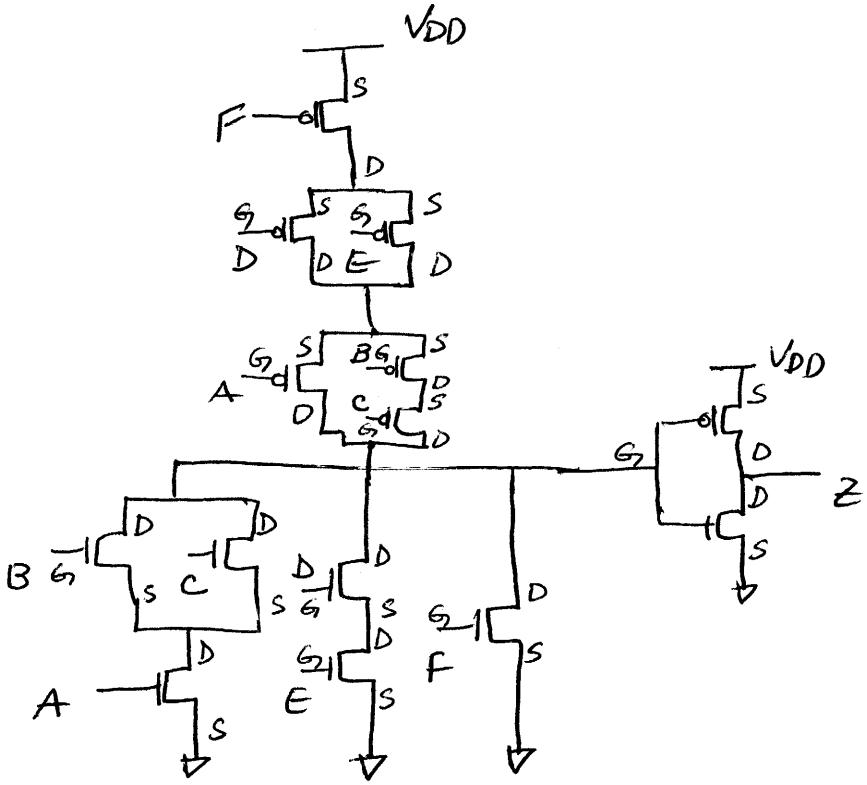
EE 365 — Solution to Hour Exam I

1. $Z = \overline{A \cdot (B+C) + (D \cdot E + F)}$

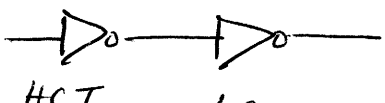


2. $t_{pHL} \propto R_n C_L$; $t_{pLH} \propto R_p C_n$

$\therefore \frac{t_{pLH}}{t_{pHL}} = \frac{R_p}{R_n} = \frac{200}{150}$

$\therefore t_{pLH} = \left(\frac{200}{150}\right) \times 20\,ns = 26.67\,ns$

3.



$V_{OHmin} = 3.84V$ | $V_{ILmax} = 0.8$

$V_{OLmax} = 0.33$ | $V_{IHmin} = 2.0V$

$I_{OHmax} = -4.0mA$ | $I_{ILmax} = -0.4mA$

$I_{OLmax} = 4.0mA$ | $I_{IHmax} = 0.02mA$

$NM_L = 0.8 - 0.33 = 0.47V$

$NM_H = 3.84 - 2.0 = 1.84V$

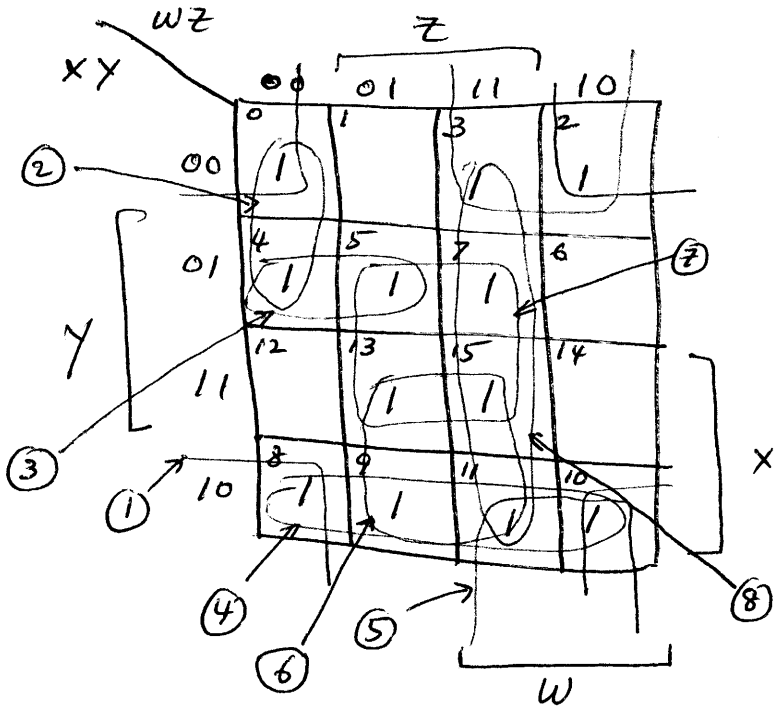
$\text{Fanout (High)} = \frac{4}{.02} = 200$

$\text{Fanout (Low)} = \frac{4}{0.4} = 10$

$\text{Fanout} = \min(200, 10)$

$= 10$

4. $Z = \sum_{x,y,w,z} (0, 2, 3, 4, 5, 7, 8, 9, 10, 11, 13, 15)$



8 Prime implicants

① $y' \cdot z'$
② $x' \cdot w' \cdot z'$
③ $x' \cdot y \cdot w'$
④ $x \cdot y'$
⑤ $y' \cdot w$
⑥ $x \cdot z$
⑦ $y \cdot z$
⑧ $w \cdot z$

○ distinguished 1-cell
○ essential prime implicants

minimal Sum expression

$$Z = \underset{(1)}{y' \cdot z'} + \underset{(3)}{x' \cdot y \cdot w'} + \underset{(6)}{x \cdot z} + \underset{8}{w \cdot z}$$

or

$$Z = \underset{(4)}{x \cdot y'} + \underset{(7)}{y \cdot z} + \underset{(2)}{x' \cdot w' \cdot z'} + \underset{(5)}{y' \cdot w}$$