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University of Delhi - Open Book Examination
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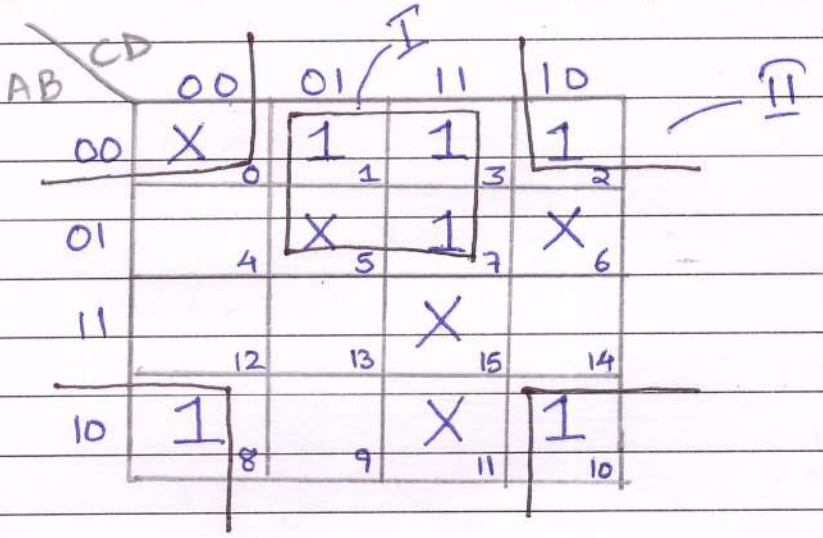
QUESTION : 1

Ans.

a) $f(A, B, C, D) = \Sigma(1, 2, 3, 7, 8, 10)$

$d(A, B, C, D) = \Sigma(0, 5, 6, 11, 15)$



$f = I + II$

$\boxed{f = \bar{A}D + \bar{B}\bar{D}}$ (Optimized expression)

b) $f = \bar{A}D + \bar{B}\bar{D}$

using De-Morgan's law $[(X + Y)' = X'Y']$

$f' = (\bar{A}D + \bar{B}\bar{D})' = (A + \bar{D})(B + D)$

$\boxed{f = (A + \bar{D})(B + D)}$

c) $f = \bar{A}D + \bar{B}\bar{D} = \bar{A} \cdot 1 \cdot 1 \cdot D + 1 \cdot \bar{B} \cdot 1 \cdot \bar{D}$

$= (\bar{A})(B + \bar{B})(C + \bar{C})(D) + (A + \bar{A})(\bar{B})(C + \bar{C})(\bar{D})$

$= (\bar{A}B + \bar{A}\bar{B})(CD + \bar{C}D) + (A\bar{B} + \bar{A}\bar{B})(C\bar{D} + \bar{C}\bar{D})$

$\boxed{f = \bar{A}BCD + \bar{A}B\bar{C}D + \bar{A}\bar{B}CD + \bar{A}\bar{B}\bar{C}D + A\bar{B}C\bar{D} + A\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}\bar{C}\bar{D}}$

(Original expression)

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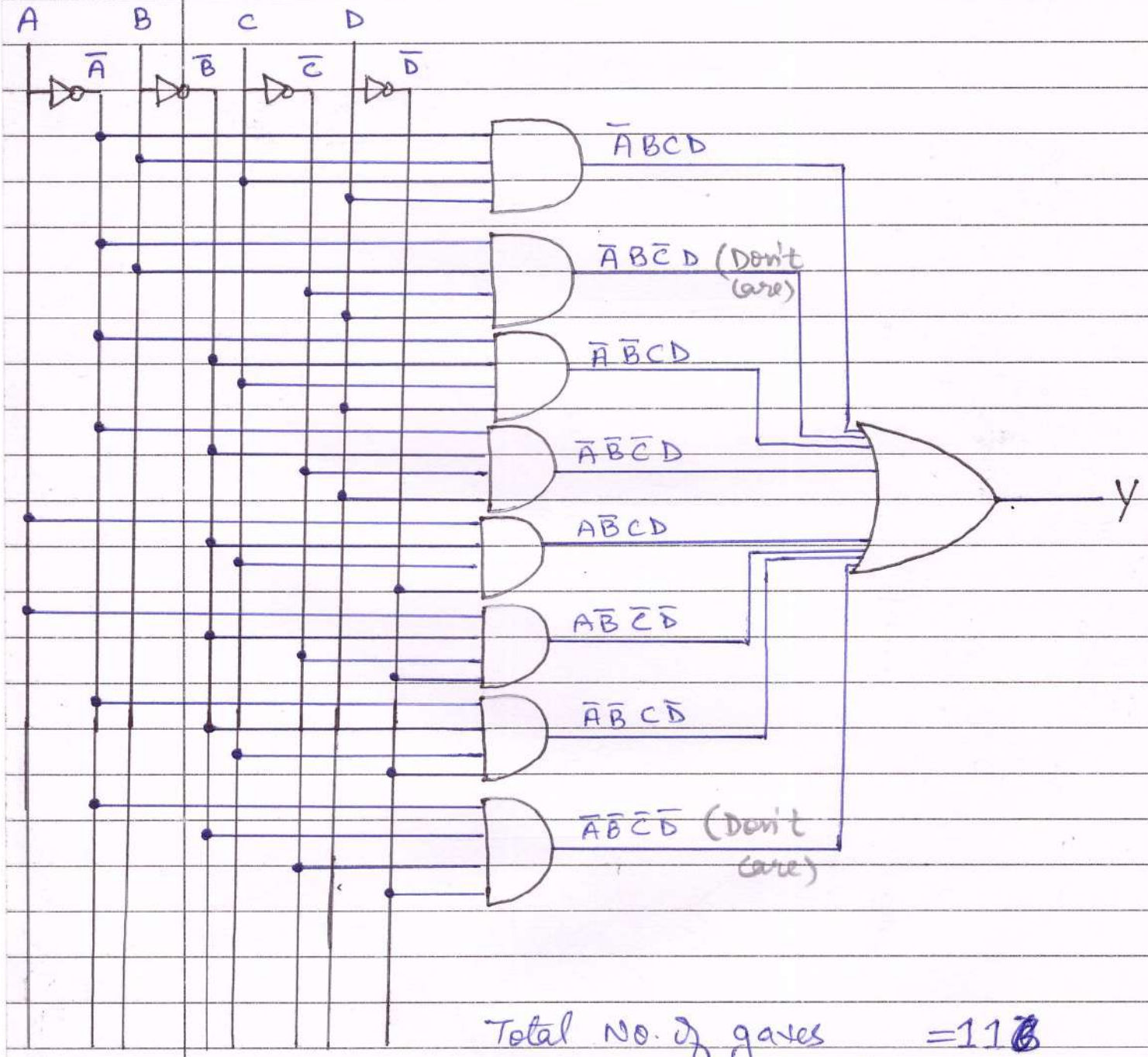
c) $f = \bar{A}D + \bar{B}\bar{D}$ (Optimized form)

$f = \bar{A}BCD + \bar{A}B\bar{C}D + \bar{A}\bar{B}CD + \bar{A}\bar{B}\bar{C}D + A\bar{B}C\bar{D} + A\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}\bar{C}\bar{D}$ (original form)



Total No. of gates in original expression = 11

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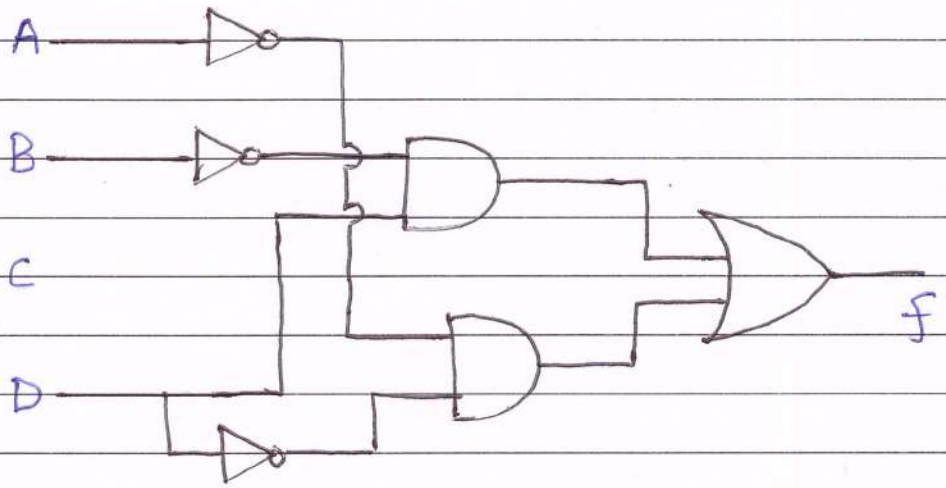

Total No. of gates = 6
in optimised form

d) $f = \bar{A}D + \bar{B}\bar{D}$

$f' = AB + AD + B\bar{D}$

$= AD + B\bar{D} + AB(D+\bar{D})$

$= AD + B\bar{D} + ABD + AB\bar{D}$

$= AD + ABD + B\bar{D} + AB\bar{D}$

$= AD(1+B) + B\bar{D}(1+A)$

$= AD(1) + B\bar{D}(1)$ $[1+X=1]$

$f' = AD + B\bar{D}$

- $f \cdot f' = (\bar{A}D + \bar{B}\bar{D})(AD + B\bar{D})$

$= \bar{A}ADD + \bar{A}BD\bar{D} + A\bar{B}D\bar{D} + B\bar{B}\bar{D}\bar{D}$

$= 0 + 0 + 0 + 0$

$= 0$

- $f + f' = \bar{A}D + \bar{B}\bar{D} + AD + B\bar{D}$

$= \bar{A}D + AD + \bar{B}\bar{D} + B\bar{D}$

$= D(A+\bar{A}) + \bar{D}(B+\bar{B})$

$= D(1) + \bar{D}(1)$

$= D + \bar{D}$

$= 1$

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e) $AB + A(CD + C\bar{D})$

$= AB + AC(D + \bar{D})$

$= AB + AC(1)$

$= A(B + C)$