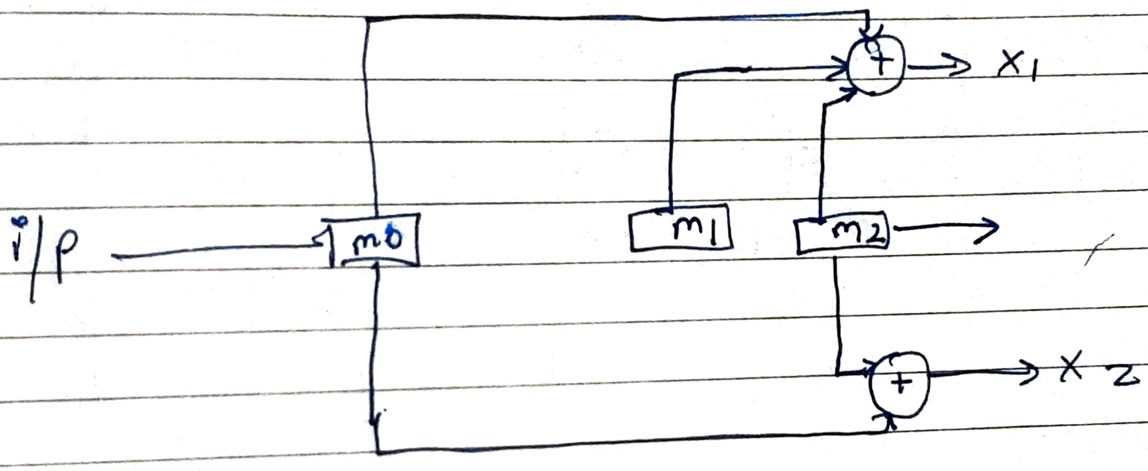
Tutorial No: 7

Soumen Samanta
16010420133
Batch : B1

Q1] For the convolution encoder shown below.



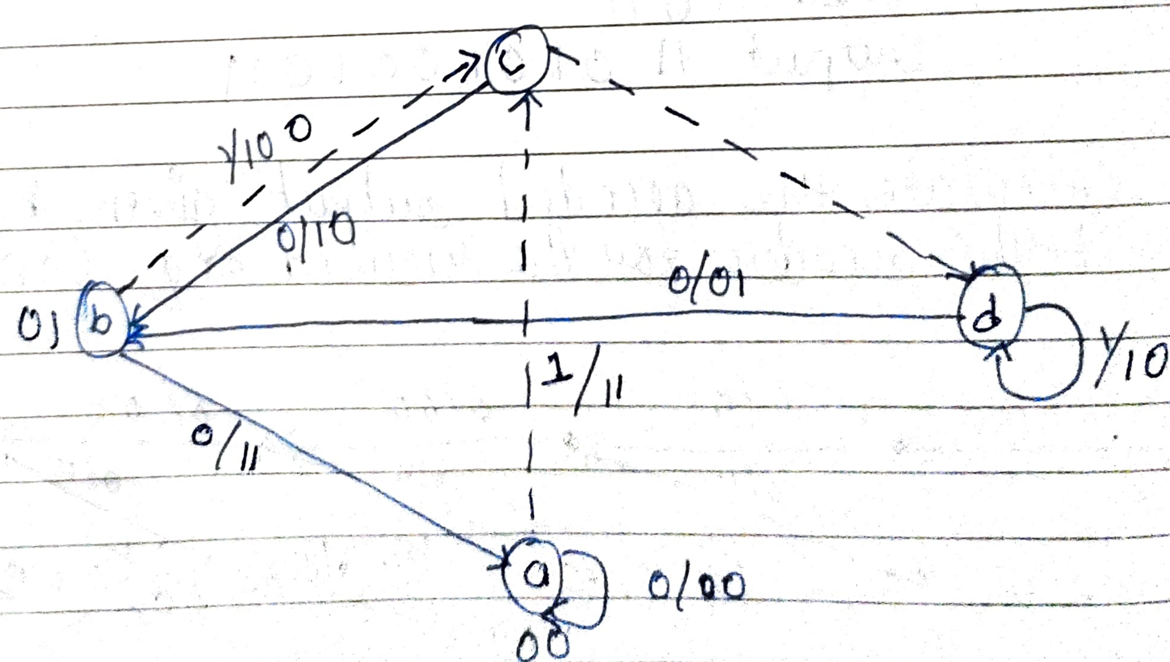
a) Draw the state diagram.

m1	m2	state
0	0	a
0	1	b
1	0	c
1	1	d

Here $x_1 = m0 \oplus m1 \oplus m2$
$x_2 = m0 \oplus m2$

m0	m1	m2	x1	x2	Current state	Next state
0	0	0	0	0	a	a
1	0	0	1	1	a	c
0	0	1	1	1	b	a
1	0	1	0	0	b	c
0	1	0	1	0	c	b
1	1	0	0	1	c	d
0	1	1	0	1	d	b
1	1	1	1	0	d	d

state diagram (state transition diagram)

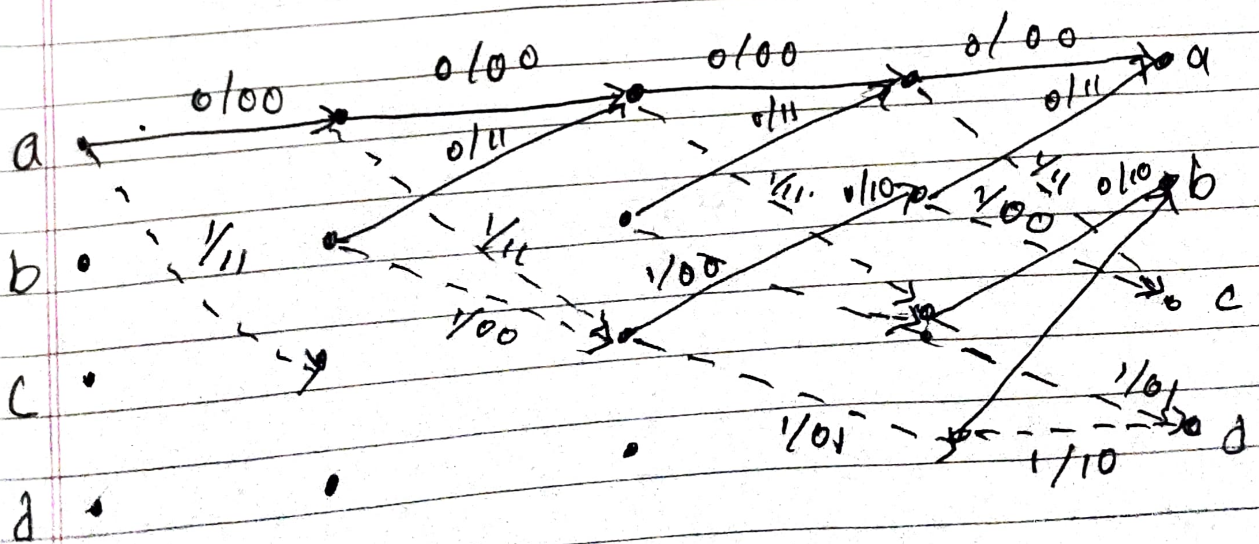


b) Write the output sequence if the message bits are [1011]

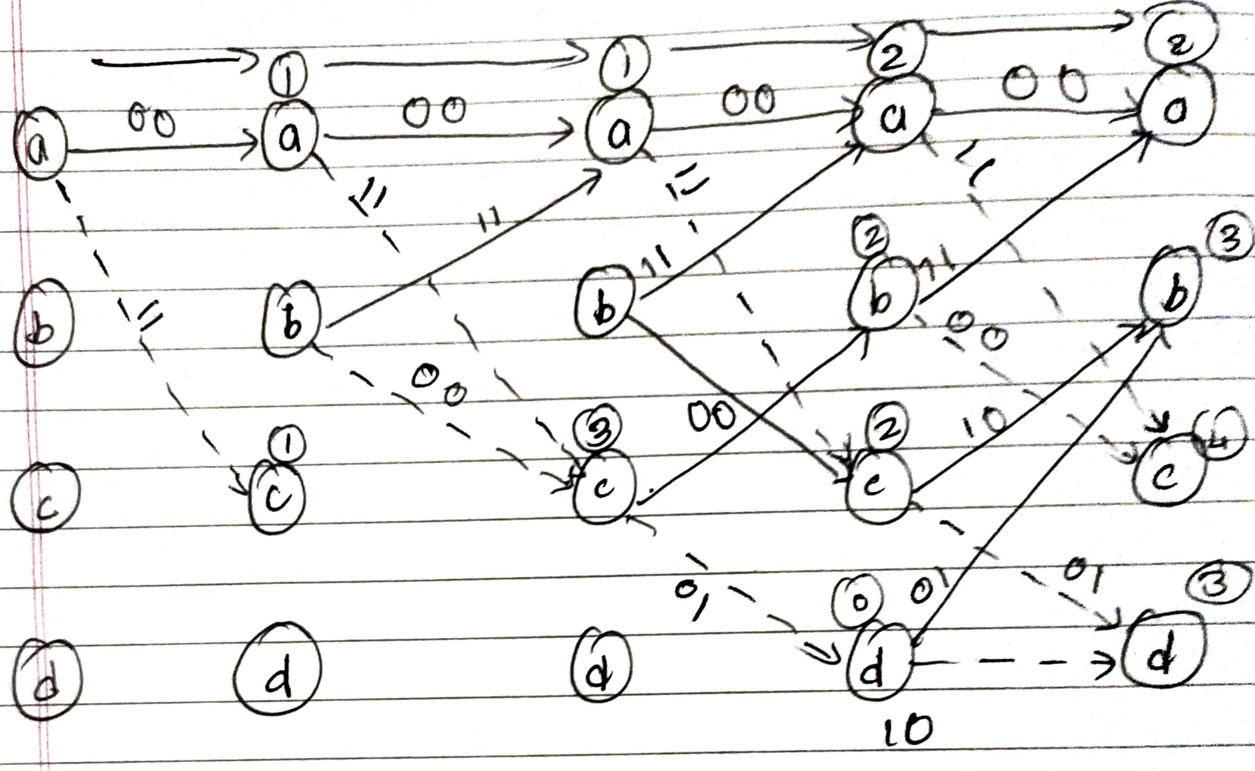
m0	m1	m2	x1	x2
0	0	0	0	0
1	0	0	1	1
1	1	0	0	1
0	1	1	0	1
1	0	1	0	0
0	1	0	1	0
0	0	1	1	1
0	0	0	0	0
1	1	1		

Code : 1011
Output 11 0101 001011

c) Calculate the decoded output given by the viterbi decoder for the received seq [01 00 0100]



Viterbi decoder.



01 00 01 00

00 00 00 00
a a a a

The decoded output for the given viterbi sequence 01 00 01 00 is 00 00 00 00 ie - a - a - a - a

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Q2] Use the Chinese Remainder theorem to find x such that.

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

$x = a_1 \pmod{m_1}$
$x = a_2 \pmod{m_2}$
$x = a_3 \pmod{m_3}$

so here

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

$\therefore M = m_1 \cdot m_2 \cdot m_3$
$= 3 \times 5 \times 7$
$M = 105$

$\therefore M_i = \frac{M}{m_i}$

$M_1 = \frac{105}{m_1}$ or $M_1 = m_2 \cdot m_3$
$= 5 \times 7 = 35$

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

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

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$M_i X_i = 1 \pmod{m_i}$

$M_1 X_1 = 1 \pmod{m_1}$

$35 X_1 = 1 \pmod{3}$

$2 X_1 = 1 \bmod 3$

$(2 X_1 = 1 \bmod 3) \times 2$

$4 X_1 = 2 \bmod 3$

$X_1 = 2$

$M_2 X_2 = 1 \pmod{m_2}$

$21 X_2 = 1 \pmod{5}$

$1 X_2 = 1 \bmod 5$

$X_2 = 1$

$M_3 X_3 = 1 \pmod{m_3}$

$15 X_3 = 1 \pmod{7}$

$1 X_3 = 1 \bmod 7$

$X_3 = 1$

$\therefore x = (M_1 X_1 a_1 + M_2 X_2 a_2 + M_3 X_3 a_3) \pmod{m}$

$= (35 \times 2 \times 2 + 21 \times 1 \times 1 + 15 \times 1 \times 6) \pmod{105}$

$= (140 + 21 + 90) \pmod{105}$

$= (251) \pmod{105}$

$x = 41$