Paper 7, TDC Part-3
Chapter– 4, Combinational Logic Design
Lecture - 16

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Combinational Logic Design

BCD-to-7-Segment Decoder :-

A digital display that consist of seven LED segments is commonly used to display decimal numerals in digital systems. Most familiar examples are electronic calculators and watches where one 7-segment display device is used for displaying one numeral 0 through 9. For using this display device, the data has to be converted from some binary code to the code required for the display. Usually, the binary code used is natural BCD. Figure below shows the 7 segment display device.

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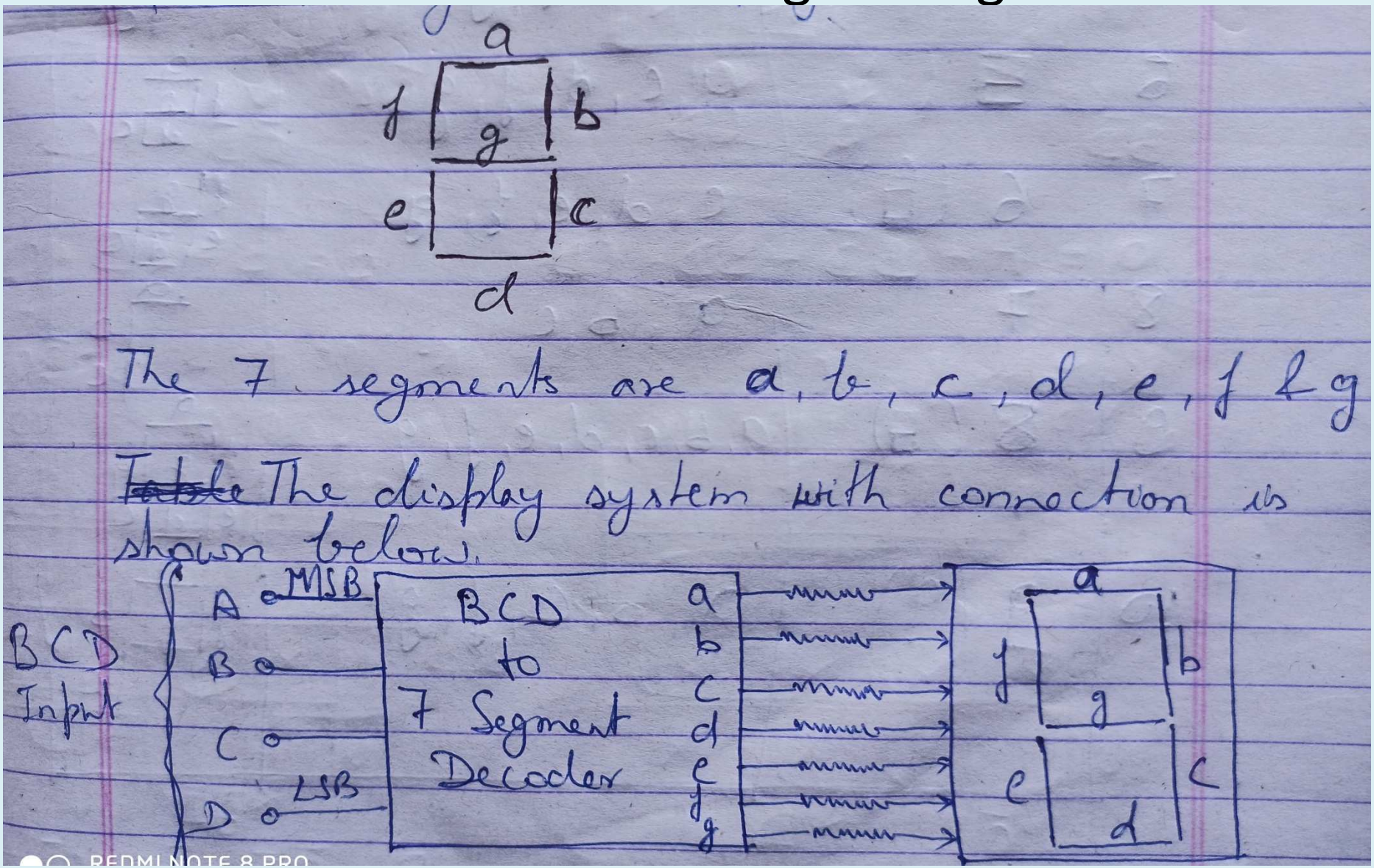

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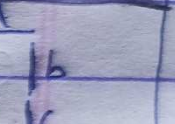
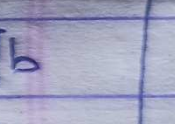
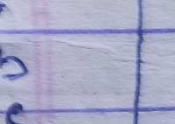
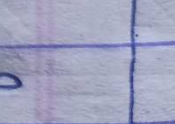
Table below shows the segments which must be illuminated for each of the numeral

	Numerals	Segments Illuminated	Display pattern
1	0	a, b, c, d, e, f	
2	1	a, b	
3	2 (2)	a, b, d, e, g	
4	3 (3)	a, b, c, d, g	
5	4	b, c, f, g	

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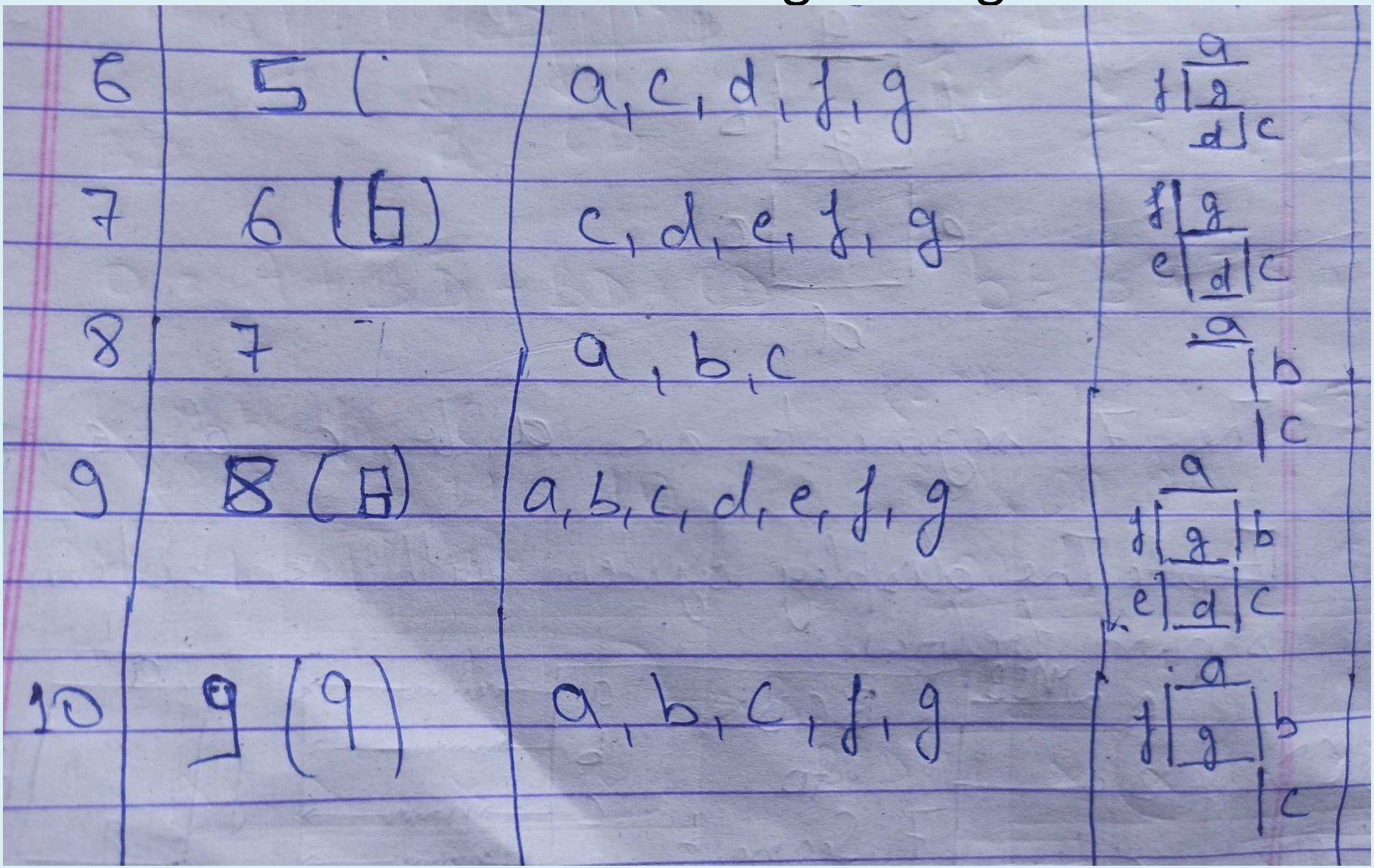

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Table below gives the truth table of BCD to 7-segment decoder. ABCD inputs is for the natural BCD code for numerals 0 to 9. The outputs of 7 segments displays are, a, b, c, d, e, f & g.

Truth Table of BCD to 7 Segment Decoder

Decimal Digit Displayed	Inputs A	B	C	D	Outputs. a	b	c	d	e	f	g
0	0	0	0	0	1	1	1	1	1	1	0
1	0	0	0	1	1	1	0	0	0	0	0
2	0	0	1	0	1	1	0	1	1	0	1
3	0	0	1	1	1	1	1	1	0	0	1
4	0	1	0	0	0	1	1	0	0	1	1
5	0	1	0	1	1	0	1	1	0	1	1
6	0	1	1	0	0	0	1	1	1	1	1

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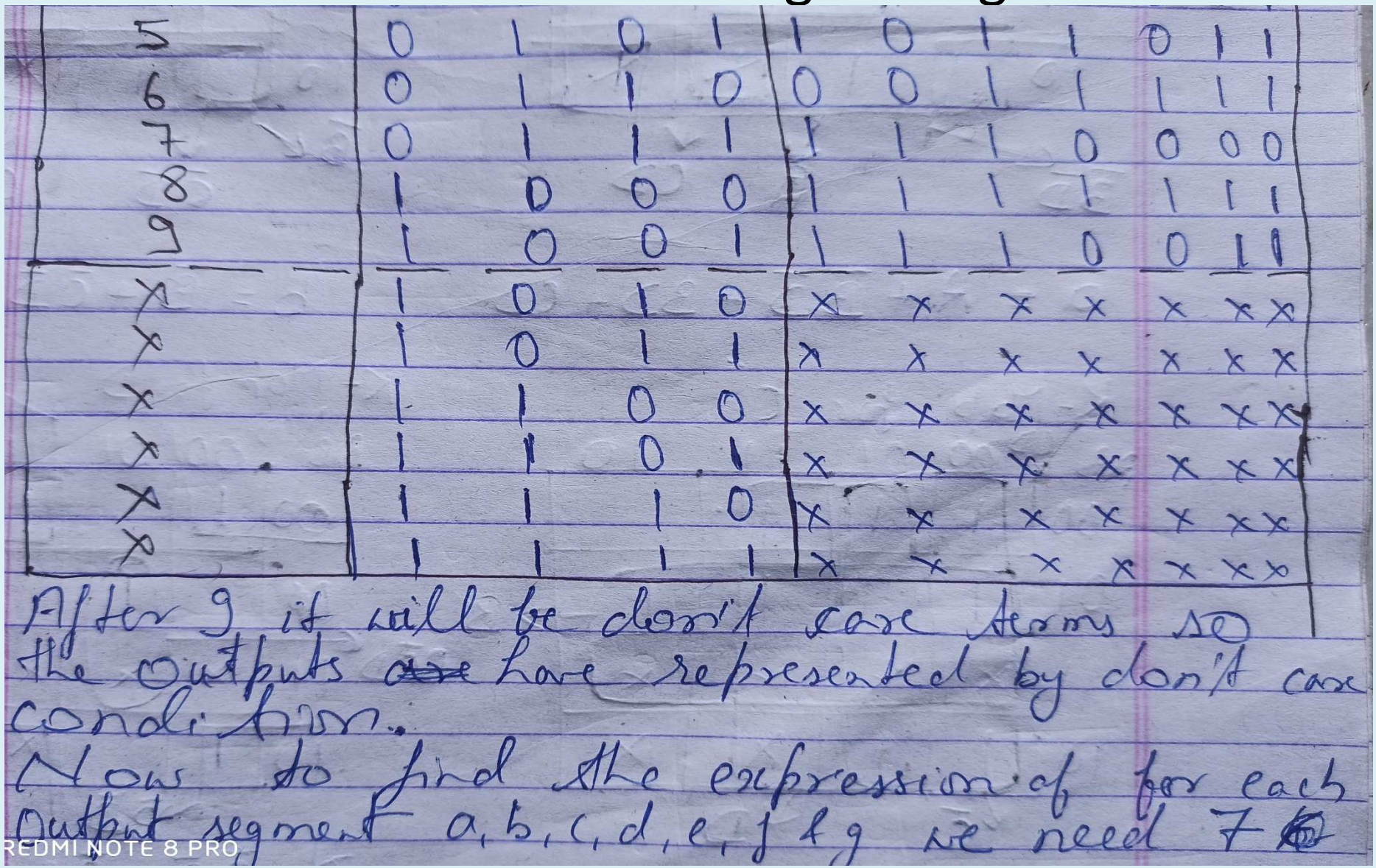

5	0	1	0	1	1	0	1	1	0	1	1
6	0	1	1	0	0	0	1	1	1	1	1
7	0	1	1	1	1	1	1	0	0	0	0
8	1	0	0	0	1	1	1	1	1	1	1
9	1	0	0	1	1	1	1	0	0	1	1
x	1	0	1	0	x	x	x	x	x	x	x
x	1	0	1	1	x	x	x	x	x	x	x
x	1	1	0	0	x	x	x	x	x	x	x
x	1	1	0	1	x	x	x	x	x	x	x
x	1	1	1	0	x	x	x	x	x	x	x
x	1	1	1	1	x	x	x	x	x	x	x

After 9 it will be don't care terms so the outputs ~~are~~ have represented by don't care condition.

Now to find the expression of for each output segment a, b, c, d, e, f & g we need 7

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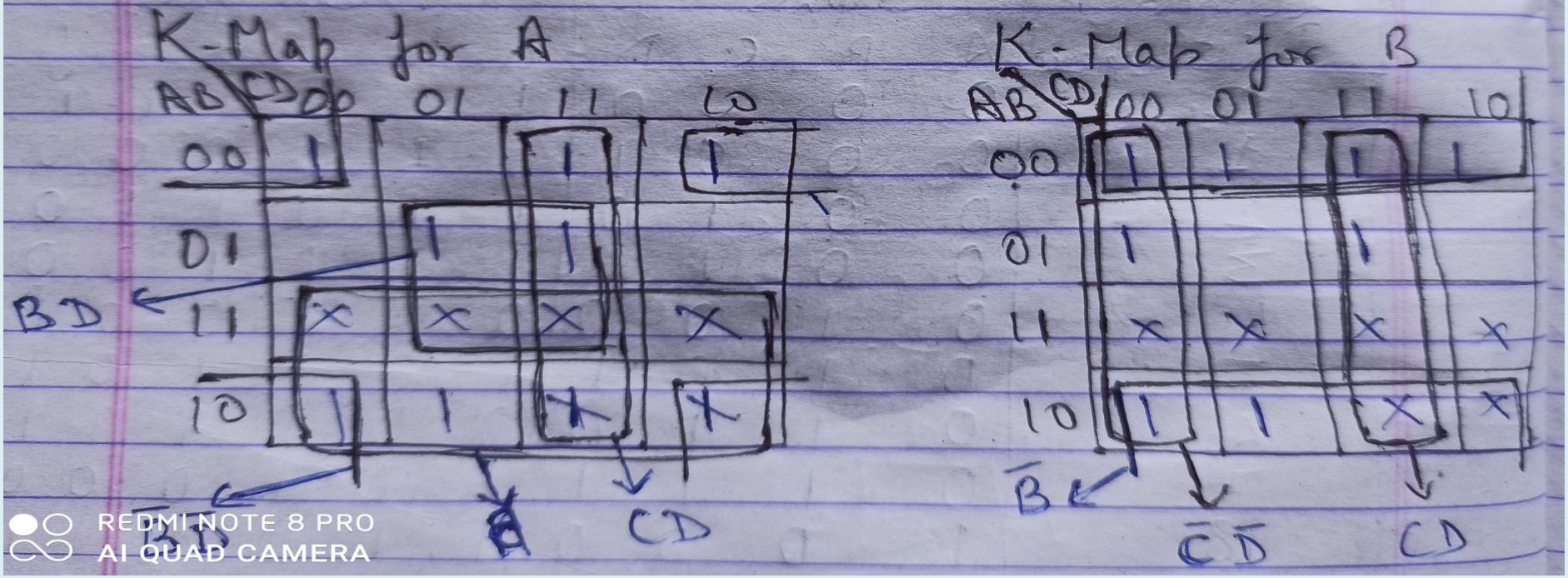
K-maps, i.e. for each segment K-map is plotted

K-Map ~~for output A~~ :→

As there are 4 inputs lines (A, B, C & D) so 16 entries are possible so each K-Map is of 16 cells i.e. 4 variable K-map.



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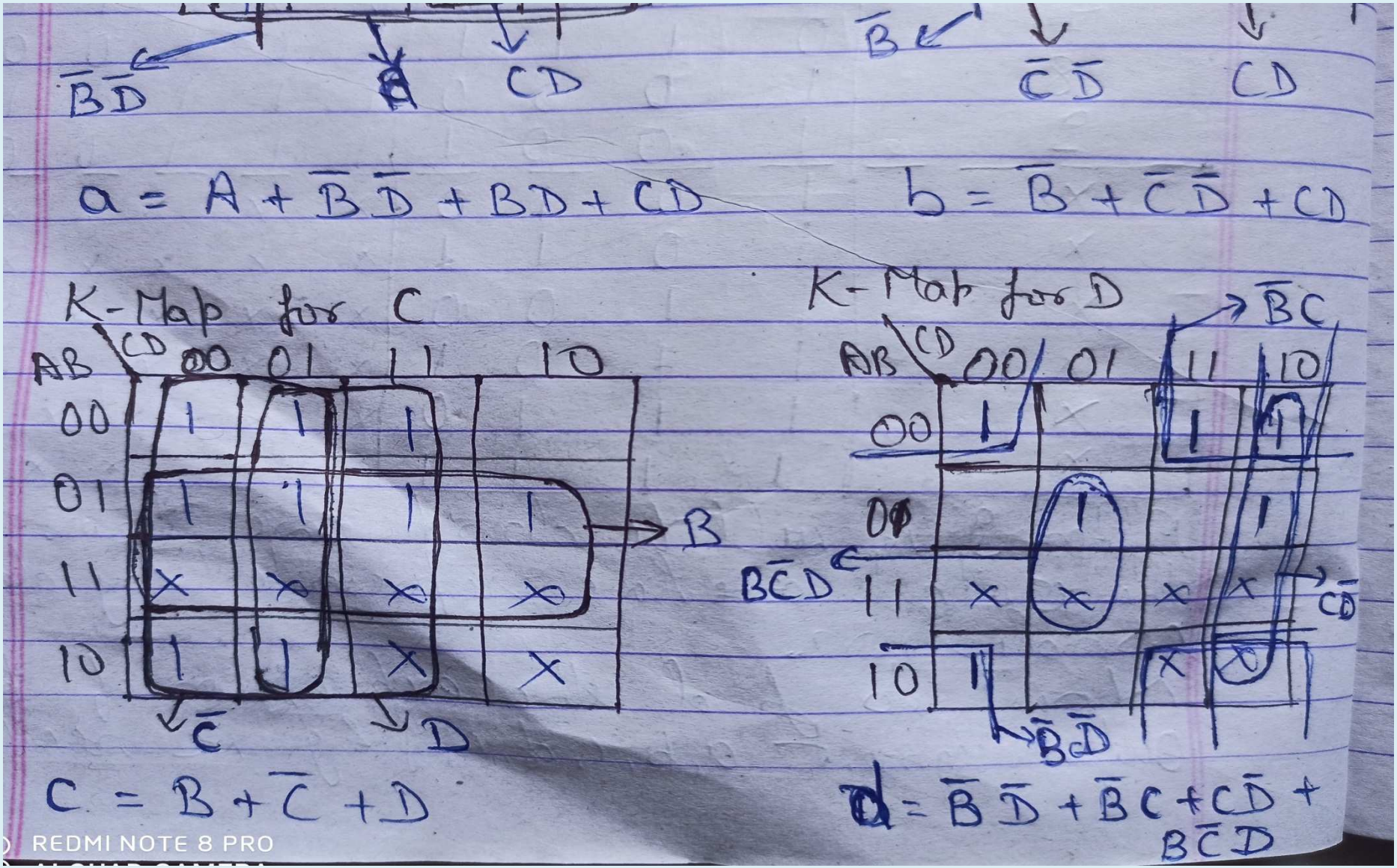

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To be continued

Refer book- Modern Digital Electronics by RP Jain.

Thank You