

ECE240 Spring 2008 Name KEY

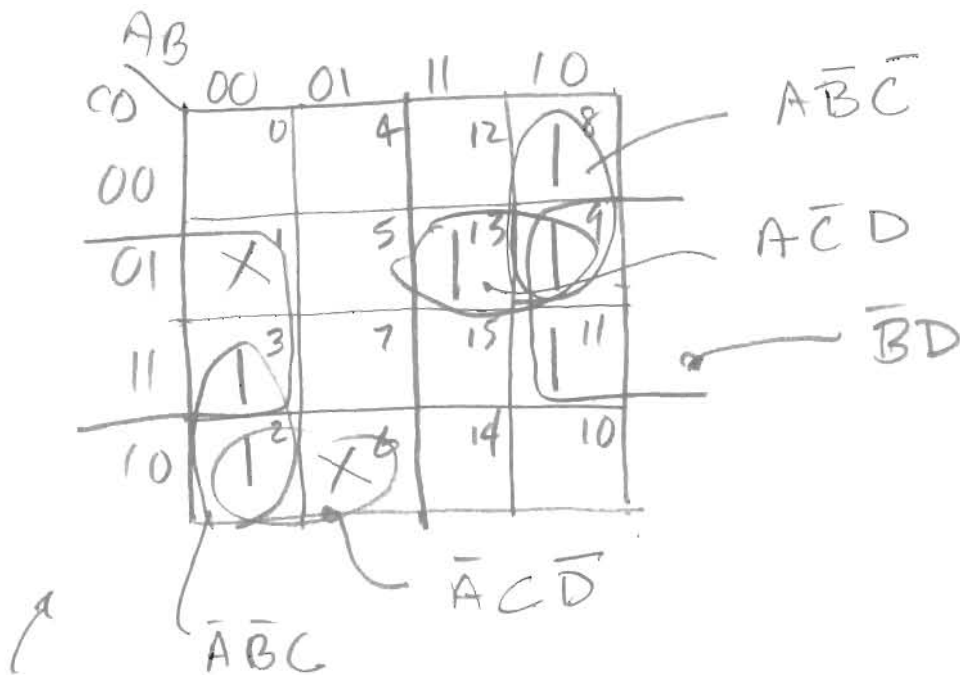
In-Class Quiz #2

15 minutes; 20 points. Two problems.

Closed book, closed notes. Calculators allowed.

- [10] Using a Karnaugh map, find a minimal sum-of-products expression for the following Boolean function, where $m()$ represents minterms and $d()$ represents "don't care".

$$Y(A, B, C, D) = \sum m(2,3,8,9,11,13) + \sum d(1,6)$$

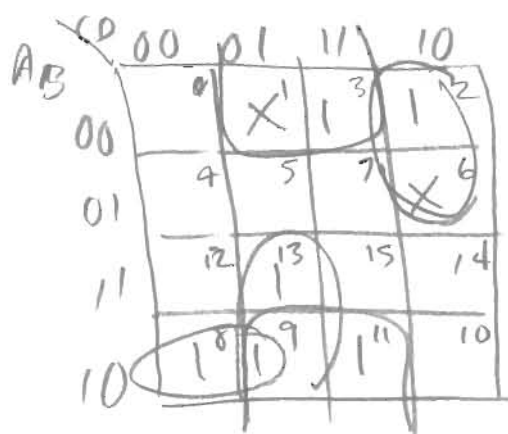


or

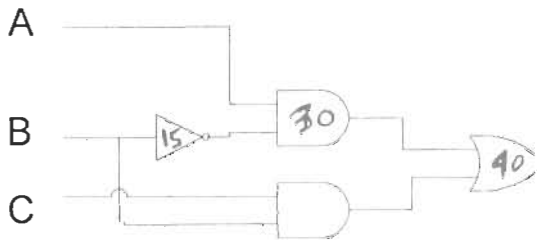
$$Y = \bar{B}D + A\bar{B}\bar{C} + A\bar{C}D + \bar{A}\bar{B}C$$

or

$$\bar{A}C\bar{D}$$



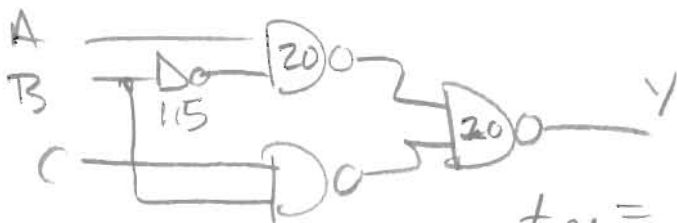
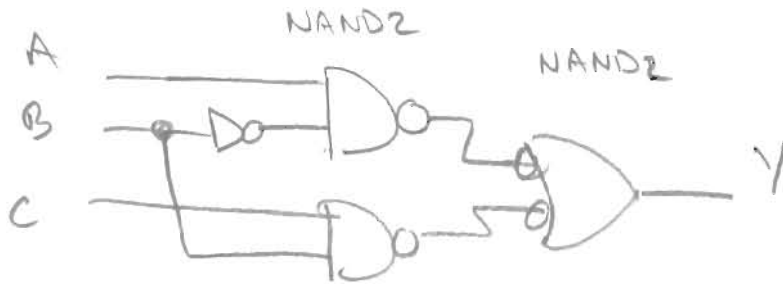
2. Refer to the logic circuit below, which was synthesized using the logic gates whose delays are shown in the table. The critical path delay is **75 ps**. Using only gates from the table, draw a logically equivalent circuit whose critical path delay is less than 60 ps.



Loops!
 $t_{pd} = 15 + 30 + 40 = 85$

$$Y = A\bar{B} + ABC$$

Gate	$T_{pd}(ps)$	$t_{cd}(ps)$
NOT	15	10
2-input NAND	20	15
3-input NAND	30	25
2-input NOR	30	25
3-input NOR	45	35
2-input AND	30	25
3-input AND	40	30
2-input OR	40	30
3-input OR	55	45
2-input XOR	60	40



$$t_{pd} = 20 + 20 + 15 = 55 \text{ ns}$$

CHECK

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