

6G5Z1005 – Computer Networks & Operating Systems

Exercise 2: Error Detection – Solutions

1. 1

	A	c	e
MSB (parity bit)	0	0	0
	1	1	1
	0	1	1
	0	0	0
	0	0	0
	0	0	1
	0	1	0
LSB	1	1	1

Bit stream sent. BCC on right
 <-- 100000101110001101010011011100010

Bit stream sent. BCC on left
 01000111011001010110001101000001 -->
 3

	C	u	p
MSB (parity bit)	1	1	1
	1	1	1
	0	1	1
	0	1	1
	0	0	0
	0	1	0
	1	0	0
LSB	1	1	0

Bit stream sent. BCC on right
 <-- 11000011101011110000111101100011

Bit stream sent. BCC on left
 11000110111100001111010111000011 -->

2

	B	a	t
MSB (parity bit)	0	1	0
	1	1	1
	0	1	1
	0	0	1
	0	0	0
	0	0	1
	1	0	0
LSB	0	1	0

Bit stream sent. BCC on right
 <-- 01000010100001110010111011101011

Bit stream sent. BCC on left
 11010111011101001110000101000010 -->
 4

	D	i	g
MSB (parity bit)	0	0	1
	1	1	1
	0	1	1
	0	0	0
	0	1	0
	1	0	1
	0	0	1
LSB	0	1	1

Bit stream sent. BCC on right
 <-- 00100010100101101110011101010011

Bit stream sent. BCC on left
 11001010111001110110100101000100 -->

5

	E	l	m
MSB (parity bit)	1	0	1 0
	1	1	1 1
	0	1	1 0
	0	0	0 0
	0	1	1 0
	1	1	1 1
	0	0	0 0
LSB	1	0	1 0

Bit stream sent. BCC on right
 <-- 10100011001101101011011100100010

Bit stream sent. BCC on left
 01000100111011010110110011000101 -->
 7

	G	e	l
MSB (parity bit)	0	0	0 0
	1	1	1 1
	0	1	1 0
	0	0	0 0
	0	0	1 1
	1	1	1 1
	1	0	0 1
LSB	1	1	0 0

Bit stream sent. BCC on right
 <-- 11100010101001100011011001110010

Bit stream sent. BCC on left
 01001110011011000110010101000111 -->
 9

	I	v	y
MSB (parity bit)	1	1	1 1
	1	1	1 1
	0	1	1 0
	0	1	1 0
	1	0	1 0
	0	1	0 1
	0	1	0 1
LSB	1	0	1 0

Bit stream sent. BCC on right
 <-- 10010011011011111001111101100011

Bit stream sent. BCC on left
 11000110111110011111011011001001 -->

6

	F	u	n
MSB (parity bit)	1	1	1 1
	1	1	1 1
	0	1	1 0
	0	1	0 1
	0	0	1 1
	1	1	1 1
	1	0	1 0
LSB	0	1	0 1

Bit stream sent. BCC on right
 <-- 0110001110101111011101110111011

Bit stream sent. BCC on left
 11011101111011101111010111000110 -->
 8

	H	i	d
MSB (parity bit)	0	0	1 1
	1	1	1 1
	0	1	1 0
	0	0	0 0
	1	1	0 0
	0	0	1 1
	0	0	0 0
LSB	0	1	0 1

Bit stream sent. BCC on right
 <-- 00010010100101100010011110100011

Bit stream sent. BCC on left
 11000101111001000110100101001000 -->
 10

	J	a	m
MSB (parity bit)	1	1	1 1
	1	1	1 1
	0	1	1 0
	0	0	0 0
	1	0	1 0
	0	0	1 1
	1	0	0 1
LSB	0	1	1 0

Bit stream sent. BCC on right
 <-- 01010011100001111011011101100011

Bit stream sent. BCC on left
 11000110111011011110000111001010 -->

11

	K	e	y
MSB (parity bit)	0	0	1 1
	1	1	1 1
	0	1	1 0
	0	0	1 1
	1	0	1 0
	0	1	0 1
	1	0	0 1
LSB	1	1	1 1

Bit stream sent. BCC on right
 <-- 1101001010100110100111111101011

Bit stream sent. BCC on left
 1101011111110010110010101001011 -->
 13

	M	a	t
MSB (parity bit)	0	1	0 1
	1	1	1 1
	0	1	1 0
	0	0	1 1
	1	0	0 1
	1	0	1 0
	0	0	0 0
LSB	1	1	0 0

Bit stream sent. BCC on right
 <-- 10110010100001110010111000011011

Bit stream sent. BCC on left
 11011000011101001110000101001101 -->
 15

	O	u	t
MSB (parity bit)	1	1	0 0
	1	1	1 1
	0	1	1 0
	0	1	1 0
	1	0	0 1
	1	1	1 1
	1	0	0 1
LSB	1	1	0 0

Bit stream sent. BCC on right
 <-- 11110011101011110010111001110010

Bit stream sent. BCC on left
 01001110011101001111010111001111 -->

12

	L	o	p
MSB (parity bit)	1	0	1 0
	1	1	1 1
	0	1	1 0
	0	0	1 1
	1	1	0 0
	1	1	0 0
	0	1	0 1
LSB	0	1	0 1

Bit stream sent. BCC on right
 <-- 00110011111101100000111111001010

Bit stream sent. BCC on left
 01010011111100000110111111001100 -->
 14

	N	i	b
MSB (parity bit)	0	0	1 1
	1	1	1 1
	0	1	1 0
	0	0	0 0
	1	1	0 0
	1	0	0 1
	1	0	1 0
LSB	0	1	0 1

Bit stream sent. BCC on right
 <-- 01110010100101100100011110100011

Bit stream sent. BCC on left
 11000101111000100110100101001110 -->
 16

	P	i	p
MSB (parity bit)	0	0	1 1
	1	1	1 1
	0	1	1 0
	1	0	1 0
	0	1	0 1
	0	0	0 0
	0	0	0 0
LSB	0	1	0 1

Bit stream sent. BCC on right
 <-- 00001010100101100000111110010011

Bit stream sent. BCC on left
 11001001111100000110100101010000 -->

17

	Q	u	e
MSB (parity bit)	1	1	0 0
	1	1	1 1
	0	1	1 0
	1	1	0 0
	0	0	0 0
	0	1	1 0
	0	0	0 0
LSB	1	1	1 1

Bit stream sent. BCC on right
 <-- 10001011101011111010011010000010

Bit stream sent. BCC on left
 01000001011001011111010111010001 -->
 19

	S	a	m
MSB (parity bit)	0	1	1 0
	1	1	1 1
	0	1	1 0
	1	0	0 1
	0	0	1 1
	0	0	1 1
	1	0	0 1
LSB	1	1	1 1

Bit stream sent. BCC on right
 <-- 1100101010000111101101111111010

Bit stream sent. BCC on left
 0101111111011011110000101010011 -->
 21

	U	r	l
MSB (parity bit)	0	0	0 0
	1	1	1 1
	0	1	1 0
	1	1	0 0
	0	0	1 1
	1	0	1 0
	0	1	0 1
LSB	1	0	0 1

Bit stream sent. BCC on right
 <-- 10101010010011100011011011010010

Bit stream sent. BCC on left
 01001011011011000111001001010101 -->

18

	R	a	d
MSB (parity bit)	1	1	1 1
	1	1	1 1
	0	1	1 0
	1	0	0 1
	0	0	0 0
	0	0	1 1
	1	0	0 1
LSB	0	1	0 1

Bit stream sent. BCC on right
 <-- 01001011100001110010011111101011

Bit stream sent. BCC on left
 11010111111001001110000111010010 -->
 20

	T	o	r
MSB (parity bit)	1	0	0 1
	1	1	1 1
	0	1	1 0
	1	0	1 0
	0	1	0 1
	1	1	0 0
	0	1	1 0
LSB	0	1	0 1

Bit stream sent. BCC on right
 <-- 00101011111101100100111010010011

Bit stream sent. BCC on left
 11001001011100100110111111010100 -->
 22

	V	e	x
MSB (parity bit)	0	0	0 0
	1	1	1 1
	0	1	1 0
	1	0	1 0
	0	0	1 1
	1	1	0 0
	1	0	0 1
LSB	0	1	0 1

Bit stream sent. BCC on right
 <-- 01101010101001100001111011010010

Bit stream sent. BCC on left
 01001011011110000110010101010110 -->

23

	W	o	k	
MSB (parity bit)	1	0	1	0
	1	1	1	1
	0	1	1	0
	1	0	0	1
	0	1	1	0
	1	1	0	0
	1	1	1	1
LSB	1	1	1	1

Bit stream sent. BCC on right
 <-- 11101011111101101101011111001010

Bit stream sent. BCC on left
 01010011111101101101111111010111 -->
 25

	Y	a	w	
MSB (parity bit)	0	1	0	1
	1	1	1	1
	0	1	1	0
	1	0	1	0
	1	0	0	1
	0	0	1	1
	0	0	1	1
LSB	1	1	1	1

Bit stream sent. BCC on right
 <-- 10011010100001111110111011110011

Bit stream sent. BCC on left
 11001111011101111110000101011001 -->

24

	X	e	r	
MSB (parity bit)	1	0	0	1
	1	1	1	1
	0	1	1	0
	1	0	1	0
	1	0	0	1
	0	1	0	1
	0	0	1	1
LSB	0	1	0	1

Bit stream sent. BCC on right
 <-- 00011011101001100100111011110011

Bit stream sent. BCC on left
 11001111011100100110010111011000 -->
 26

	Z	i	p	
MSB (parity bit)	0	0	1	1
	1	1	1	1
	0	1	1	0
	1	0	1	0
	1	1	0	0
	0	0	0	0
	1	0	0	1
LSB	0	1	0	1

Bit stream sent. BCC on right
 <-- 01011010100101100000111111000011

Bit stream sent. BCC on left
 11000011111100000110100101011010 -->

2.

	\	o	g	BCC
(Parity bit) MSB	1	1	1	0
	1	1	1	0
	0	1	0	0
	1	0	0	1
	1	1	0	0
	1	1	1	0
	0	1	1	1
	LSB 0	1	1	1

The shaded bits in the BCC indicate an error or errors in the rows concerned.

3.

(Data sets 1, 7, 13, 19, 25)

Divisor = 1010

1101110000

^1010

1111

^1010

1011

^1010

1000

^1010

100

Message transmitted = 1101110100

(Data sets 3, 9, 15, 21)

Divisor = 1011

1100111000

^1011

1111

^1011

1001

^1011

1010

^1011

100

Message transmitted = 1100111100

(Data sets 5, 11, 17, 23)

Divisor = 1110

1101010000

^1110

1101

^1110

1100

^1110

1000

^1110

110

Message transmitted = 1101010110

(Data sets 2, 8, 14, 20, 26)

Divisor = 1101

1011011000

^1101

1100

^1101

1110

^1101

1100

^1101

001

Message transmitted = 1011011001

(Data sets 4, 10, 16, 22)

Divisor = 1001

1100111000

^1001

1011

^1001

1011

^1001

1000

^1001

010

Message transmitted = 1100111010

(Data sets 6, 12, 18, 24)

Divisor = 1100

1110101000

^1100

1010

^1100

1101

^1100

1000

^1100

100

Message transmitted = 1110101100

4. (Data sets 1, 7, 13, 19, 25)

Divisor = 1010

1101110

^1010

1111

^1010

1011

^1010

010

Error in message!

(Data sets 3, 9, 15, 21)

Divisor = 1011

1100111

^1011

1111

^1011

1001

^1011

101

Error in message!

(Data sets 5, 11, 17, 23)

1101010

^1110

1101

^1110

110

Error in message!

(Data sets 2, 8, 14, 20, 26)

Divisor = 1101

1011011

^1101

1100

^1101

111

Error in message!

(Data sets 4, 10, 16, 22)

Divisor = 1001

1100111

^1001

1011

^1001

1011

^1001

010

Error in message!

(Data sets 6, 12, 18, 24)

Divisor = 1100

1110101

^1100

1010

^1100

1101

^1100

001

Error in message!