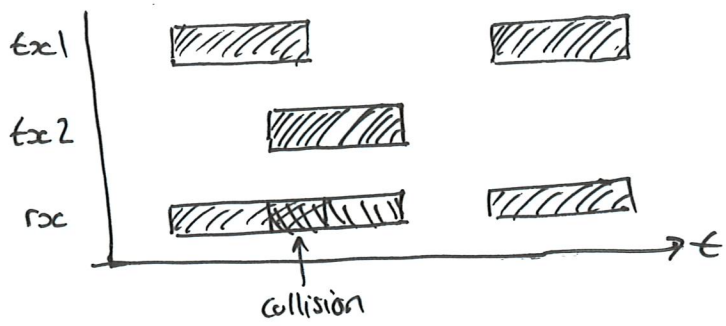
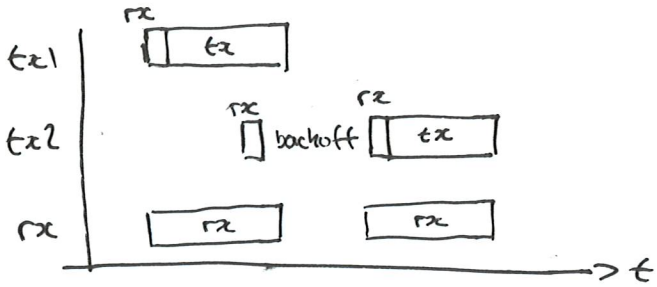
2022/23 Q1a

ALOHA



Non-persistent CSMA



Q1bi

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
p1	p2	M3	p4	M5	M6	M7	p8	M9	M10	M11	M12	M13	M14	M15
0	1	0	0	1	1	0	0	1	1	0	0	1	0	1

Q1bii

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	1	0	0	1	1	1	0	1	1	0	0	1	0	1

$P_8 = 0$
$P_4 = 1$
$P_2 = 1$
$P_1 = 1$

$\neq 0$ ∴ error occurred at bit $0111_2 = 7$

Q1b iii

error syndrome of 8_{10}

biv

Hamming (15,11)

6x Hamming Codes per frame.

90 bits of data/frame (26 bits overhead)

as error correction, no retransmissions.

Parity

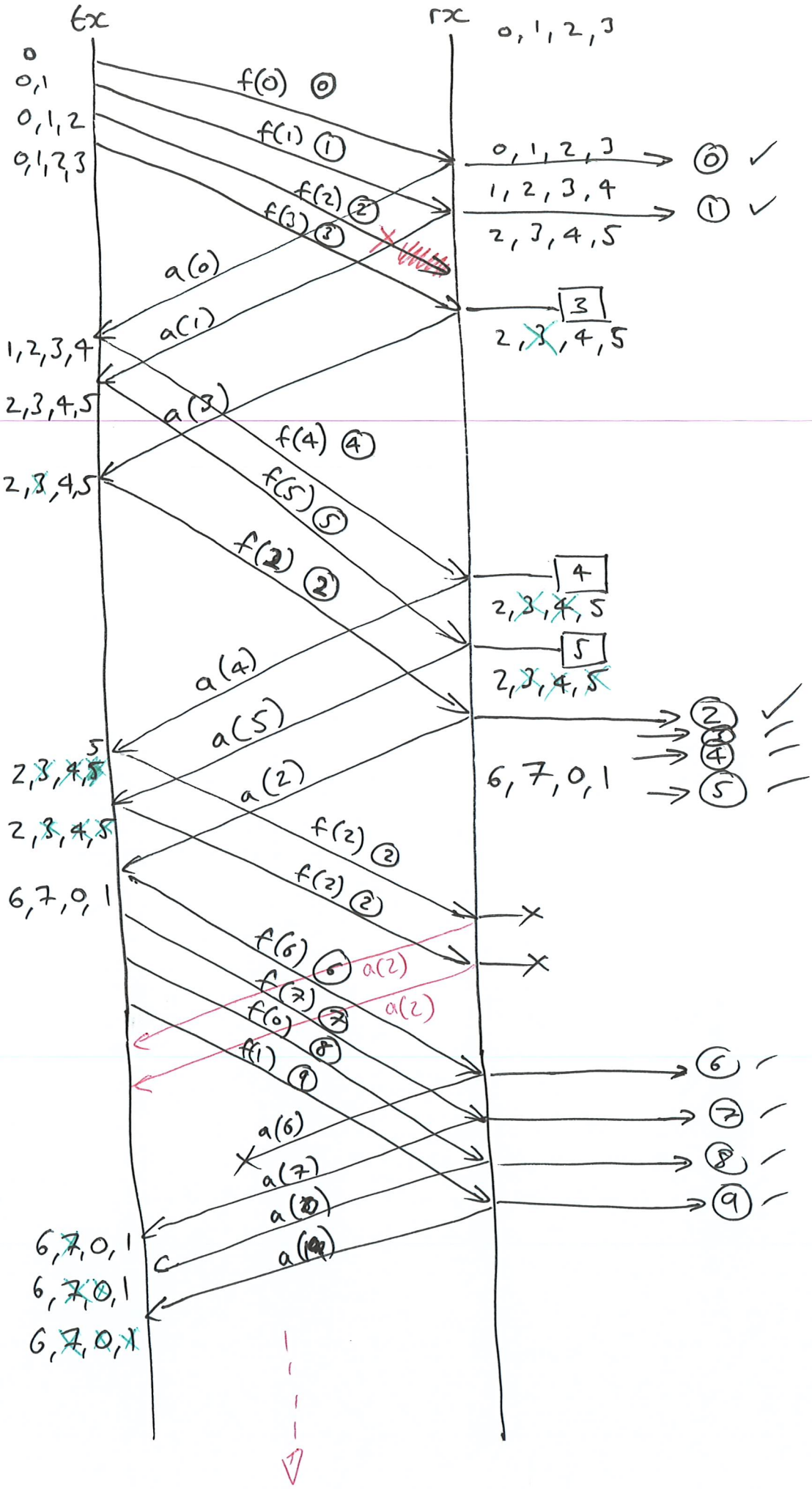
64 bit + 1 parity bit

$$\frac{1}{1\times10^{-3}\times 65} = 1 \text{ in } 15.4 \text{ frames erroneous}$$

$$\frac{65}{15.4} = 4.22 \text{ bits/frame.}$$

overhead/frame = 1 + 4.22 bits/frame

c


tx
rx
0, 1, 2, 3
0
0,1
0,1,2
0,1,2,3
f(0) ⓪
f(1) ①
f(2) ②
f(3) ③
0, 1, 2, 3
⓪ ✓
1, 2, 3, 4
① ✓
2, 3, 4, 5
a(0)
a(1)
3
2, 3, 4, 5
1,2,3,4
2,3,4,5
a(3)
f(4) ④
f(5) ⑤
f(2) ②
4
2, 3, 4, 5
5
2, 3, 4, 5
a(4)
a(5)
a(2)
2
4
5
6, 7, 0, 1
2,3,4,5
2,3,4,5
6,7,0,1
f(2) ②
f(2) ②
f(6) ⑥
f(7) ⑦
f(0) ⑧
f(1) ⑨
a(2)
a(2)
6
7
8
9
a(6)
a(7)
a(0)
a(1)
6,7,0,1
6,7,0,1
6,7,0,1