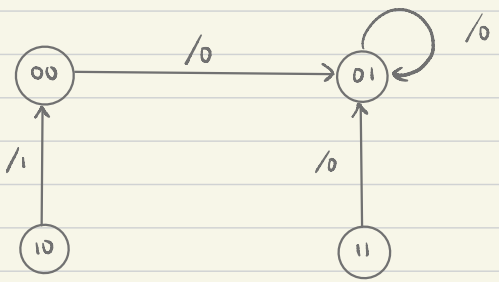
CS2100 – Tutorial 12 – Sequential Logic

Reading Week

1(a).

Present state AB	Next state A^+B^+	Output P
0 0	0 1	0
0 1	0 1	0
1 0	0 0	1
1 1	0 1	0



(b). 00 → (1) 01 → (2) 01 → (3) 01

(c). 1

(d). 01

2.

Present state		Input	Next state	
A	B	x	A^+	B^+
0	0	0	0	1
0	0	1	1	0
0	1	0	1	0
0	1	1	0	0
1	0	0	0	0
1	0	1	0	1
1	1	0	X	X
1	1	1	X	X

Flip flop inputs

JA	KA	JB	KB
0	X	1	X
1	X	0	X
1	X	0	X
0	X	0	X
X	1	X	1
X	1	X	0
X	X	X	X
X	X	X	X

JA

A \ Bx	00	01	11	10
0		1		1
1	X	X	X	X

$JA = B' \cdot x + B \cdot x'$

KA

A \ Bx	00	01	11	10
0	X	X	X	X
1	1	1	X	X

$KA = 1$

JB

A \ Bx	00	01	11	10
0	1			
1	X	X	X	X

$JB = B' \cdot x'$

KB

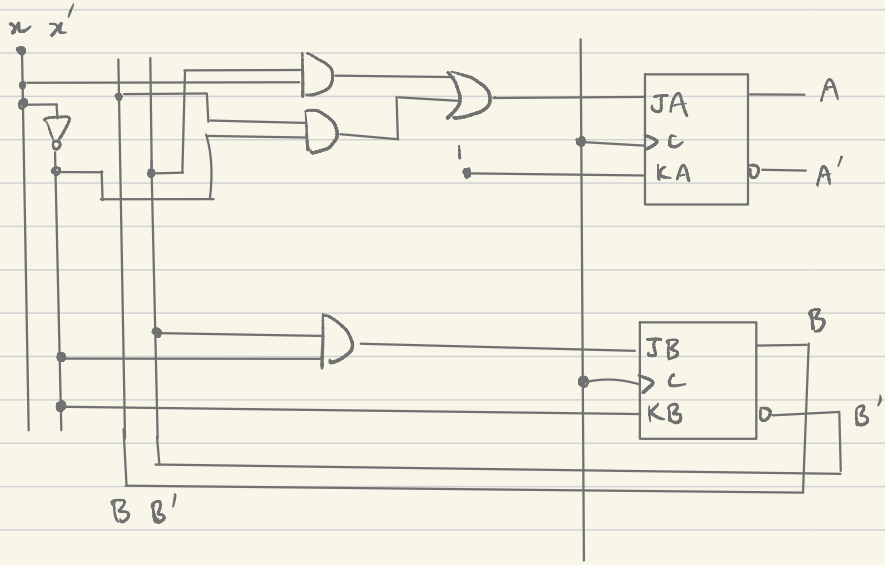
A \ Bx	00	01	11	10
0	X	X	X	X
1	1		X	X

$KB = x'$

$B \oplus x$

$JA = B' \cdot x + B \cdot x'$ $\quad KA = 1$

$JB = B' \cdot x'$ $\quad KB = x'$



3(a).

Present state			Next state			Flip-flop inputs				
A	**B**	**C**	A^+	B^+	C^+	**TA**	**JB**	**KB**	**JC**	**KC**
0	0	0	0	1	1	0	1	X	1	X
0	0	1	X	X	X	X	X	X	X	X
0	1	0	1	1	1	1	X	0	1	X
0	1	1	1	1	1	1	X	0	X	0
1	0	0	0	1	0	1	1	X	0	X
1	0	1	X	X	X	X	X	X	X	X
1	1	0	X	X	X	X	X	X	X	X
1	1	1	1	0	0	0	X	1	X	1

$TA = A \cdot B' + A' \cdot B$

$JB = 1$

$KB = A$

$JC = A'$

$KC = A$

TA

A \ BC	00	01	11	10
0		X	1	1
1	1	X		X

B, C

JB

A \ BC	00	01	11	10
0	1	X	X	X
1	1	X	X	X

B, C

KB

A \ BC	00	01	11	10
0	X	X		
1	X	X	1	X

B, C

JC

A \ BC	00	01	11	10
0	1	X	X	1
1		X	X	X

B, C

KC

A \ BC	00	01	11	10
0	X	X		X
1	X	X	1	X

B, C

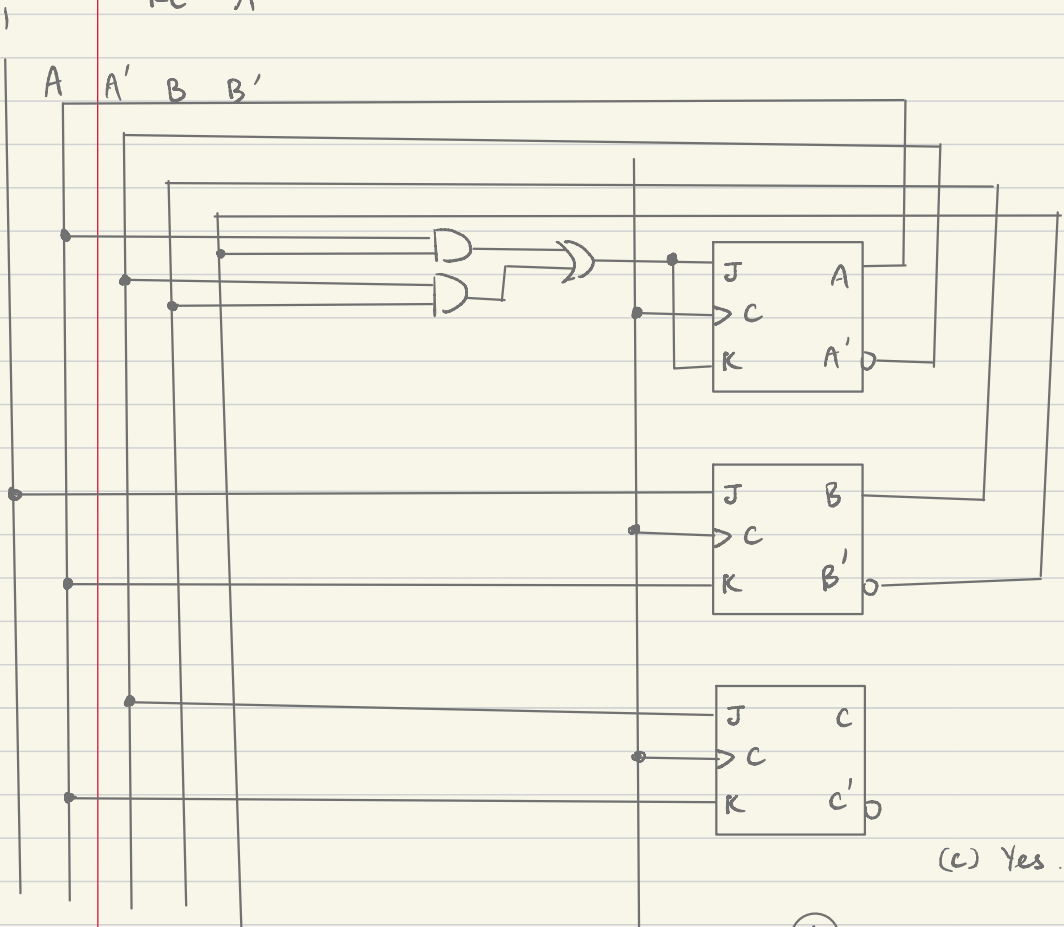
$TA = A \cdot B' + A' \cdot B$

$JB = 1$

$KB = A$

$JC = A'$

$KC = A$



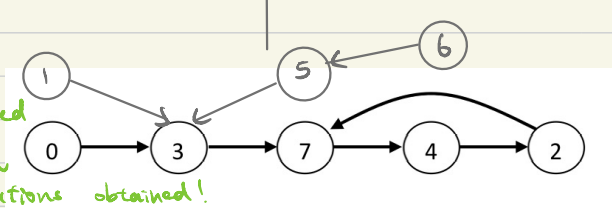
(c) Yes.

(b) Update state table based on new functions obtained!

1 → 3

5 → 3

6 → 5



4(a).

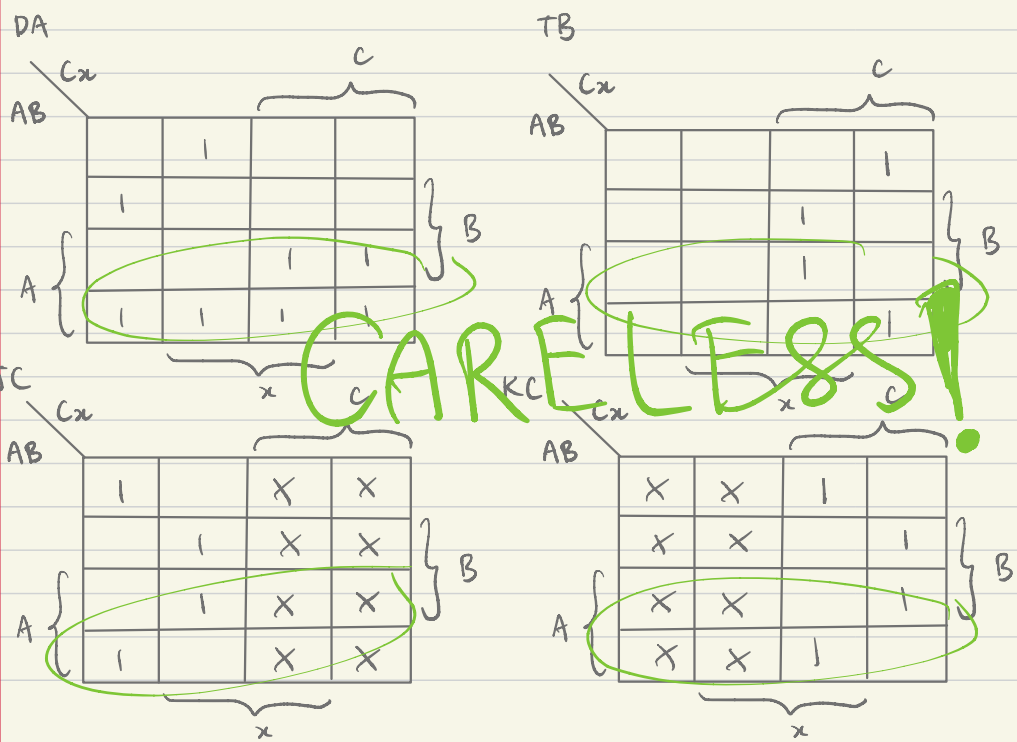
A	B	C	X	A+	B+	C+	DA	TB	JC	KC
0	0	0	0	**0**	**0**	**1**	0	0	1	X
0	0	0	1	**1**	**0**	**0**	1	0	0	X
0	0	1	0	**0**	**1**	**1**	0	1	X	0
0	0	1	1	**0**	**0**	**0**	0	0	X	1
0	1	0	0	1	1	0	1	0	0	X
0	1	0	1	0	1	1	0	0	1	X
0	1	1	0	0	1	0	0	0	X	1
0	1	1	1	0	0	1	0	1	X	0
1	0	0	0	0	0	0	0	0	0	X
1	0	0	1	1	0	1	1	0	1	X
1	0	1	0	1	0	0	1	0	X	1
1	0	1	1	1	1	1	1	1	X	0
1	1	0	0	1	1	1	1	0	1	X
1	1	0	1	0	1	0	0	0	0	X
1	1	1	0	1	0	1	1	1	X	0
1	1	1	1	1	1	0	1	0	X	1

$DA = A \cdot B' + A \cdot C + B' \cdot C' \cdot x + A' \cdot B \cdot C' \cdot x'$

$TB = A' \cdot B' \cdot C + B \cdot C \cdot x$

$JC = A' \cdot B' + B \cdot x$

$KC = B \cdot x' + B' \cdot x$

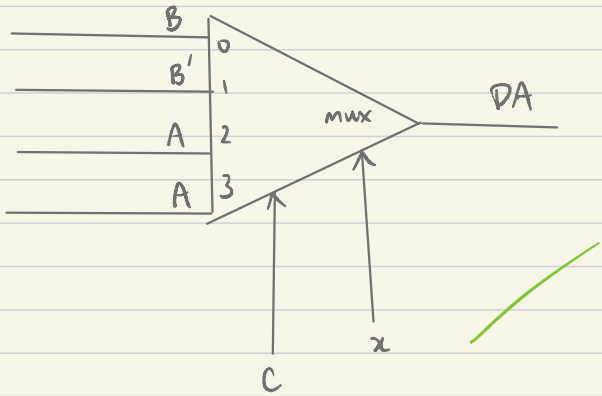


(b) $DA = A \cdot B' + A \cdot C + B' \cdot C' \cdot x + A' \cdot B \cdot C' \cdot x'$

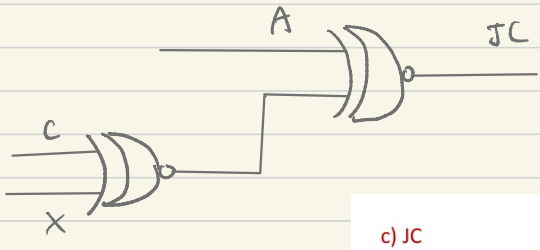
$TB = A' \cdot B' \cdot C + B \cdot C \cdot x$

$JC = A' \cdot B' + B \cdot x$

$KC = B \cdot x' + B' \cdot x$



(c)



c) JC

= A'.B'.X' + A'.B.X + A.B.X' + A.B'.X

= **A'.B'.X' + A.B.X' + A.B'.X + A'.B.X**

= **(A'.B').X' + (A.B).X' + (A.B').X + (A'.B).X**

= **(A ⊕ B)'. X' + (A ⊕ B). X**

= (A ⊕ B) ⊙ X