SOMAIYA VIDYAVIHAR UNIVERSITY

Batch: A2 Roll No.: 1601042063

Name :

Course :

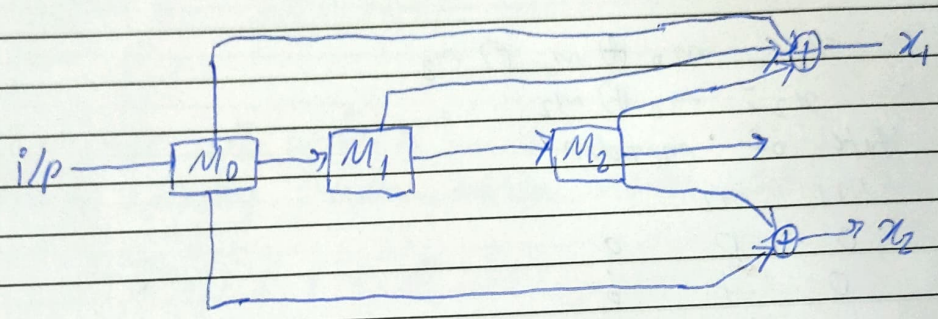
Experiment / assignment / tutorial No.

Grade: Signature of the Faculty with date

Information Theory and Coding (Unit 2)

Name - Arya Nair
Batch - A4
Roll No. - 1601042063

Q1) For convolutional encoder shown below,

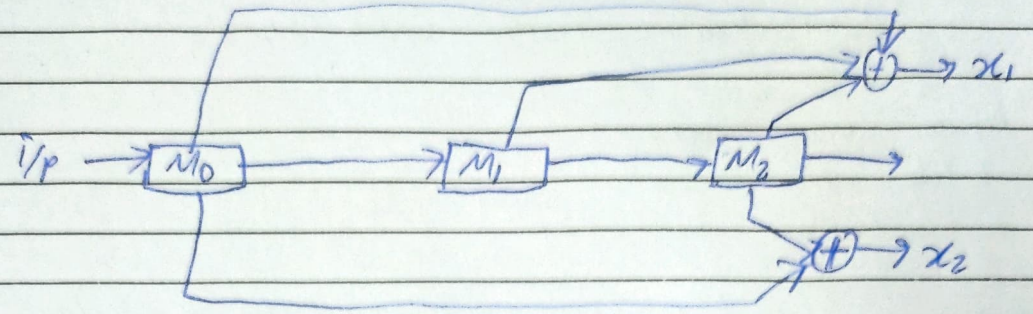


a) Draw the state diagram
b) Write output sequence if message bits are [1 0 1 1]

Q2) Using chinese remainder theorem to find x such that

a) $x \equiv 2 \bmod 3$
b) $x \equiv 1 \bmod 5$
c) $x \equiv 6 \bmod 7$

Ans:



$x_1 = m_0 \oplus m_1 \oplus m_2$

$x_2 = m_0 \oplus m_2$

State of encoder

m_1	m_2	
0	0	a
0	1	b
1	0	c
1	1	d

Next input	Present state			Next State				
m_0	m_1	m_2		m_1'	m_2'		x_1	x_2
0	0	0	a	0	0	a	0	0
1	0	0	a	1	0	c	1	1
0	0	1	b	0	0	a	1	1
1	0	1	b	1	0	c	0	0
0	1	0	c	0	1	b	1	0
1	1	0	c	1	1	d	0	1
0	1	1	d	0	1	b	0	1
1	1	1	d	1	1	d	1	0

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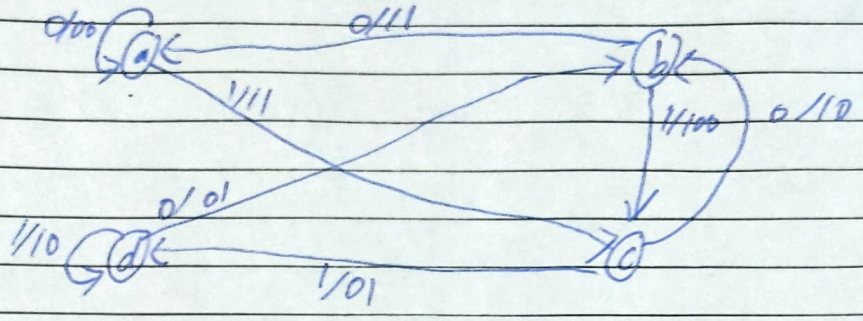
a) State diagram



b) Message bits = [1011]

Consider sliding window (assuming initial state) = 00

← 0 0 1 0 1 1 ←

$m_2\ m_1\ m_0$

$m_2\ m_1\ m_0$

$m_2\ m_1\ m_0$

$m_2\ m_1\ m_0$

m_0	m_1	m_2	x_1	x_2
1	0	0	1	1
0	1	0	1	0
1	0	1	0	0
1	1	0	0	1

The output sequence is

[11 10 00 01]

Ans (Q2)

$x = 2 \bmod 3$
$x = 1 \bmod 5$
$x = 6 \bmod 7$

Here 3 divisor 3, 5, 7 are relatively prime.
$\gcd(3, 5, 7) = 1$

$a_1 = 2 \quad a_2 = 1 \quad a_3 = 6$
$m_1 = 3 \quad m_2 = 5 \quad m_3 = 7$

$M = 3 \times 5 \times 7$
$= 105$

We know $M_i = \frac{M}{m_i}$

$M_1 = \frac{105}{3} = 35$

$M_2 = \frac{105}{5} = 21$

$M_3 = \frac{105}{7} = 15$

$x_i \Rightarrow$ Multiplicative inverse of M_i

~~$M_i x_i = 1 \bmod$~~
$35 \times x_1 = 1 \bmod 3$
put $x = 1$
$(35 \times 1) \% 3 = 2$
put $x_1 = 2$
$(35 \times 2) \% 3 = 1$
$x_1 = 2$

Similarly

$21 \times x_2 = 1 \bmod 5$

Put $x_2 = 1$

$(21 \times 1) \% 5 = 1$

$x_2 = 1$

Similarly

$M_3 \times x_3 = 1 \bmod m_3$

$15 \times x_3 = 1 \bmod 7$

Put $x_3 = 1$

$(15 \times 1) \% 7 = 1$

$x_3 = 1$

We know that

$x = 35 \times 2 \times 2 + 21 \times 1 \times 1 + 15 \times 1 \times 6$

$= 140 + 21 + 90$

$= 251$

Thus value of x is 251

Verifying

$251 \% 3 = 2$

$251 \% 5 = 1$

$251 \% 7 = 6$

Thus satisfy all necessary condition