Stony Brook University

Error Codes Part II:
CRC Codes Basics

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Error Detecting Codes

ARQ protocols

example

$ber = 10^{-6}$ block size = 1000 bits

1000 blocks

Correcting x 10 $\frac{\text{check bits}}{\text{block}}$ x1000 blocks = 10,000 check bits

Detecting : Single Parity Bit/Block

$10^{-6} \times 1000 \times 1000 \simeq 1$ error

1000 parity bits + 1000 retransmission overhead

$\simeq 2000$ bits

CRC code — Cyclic Redundancy Code ∈ Detecting code

1 0 0 0 1 0 1

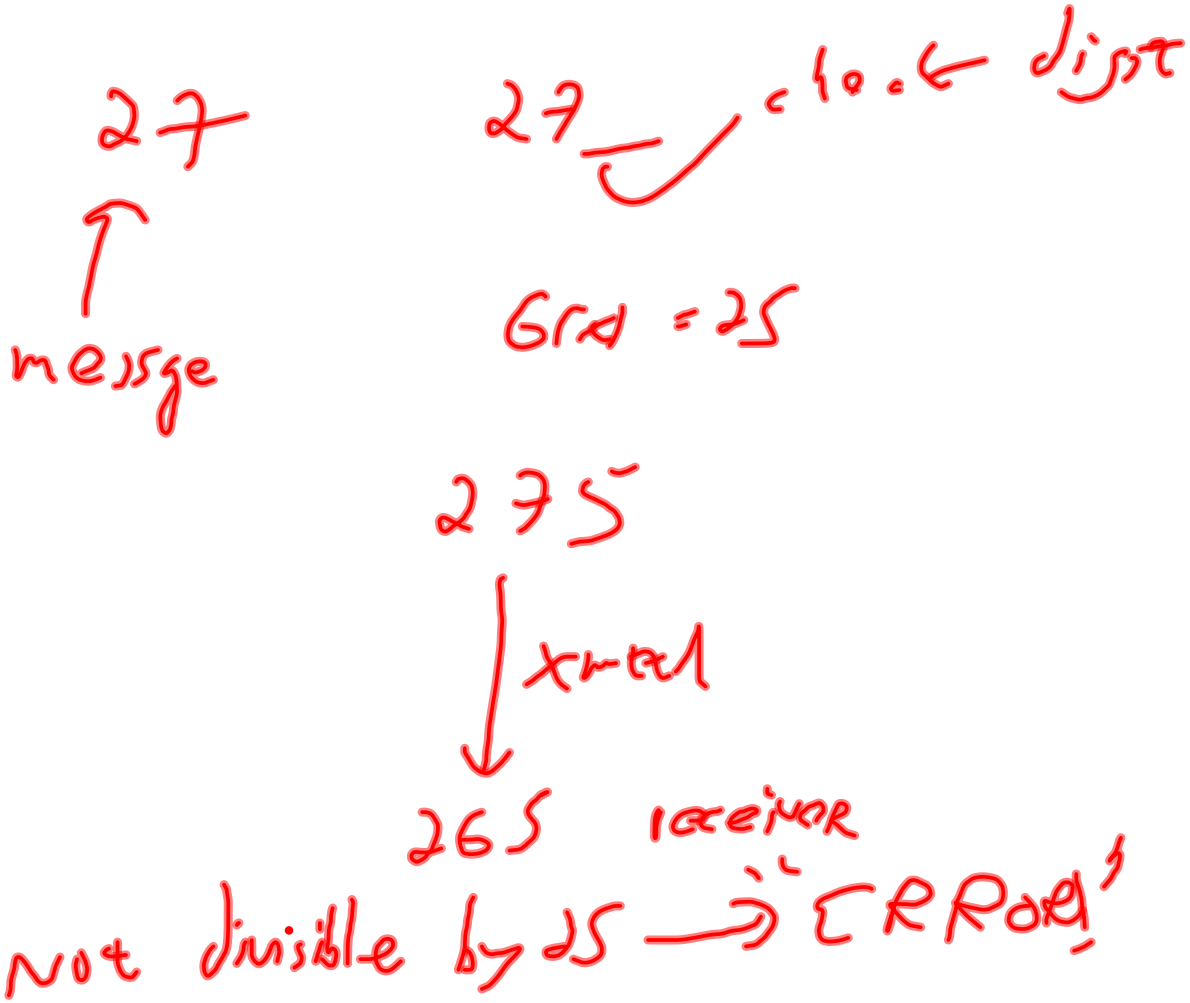
$1x^6 + 0x^5 + 0x^4 + 0x^3 + 1x^2 + 0x^1 + 1x^0$

Agree on G(x) generator polynomial

Append a checksum to message so the new codeword is exactly divisible by G(x).

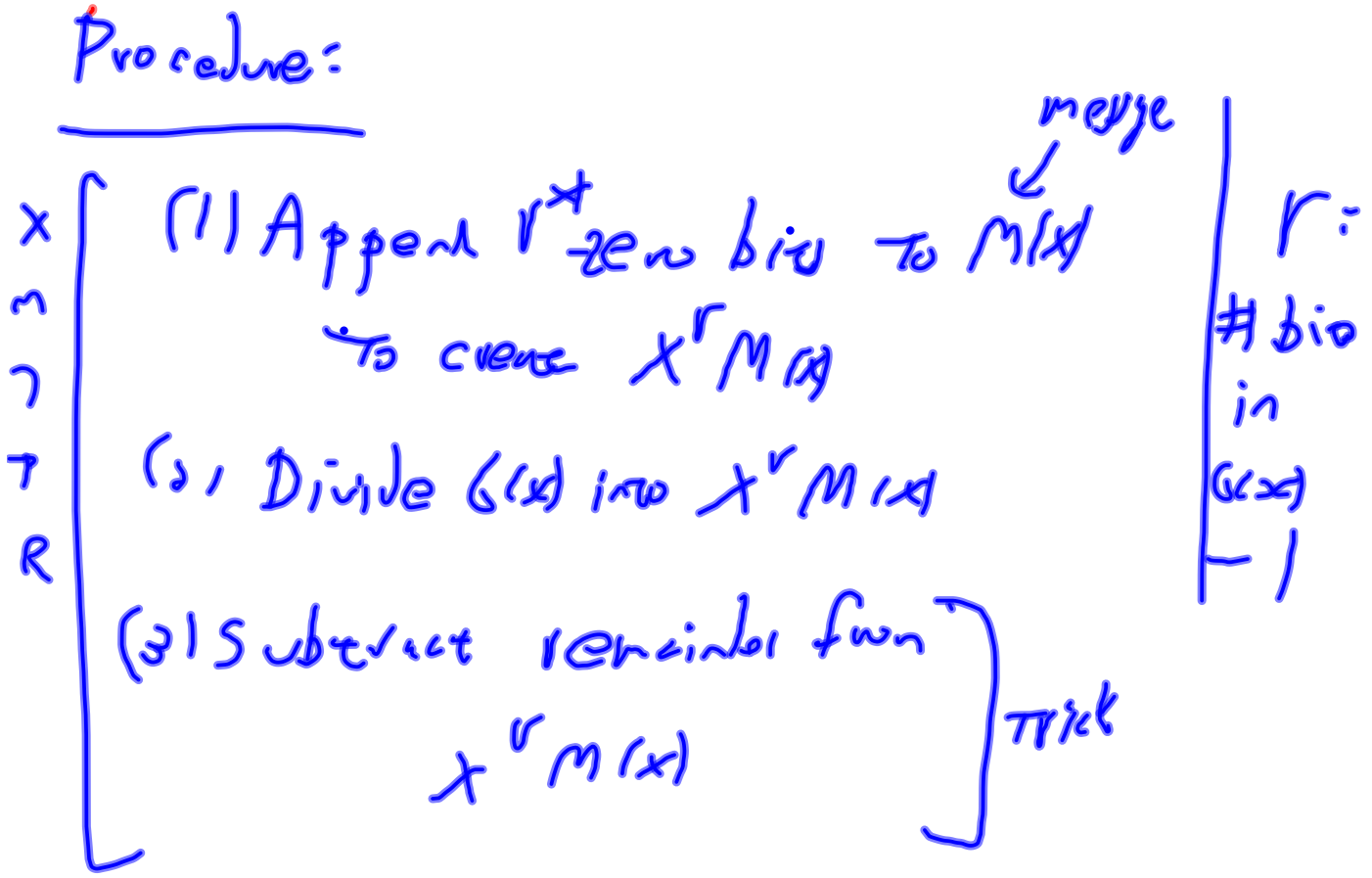
If received codeword is not divisible by G(x)
→ say "error"

If received codeword is divisible by G(x)
→ say "no error"


27
message
27
10 bit dist
GRD = 25
275
transmit
265
receiver
not divisible by 25 → "ERROR"

A	B	A − B
0	0	0
0	1	1
1	0	1
1	1	0

```
  1 1 1 1
- 1 0 1 1
---------
  0 1 0 0
```


Procedure:
merge
(1) Append r zero bits to M(x)
to create $x^r M(x)$
(2) Divide G(x) into $x^r M(x)$
(3) Subtract remainder from
$x^r M(x)$
Transmit
r:
bits
in
G(x)

```
            10011
      ___________
10011 ) 100000000
        10011
        -----
          11000
          10011
          -----
           10110
           10011
           -----
            0101
```

A	B	A−B
0	0	0
0	1	1
1	0	1
1	1	0

message = 10000

Gen = 10011

0101 → remainder becomes checkbits

```
  100000000
 −     0101
 ----------
  100000101
```