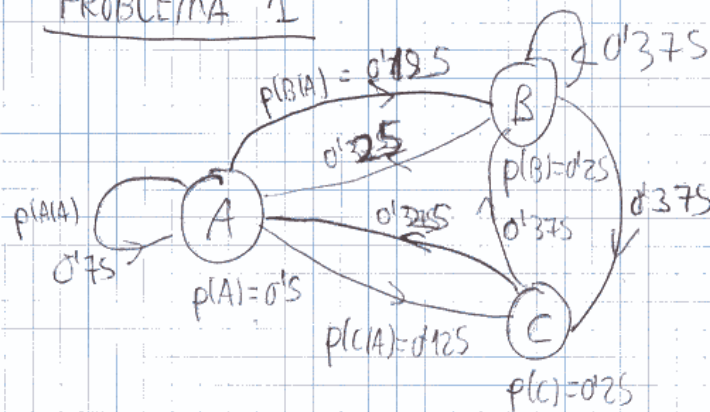


PROBLEMA 1

$$\begin{cases} p(A|A) = 0.75 \\ p(B|A) = p(C|A) = 0.125 \\ p(B|B) = p(B|C) = p(C|B) = p(C|C) = 0.375 \\ p(A|B) = p(A|C) = 0.25 \end{cases}$$

$$H(F) = p(A) \cdot H(F|A) + p(B) \cdot H(F|B) + p(C) \cdot H(F|C)$$

$$\begin{aligned} H(F|A) &= -p(A|A) \log_2 p(A|A) - p(B|A) \log_2 p(B|A) - p(C|A) \log_2 p(C|A) \\ &= -0.75 \log_2 0.75 - 2 \cdot 0.125 \log_2 0.125 = \\ &= \frac{1}{0.301} (0.093) = \underline{1.0612} \end{aligned}$$

$$\begin{aligned} H(F|B) &= \frac{1}{\log_2} (0.25 \log 0.25 + 2 \cdot 0.375 \log 0.375) = \underline{1.5643} \\ &= H(F|C) \end{aligned}$$

$$I_{\text{mín}} = 10^5 \text{ símbolos} \cdot 1'31125 \text{ bit/símbolo} = 131.125 \text{ bits}$$

$$V_{\text{máx}} = C = W \log_2 \left(1 + \frac{S}{N}\right) = 10^3 \cdot \log_2 16 = 4 \cdot 10^3 \text{ bps}$$

$$t_{\text{mín}} = \frac{I_{\text{mín}}}{V_{\text{máx}}} = \frac{131.125}{4 \cdot 10^3} = 32'78 \text{ s}$$

1	A	0'5
0	B	0'25
0	C	0'25



$$\bar{L} = 1'5 \text{ bits/símbolos}$$

$$E = \frac{H}{\bar{L}} = \frac{1'31125}{1'5} = 0'874 \quad (87'4\%)$$

c) A|A|B|C|A|B|C|A|B|C|A|A|C

LZW

POS	CAR
1	0
2	1
3	2
4	3
5	4
6	5
7	6
8	7
9	8
10	9

A  
B  
C  
AA  
AB  
BC  
CA  
ABC  
CAB  
BCA  
AAC

SALIDA  
0 0 1 2 4 6 5 3 2

1 1 2 3 5 7 6 4 3

$$N = 221 = 13 \cdot 17 \quad p = 13 \quad q = 17 \quad e = 77$$

$$a) \quad ed = 1 \pmod{\phi(N)}$$

$$\phi(N) = 12 \cdot 16 = 192$$

$$77d = 1 \pmod{192} \Rightarrow d = 5$$

$$b) \quad C = 01001100$$

$$2^6 + 2^3 + 2^2 = 64 + 8 + 4 = 76$$

$$M = C^{da} \pmod{N} = 76^5 \pmod{221} =$$

$$= 11111_2 = 64 + 32 + 8 + 4 + 2 + 1$$

$$M = 011101111 = k$$

$$c) \quad C = 00110011$$

$$k = 011101111$$

$$M = 01011100$$