad f_3(x) = -\frac{h_3(x)}{h_1(4)}$$

$$f(x) = f_1(x) + f_2(x) + f_3(x)$$

Lagrange Interpolation:

$$(1,2) \qquad (3,2) \qquad (4,-1)$$

$$f_1(x) = 2 \times \frac{h_1(x)}{h_1(1)} \qquad f_2(x) = 2 \times \frac{h_2(x)}{h_2(3)} \qquad f_3(x) = -\frac{h_3(x)}{h_1(4)}$$

$$f(x) = f_1(x) + f_2(x) + f_3(x)$$

Unique!

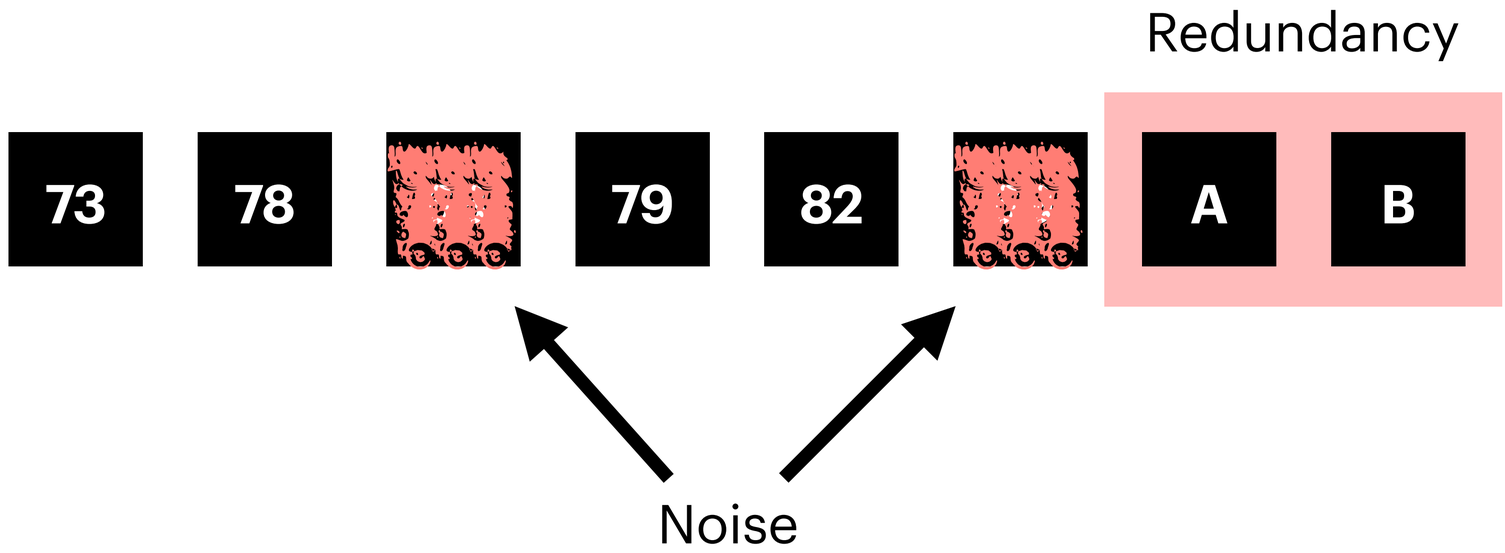
Lagrange Interpolation:

$$(1,2) \qquad (3,2) \qquad (4,-1)$$

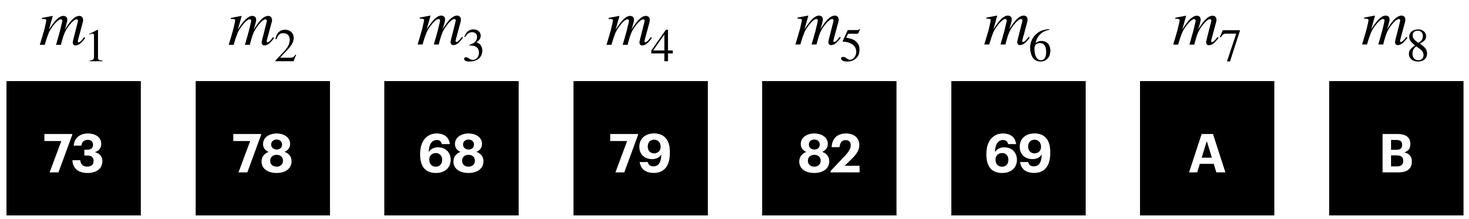
$$f_1(x) = 2 \times \frac{h_1(x)}{h_1(1)} \qquad f_2(x) = 2 \times \frac{h_2(x)}{h_2(3)} \qquad f_3(x) = -\frac{h_3(x)}{h_1(4)}$$

$$f(x) = f_1(x) + f_2(x) + f_3(x) \qquad \text{mod } p$$

Reed-Solomon Codes



Reed-Solomon Codes



Reed-Solomon Codes

Let $p > m_i$

Reed-Solomon Codes

Let $p > m_i$

Consider $f(x)$

Reed-Solomon Codes

Let $p > m_i$

Consider $f(x)$

$$f(1) = 73 \mod p$$
$$f(2) = 78 \mod p$$
$$f(3) = 68 \mod p$$
$$f(4) = 79 \mod p$$
$$f(5) = 82 \mod p$$
$$f(6) = 69 \mod p$$

Reed-Solomon Codes

m_1	m_2	m_3	m_4	m_5	m_6	m_7	m_8
73	78	68	79	82	69	m_7	m_8

Let $p > m_i$

Consider $f(x)$

$$f(1) = 73 \mod p$$

$$f(2) = 78 \mod p$$

$$f(3) = 68 \mod p$$

$$m_7 = f(7) \mod p$$

$$f(4) = 79 \mod p$$

$$f(5) = 82 \mod p$$

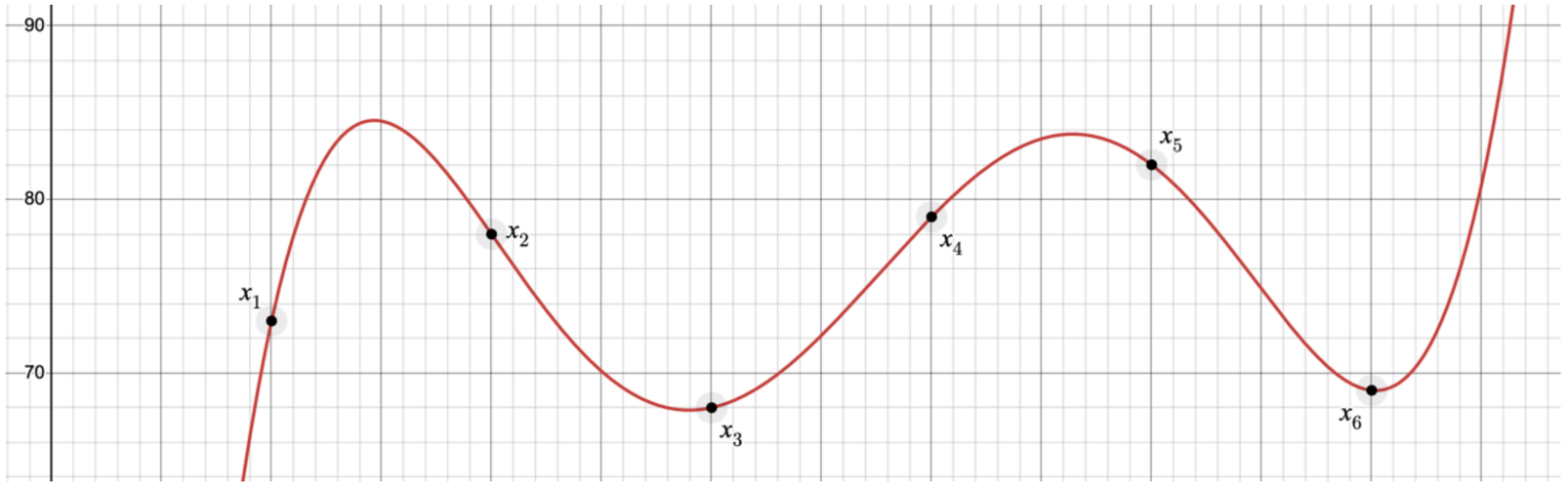
$$f(6) = 69 \mod p$$

$$m_8 = f(8) \mod p$$

Reed-Solomon Codes

m_1	m_2	m_3	m_4	m_5	m_6	m_7	m_8
73	78	68	79	82	69	m_7	m_8

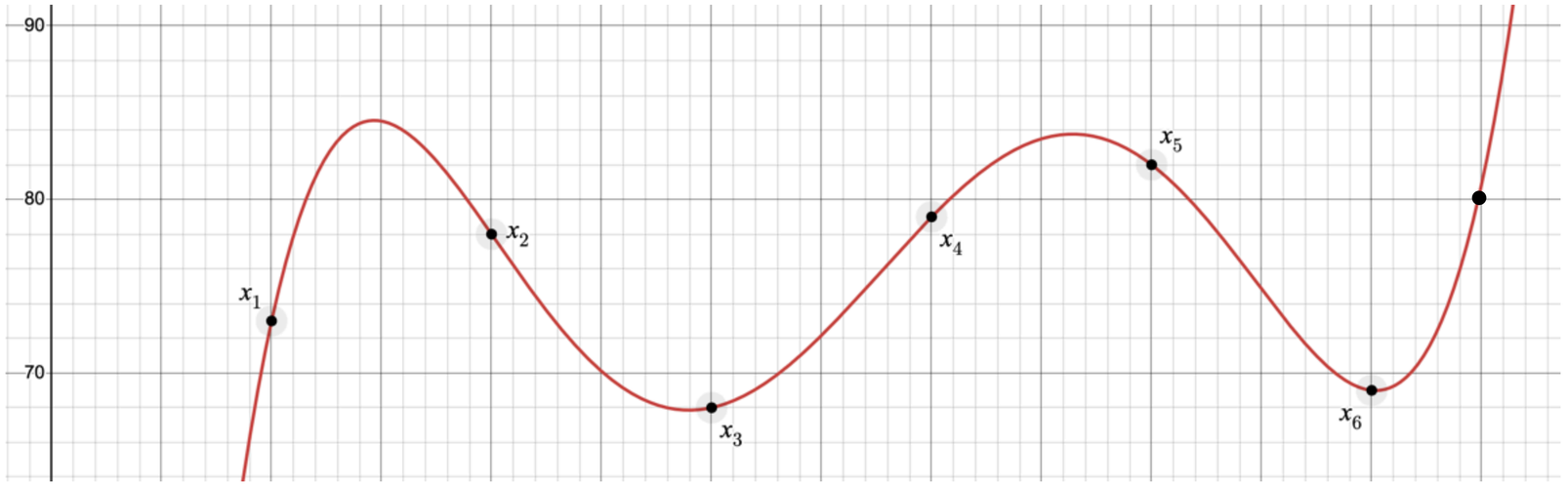
Let $p > m_i$



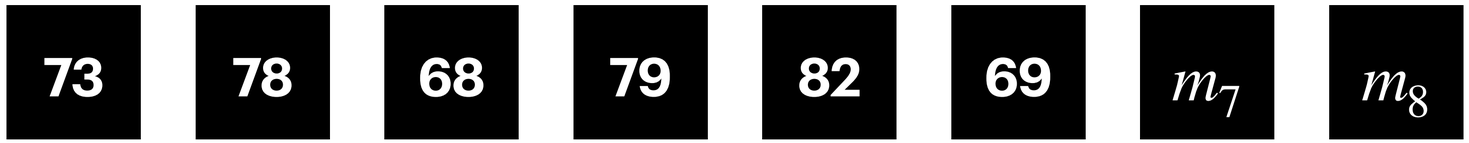
Reed-Solomon Codes

m_1	m_2	m_3	m_4	m_5	m_6	m_7	m_8
73	78	68	79	82	69	m_7	m_8

Let $p > m_i$



Reed-Solomon Codes



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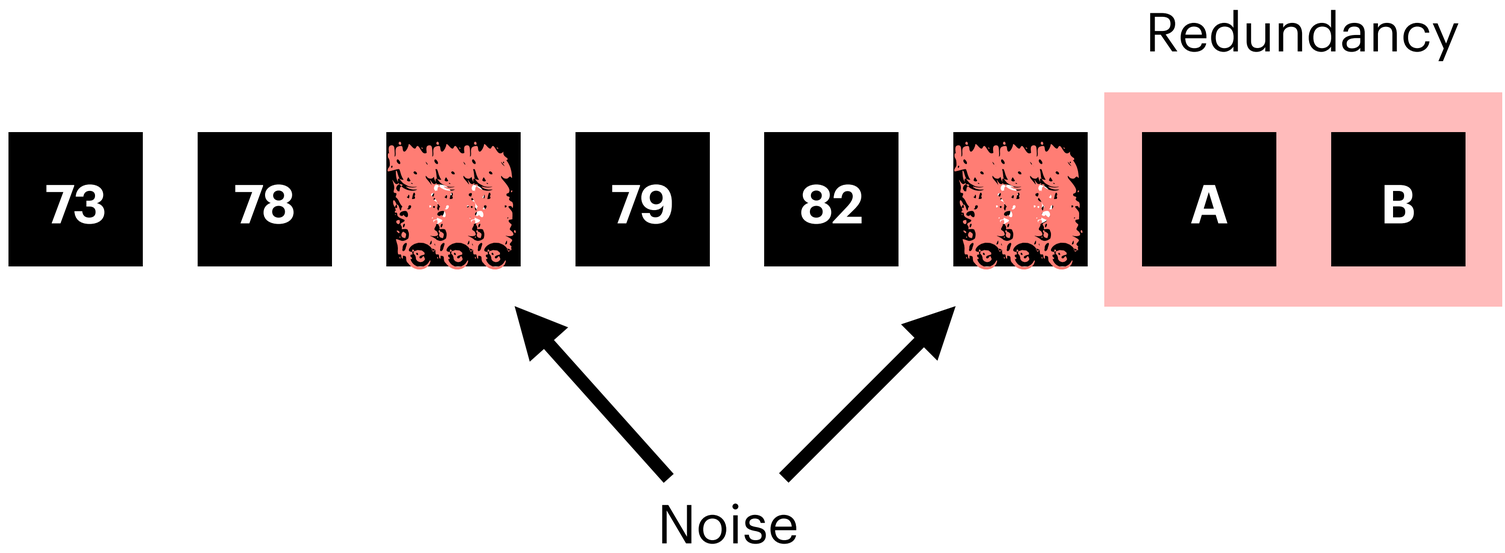
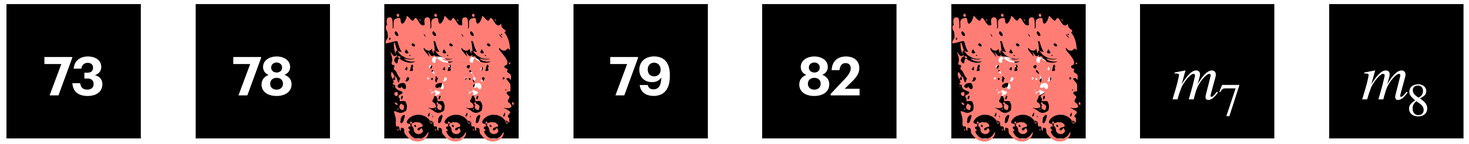


Reed-Solomon Codes



Consider $f(x)$

$f(1) = 73 \mod p$

$f(2) = 78 \mod p$

$f(3) = ?$

$f(7) = m_7 \mod p$

$f(4) = 79 \mod p$

$f(5) = 82 \mod p$

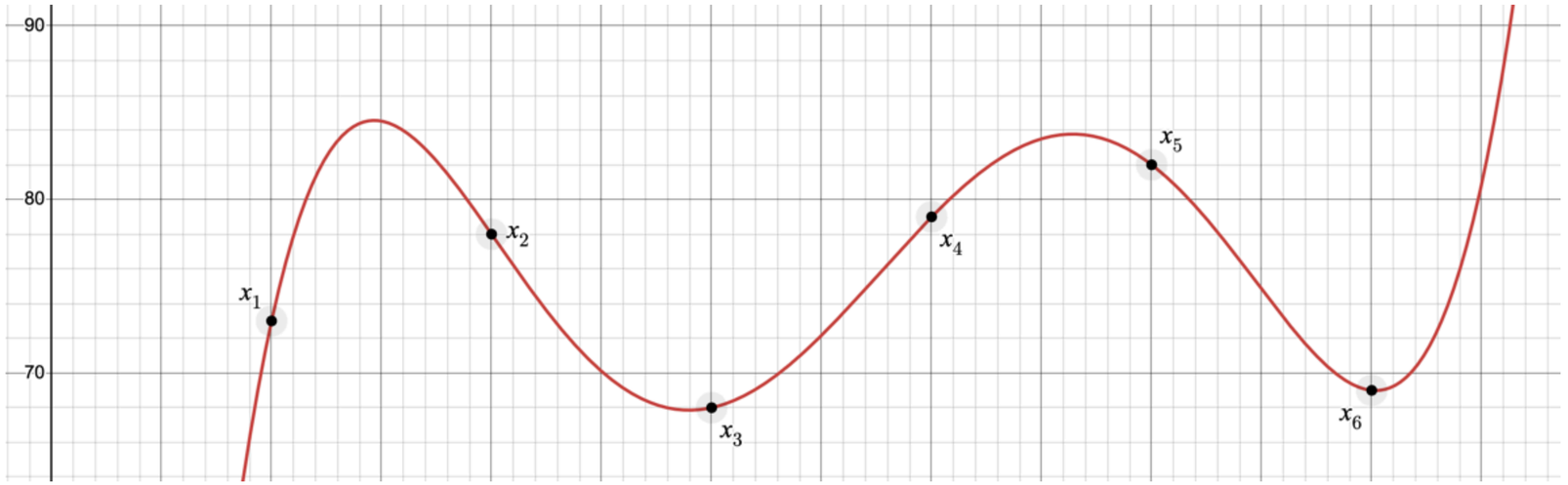
$f(6) = ?$

$m_8 = f(8) \mod p$

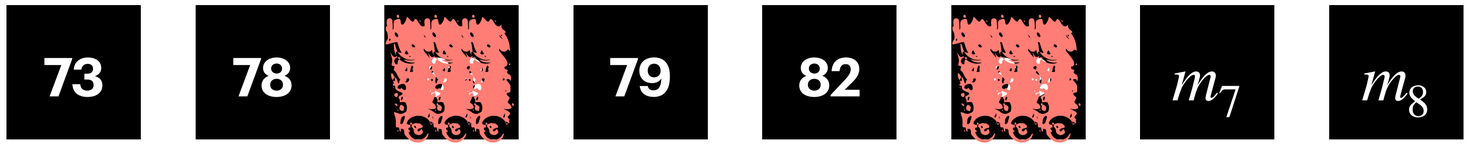
Reed-Solomon Codes

73	78		79	82		m_7	m_8

Consider $f(x)$



Reed-Solomon Codes



Consider $f(x)$

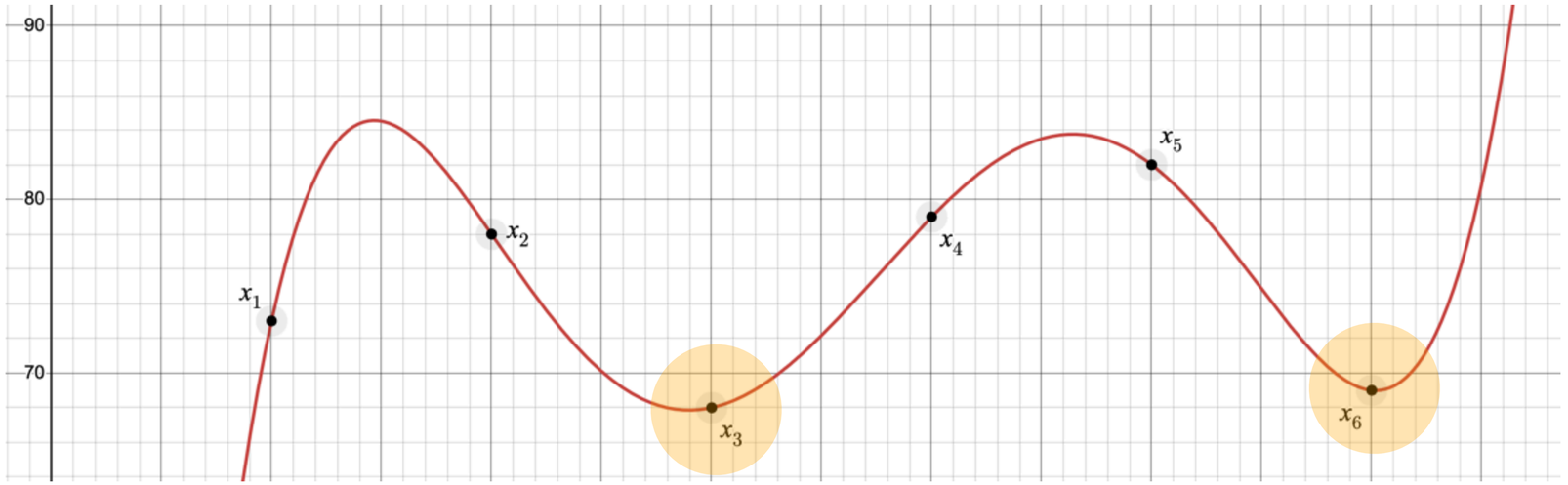
$f(3) = ?$

$f(6) = ?$

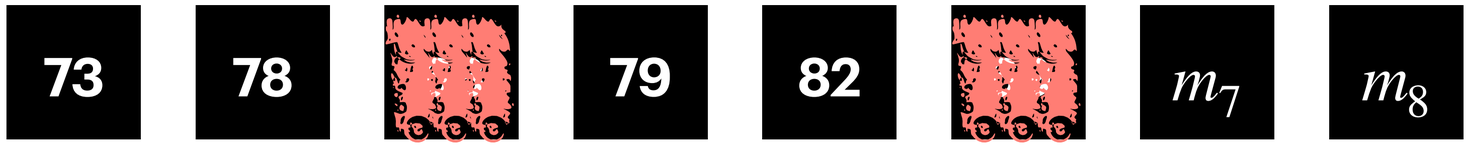
Reed-Solomon Codes

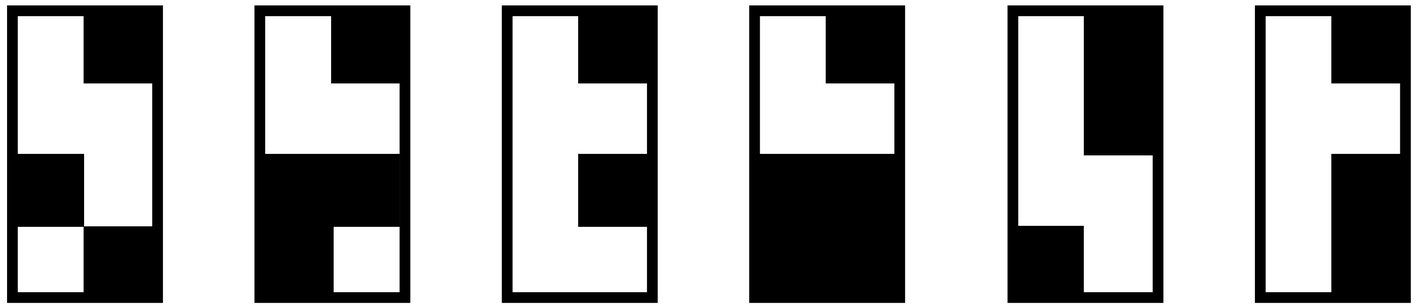
73	78		79	82		m_7	m_8

Consider $f(x)$

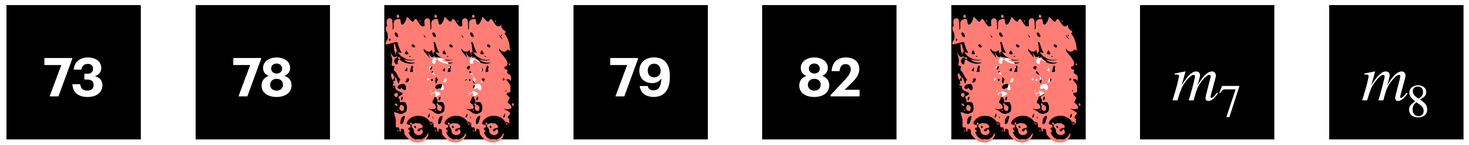


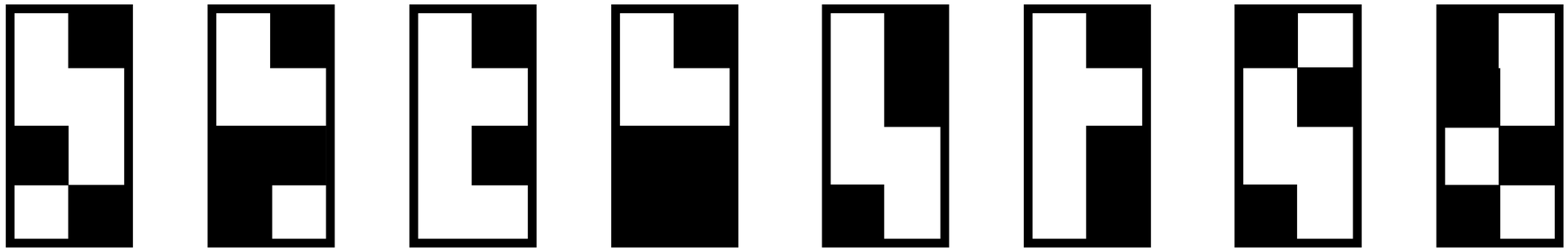
Reed-Solomon Codes



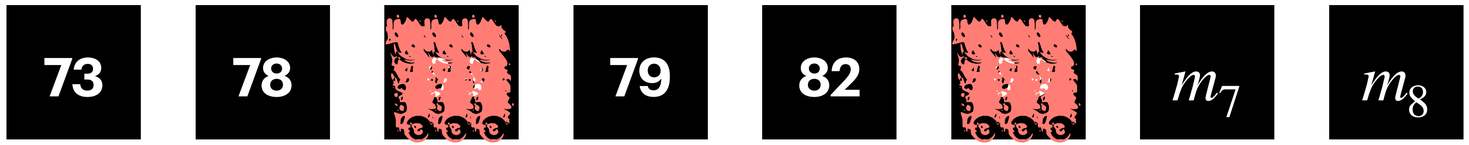


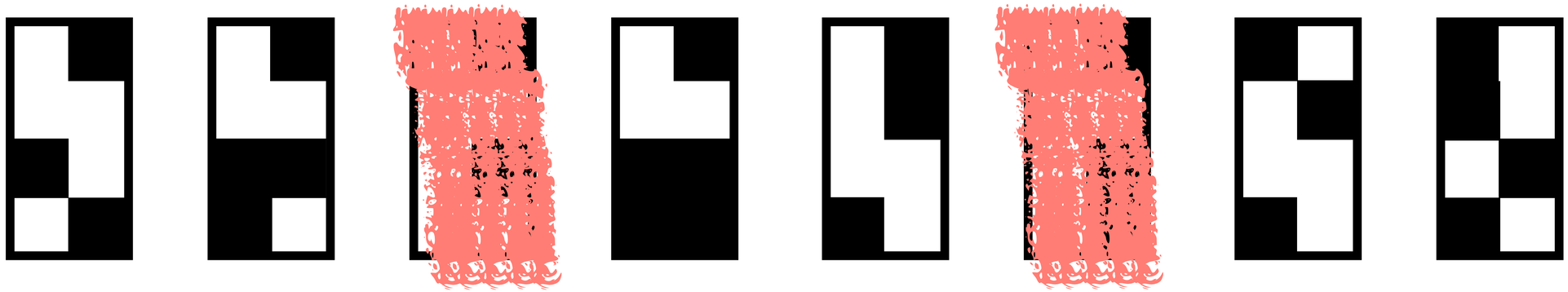
Reed-Solomon Codes





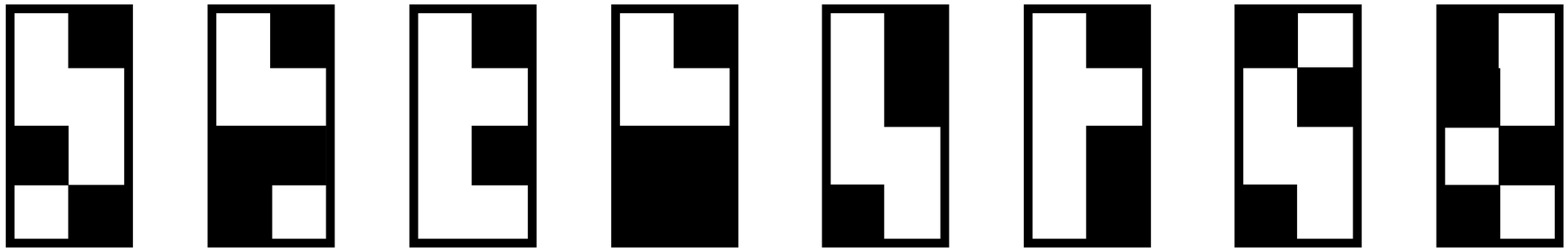
Reed-Solomon Codes

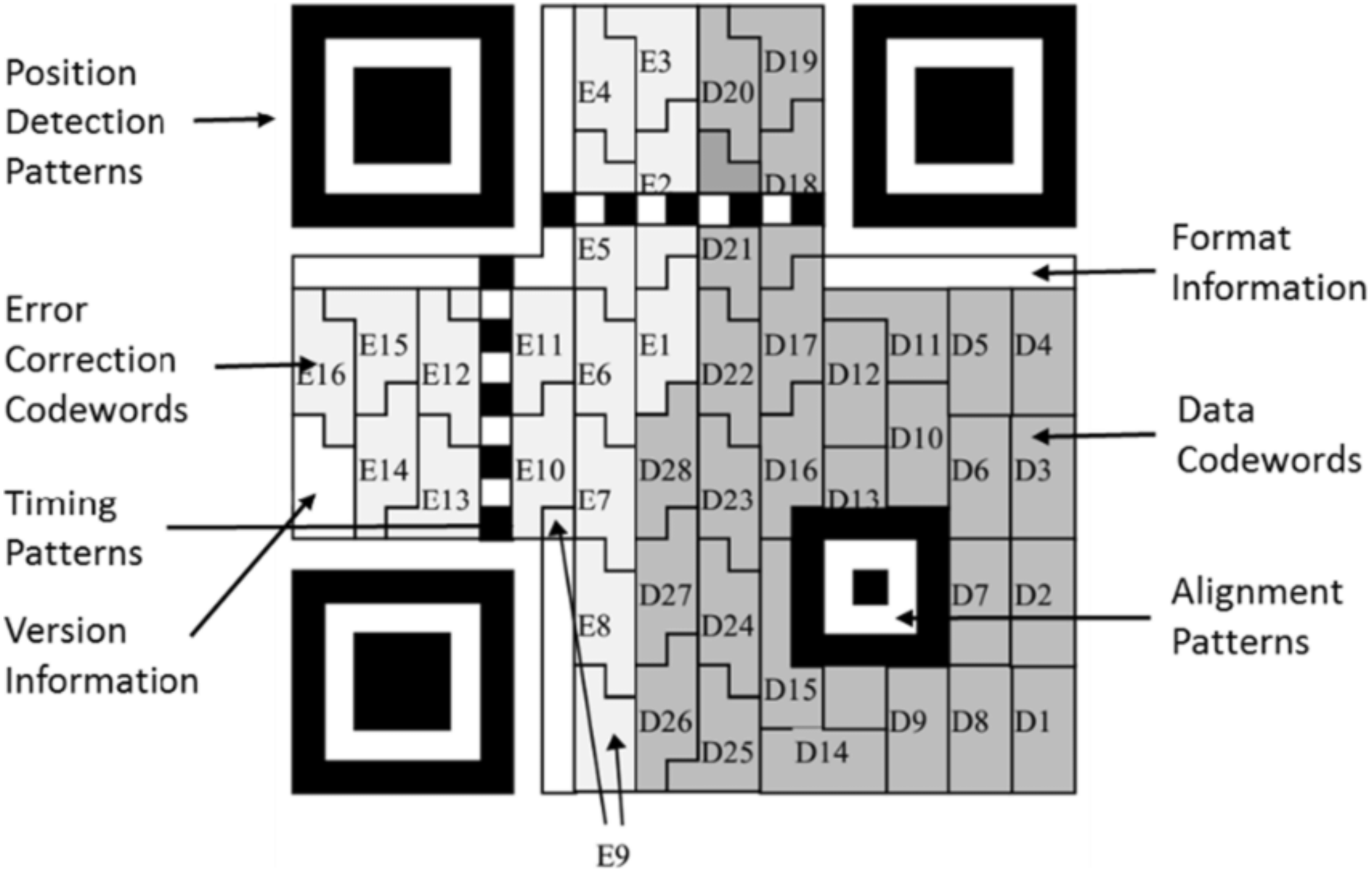




Reed-Solomon Codes

73	78	68	79	82	69	m_7	m_8




Position Detection Patterns
Error Correction Codewords
Timing Patterns
Version Information
Format Information
Data Codewords
Alignment Patterns
E4
E3
D20
D19
E2
D18
E5
D21
E16
E15
E12
E11
E6
E1
D22
D17
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D27
D24
E8
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D15
D26
D25
D14
D9
D8
D1
E9

Modular Arithmetic

Polynomials