# Paper 7, TDC Part-3
# Discussion of some questions of 2017
# Lecture - 2


**By:**

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# Discussion of 2017 Questions

(Q3) Given the logic equation:

$f = ABC + B\bar{C}D + \bar{A}BC$

(a) Make a truth table

(b) Simplify using K-map

(c) Realize f using NAND gates only.

Soln:- The function f is a logic function of 4-variables A, B, C, D, so there are total of 16 combinations are possible. Truth table for $f = ABC + B\bar{C}D + \bar{A}BC$

| A | B | C | D | ABC | $B\bar{C}D$ | $\bar{A}BC$ | f |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |

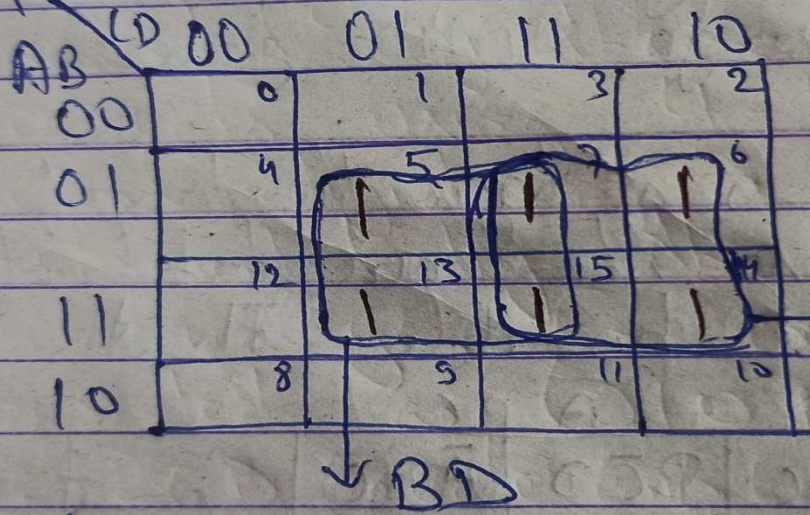
# Discussion of 2017 Questions

Contd.

| A | B | C | D | ABC | $B\bar{C}D$ | $\bar{A}BC$ | Y |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 |
| 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 |

# Discussion of 2017 Questions

(b) Simplify logic function f using K-map, since the logic function is 4-variable function so we draw K-map with 16 cells as below and enter the true value of logic function in respective cell,



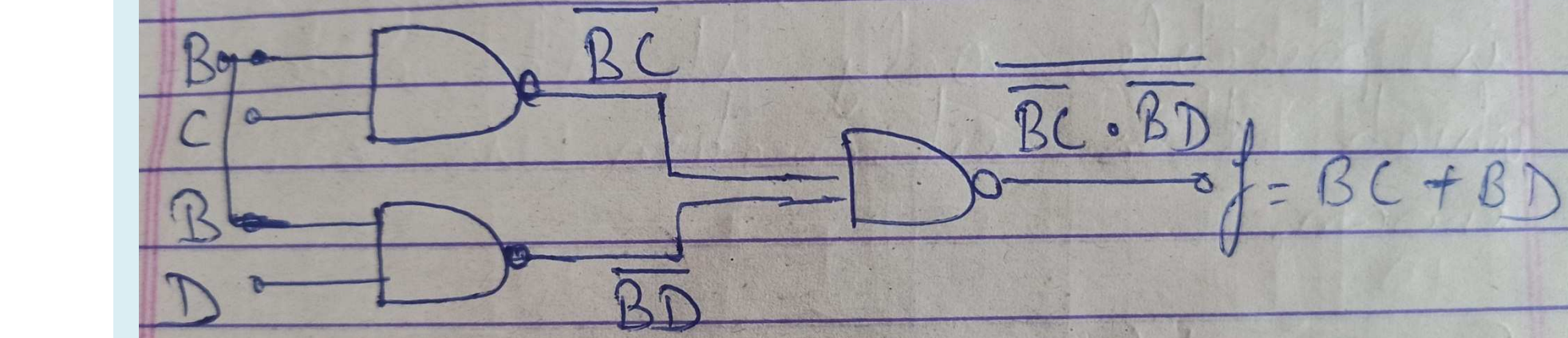

$f = BC + BD$

(c) Realising the ~~circuit using~~ simplified above logic function f using

# Discussion of 2017 Questions

NAND gates only

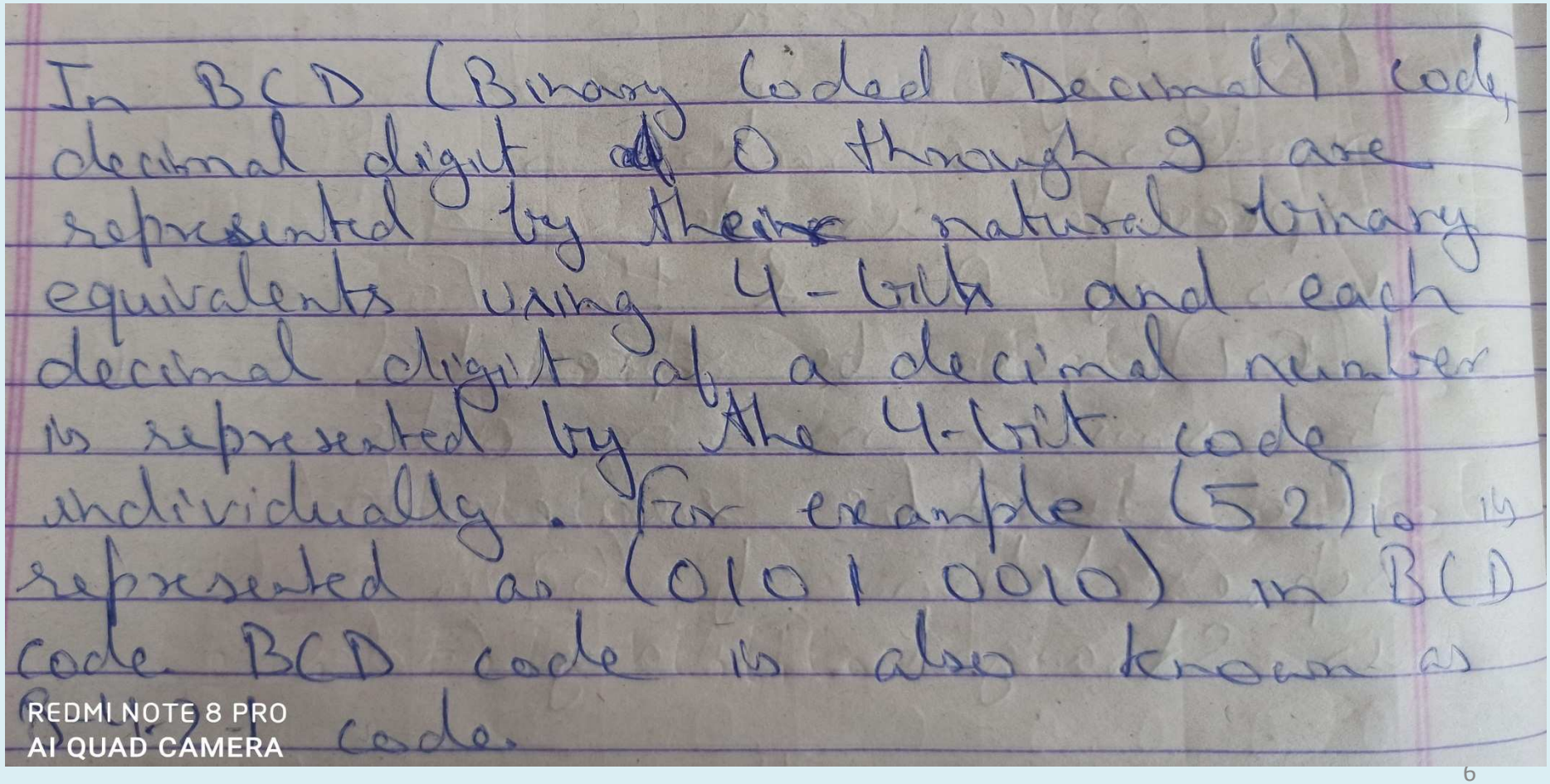
$$f = BC + BD = \overline{\overline{BC + BD}} = \overline{\overline{BC} \cdot \overline{BD}}$$




Realising $f = ABC + B\bar{C}D + \bar{A}BC$ using NAND gates only.

# Discussion of 2017 Questions

Q7) Design an excess-3 to BCD converter using minimum number of NAND gates?



# Discussion of 2017 Questions

Excess-3 code is another form of BCD code, in which each decimal digit is coded into a 4-bit binary code. The code for each decimal digit is obtained by adding decimal 3 to the natural BCD of the digit.

For example decimal 5 is coded as (0101 + 0011) = 1000 in Excess 3-code.

To design an Excess-3 to BCD converter we first write table as below

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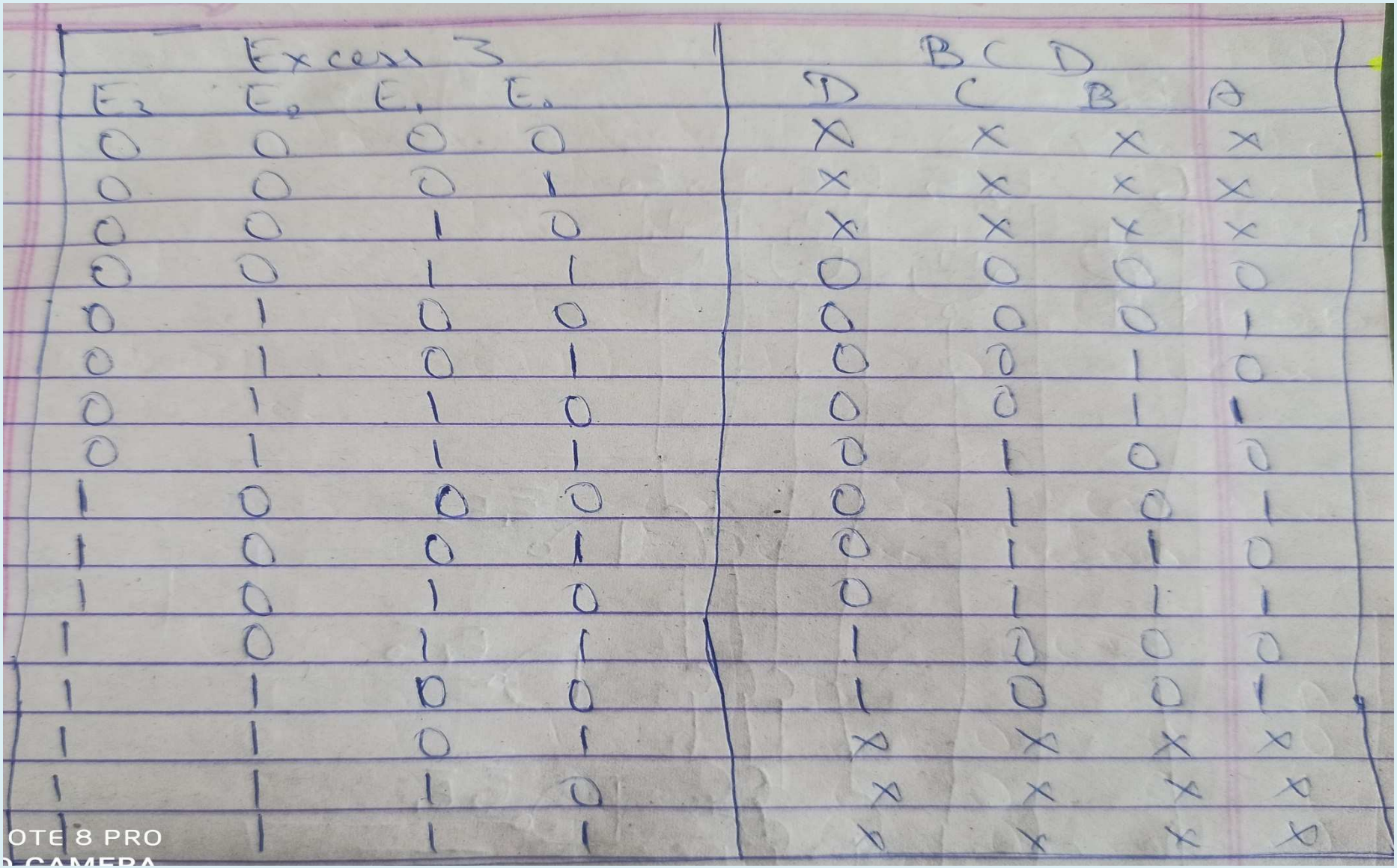

| Excess 3 | | | | BCD | | | |
|---|---|---|---|---|---|---|---|
| $E_3$ | $E_2$ | $E_1$ | $E_0$ | D | C | B | A |
| 0 | 0 | 0 | 0 | X | X | X | X |
| 0 | 0 | 0 | 1 | X | X | X | X |
| 0 | 0 | 1 | 0 | X | X | X | X |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 |
| 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | X | X | X | X |
| 1 | 1 | 1 | 0 | X | X | X | X |
| 1 | 1 | 1 | 1 | X | X | X | X |

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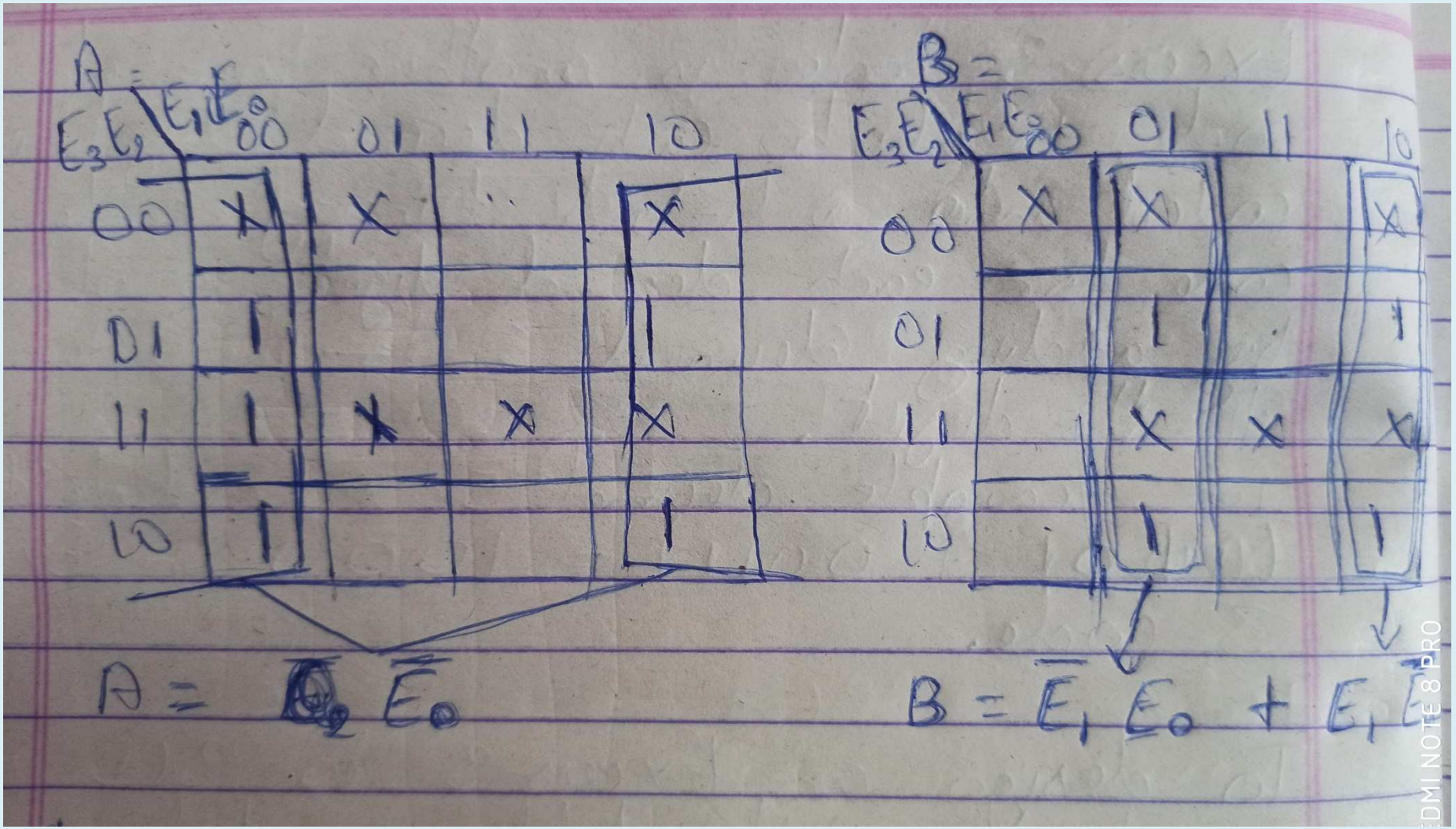

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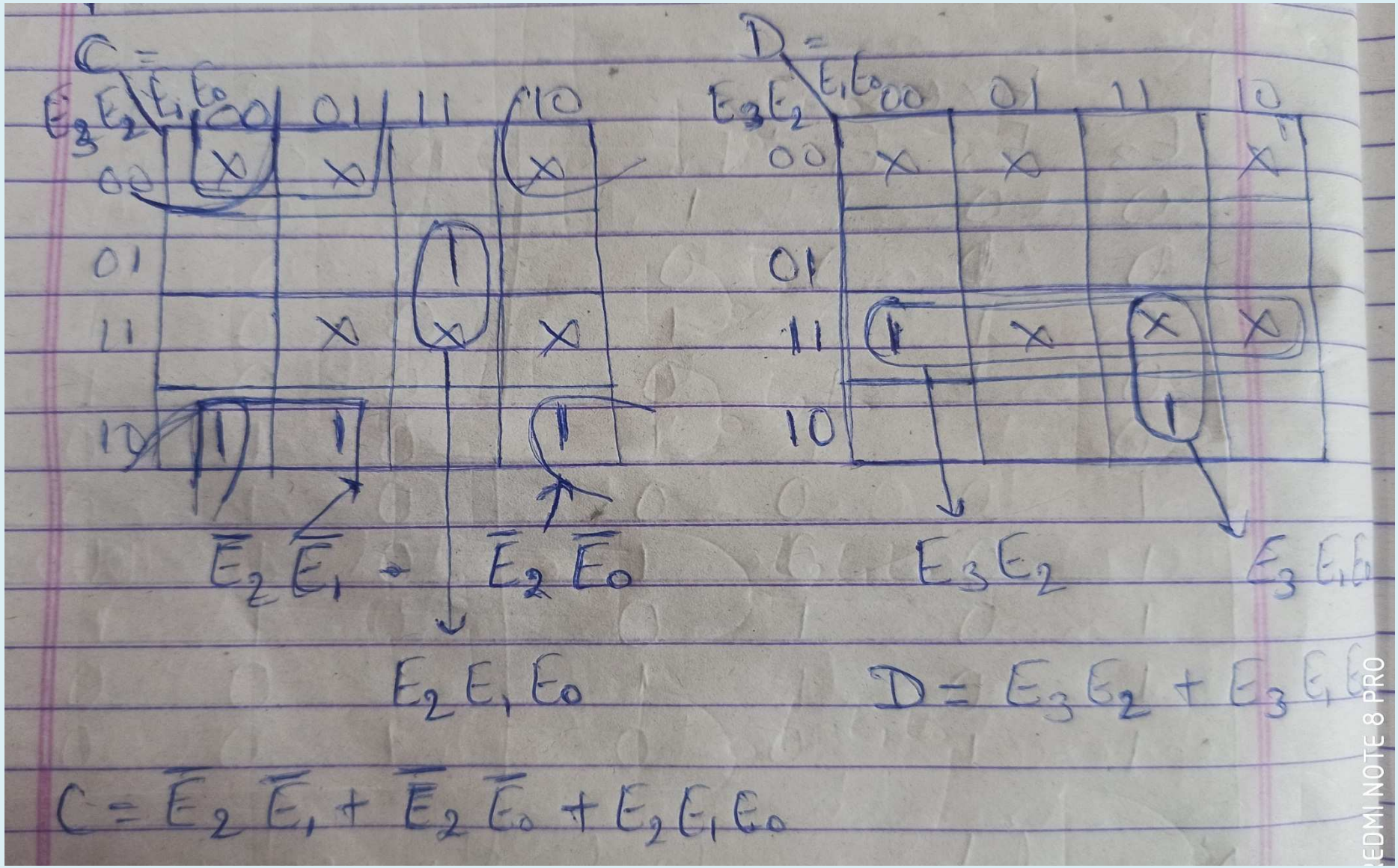

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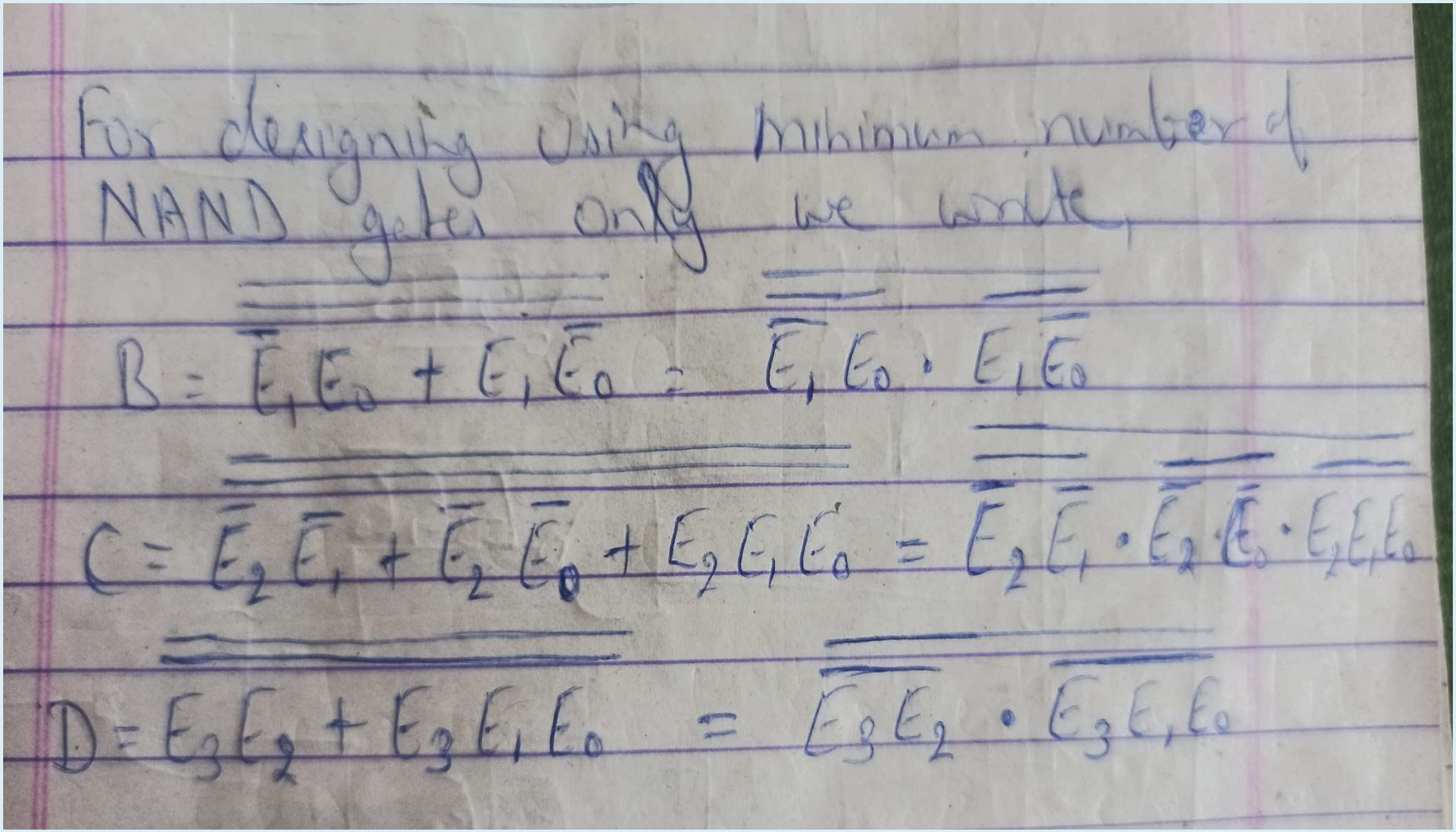

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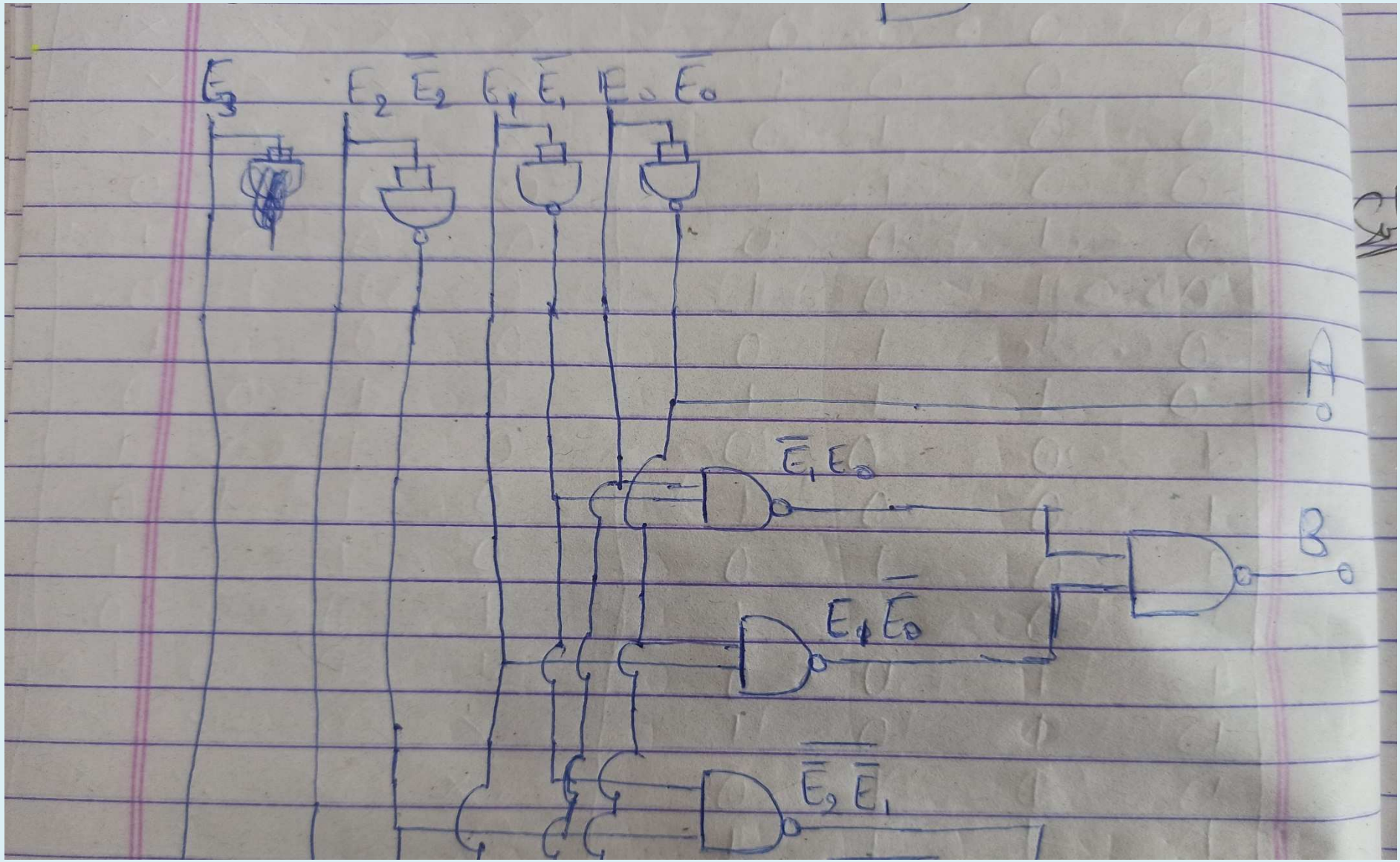

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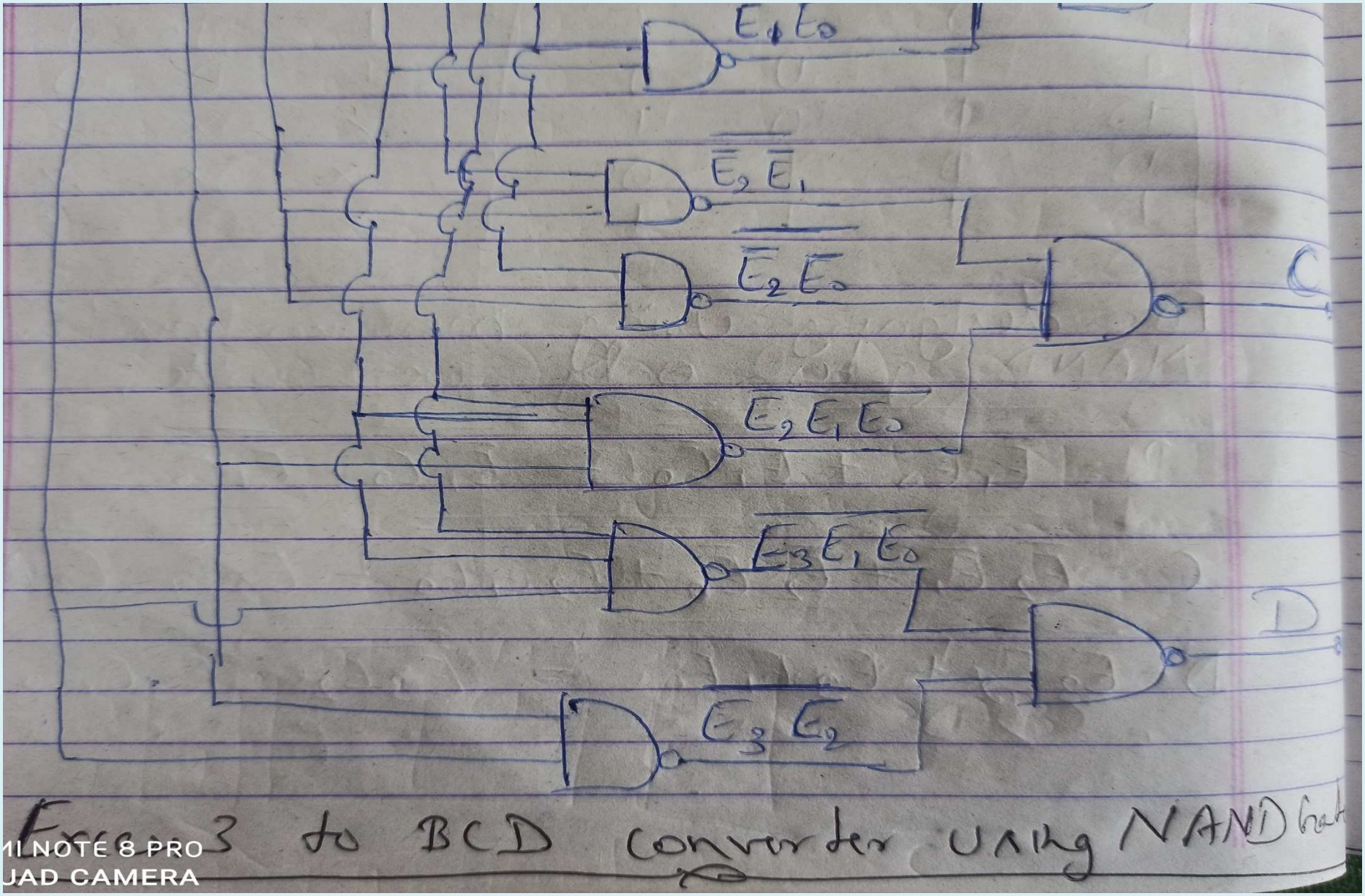

Combinational Logic Design

Refer book- Modern Digital Electronics by RP Jain.

***Thank You***