University Kasdi Merbah of Ouargla
Faculty of new technologies for information and communication
Department of Electronics and Telecommunications
Master 2 SS: Electronics of Embedded systems

A

Janvier 2024
2023/2024
Farid KADRI
45 min

Information Coding and Security

EXAM

Nom : .....
Prénom : .....

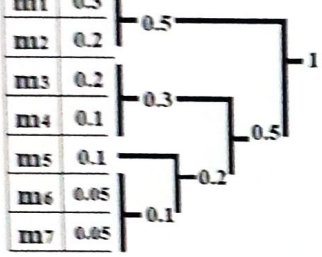
07pts. Exercise 1: Consider the following codes:

(a)

mi	pi	I	II	III	IV
m1	0.3	1	1		
m2	0.2	1	0		
m3	0.2	0	1		
m4	0.1	0	0	1	1
m5	0.1	0	0	1	0
m6	0.05	0	0	0	1
m7	0.05	0	0	0	0

(b)

mi	pi
m1	0.3
m2	0.2
m3	0.2
m4	0.1
m5	0.1
m6	0.05
m7	0.05

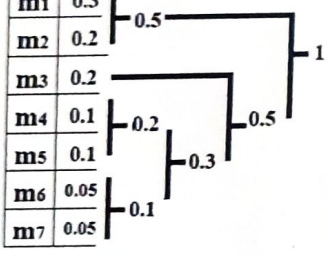


(c)

mi	pi	I	II	III	IV
m1	0.3	1	1		
m2	0.2	1	0		
m3	0.2	0	1	1	
m4	0.1	0	1	0	
m5	0.1	0	0	1	
m6	0.05	0	0	0	1
m7	0.05	0	0	0	0

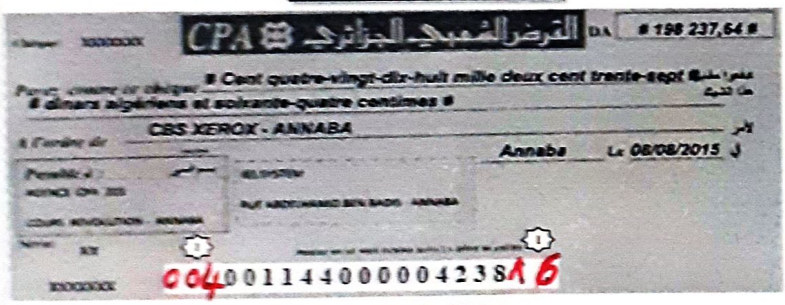
(d)

mi	pi
m1	0.3
m2	0.2
m3	0.2
m4	0.1
m5	0.1
m6	0.05
m7	0.05



- ✓ The maximum of Entropy is : $\log_2 7 = \ln 7 / \ln 2 = 2.81$ bit/mess
- ✓ The invalid code is : d
- ✓ The efficient *Shannon Fano* code is : c....., and it's variance is : $\sigma^2 = 0.44 \Rightarrow \sigma = 0.66$
- ✓ The efficient *Huffman* code is : b....., and it's average length is : $L_{av} = 2.6$ bit/mess
- ✓ The least efficient code is : a....., and it's variance is : $\sigma^2 = 0.84 \Rightarrow \sigma = 0.91$

07pts. Exercise 2: Complete to create a valid code ?



06pts. Exercise 3:

- ✓ Consider a *Hamming* code, and fill in the tables below?

Information : *mi*				Code word : *Ci*						
1	1	1	0	1	1	1	0	0	0	0
0	1	1	1	0	1	1	1	1	0	0
0	1	0	1	0	1	0	1	0	1	0
0	1	1	0	0	1	1	0	0	1	1
1	0	0	0	1	0	0	0	0	1	1
1	0	1	1	1	0	1	1	0	1	0

6 x 0.5

Received code word *Ci*							Corrected code word *Ci*						
1	0	1	1	0	1	1	1	0	1	1	0	1	0
0	0	0	0	1	1	0	0	0	1	0	1	1	0
1	1	1	0	1	1	1	1	1	1	0	1	1	1
1	1	0	0	1	0	1	0	1	0	0	1	0	1
1	0	1	0	0	0	1	1	0	1	0	0	0	1
1	0	0	1	1	1	1	0	0	0	1	1	1	1

6 x 0.5

Take courage

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EXAM

Nom : .....
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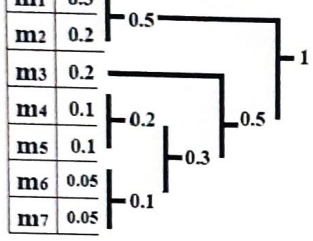
07 pts. Exercise 1: Consider the following codes:

(a)

m_i	p_i	I	II	III	IV
m_1	0.3	1	1		
m_2	0.2	1	0		
m_3	0.2	0	1	1	
m_4	0.1	0	1	0	
m_5	0.1	0	0	1	
m_6	0.05	0	0	0	1
m_7	0.05	0	0	0	0

(b)

m_i	p_i
m_1	0.3
m_2	0.2
m_3	0.2
m_4	0.1
m_5	0.1
m_6	0.05
m_7	0.05

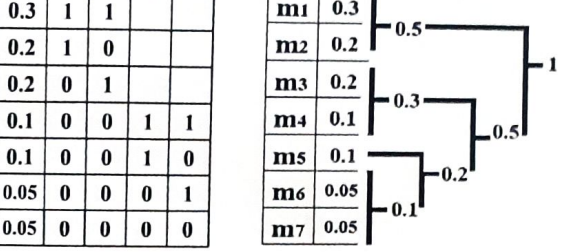


(c)

m_i	p_i	I	II	III	IV
m_1	0.3	1	1		
m_2	0.2	1	0		
m_3	0.2	0	1		
m_4	0.1	0	0	1	1
m_5	0.1	0	0	1	0
m_6	0.05	0	0	0	1
m_7	0.05	0	0	0	0

(d)

m_i	p_i
m_1	0.3
m_2	0.2
m_3	0.2
m_4	0.1
m_5	0.1
m_6	0.05
m_7	0.05



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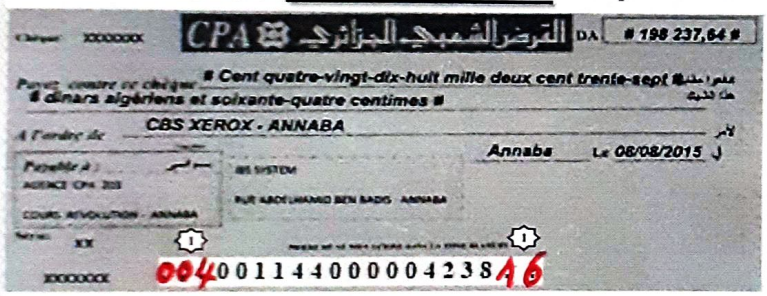
- ✓ The invalid code is : b
- ✓ The efficient *Shannon Fano* code is : a, and it's variance is : $\sigma^2 = 0,44 \Rightarrow \sigma = 0,66$
- ✓ The efficient *Huffman* code is : d, and it's average length is : $l_{av} = 2,6$ bit/mess
- ✓ The least efficient code is : c, and it's variance is : $\sigma^2 = 0,84 \Rightarrow \sigma = 0,91$

07 pts. Exercise 2: Complete to create a valid code ?



06 pts. Exercise 3:

✓ Consider a *Hamming* code, and fill in the tables below?

Information : *mi*				Code word : *Ci*						
0	1	0	1	0	1	0	1	0	1	0
0	1	1	0	0	1	1	0	0	1	1
1	1	1	0	1	1	1	0	0	0	0
0	1	1	1	0	1	1	1	1	0	0
1	0	0	0	1	0	0	0	0	1	1
1	0	1	1	1	0	1	1	0	1	0

6 x 0.5

Received code word *Ci*							Corrected code word *Ci*						
1	1	1	0	1	1	1	1	1	1	1	1	1	1
1	1	0	0	1	0	1	0	1	0	0	1	0	1
1	0	1	1	0	1	1	1	0	1	1	0	1	0
0	0	0	0	1	1	0	0	0	1	0	1	1	0
1	0	1	0	0	0	1	1	0	1	0	0	0	1
1	0	0	1	1	1	1	0	0	0	1	1	1	1

6 x 0.5

Take courage