CMPE 2020A Test 1
NAME:
GT ID NO:
Open book, open notes, no calculators.

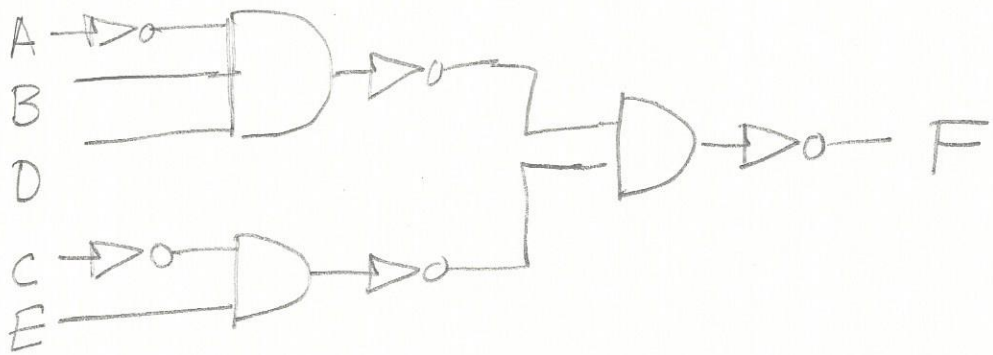
Problem 1 (10 points):

(a) Rewrite the function $F = \overline{(A + (\overline{B} + \overline{D}))} + \overline{(C + \overline{E})}$ using only the AND function and inversion. Hint: Use deMorgan's formula.

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

$= \overline{\overline{(\overline{A}BD)} \cdot \overline{(\overline{C}E)}}$

(b) Draw a circuit for F using only AND gates and inverters from the expression for F derived in part (a)



Problem 2 (10 points):

(a) Convert 347 (OCTAL) to HEXADECIMAL

HEX representation = $011100111 = E7$

(3 4 7 → 011 100 111 → E 7)

(b) Convert 67.35 into binary. Compute the fractional part to 4 bits of accuracy.

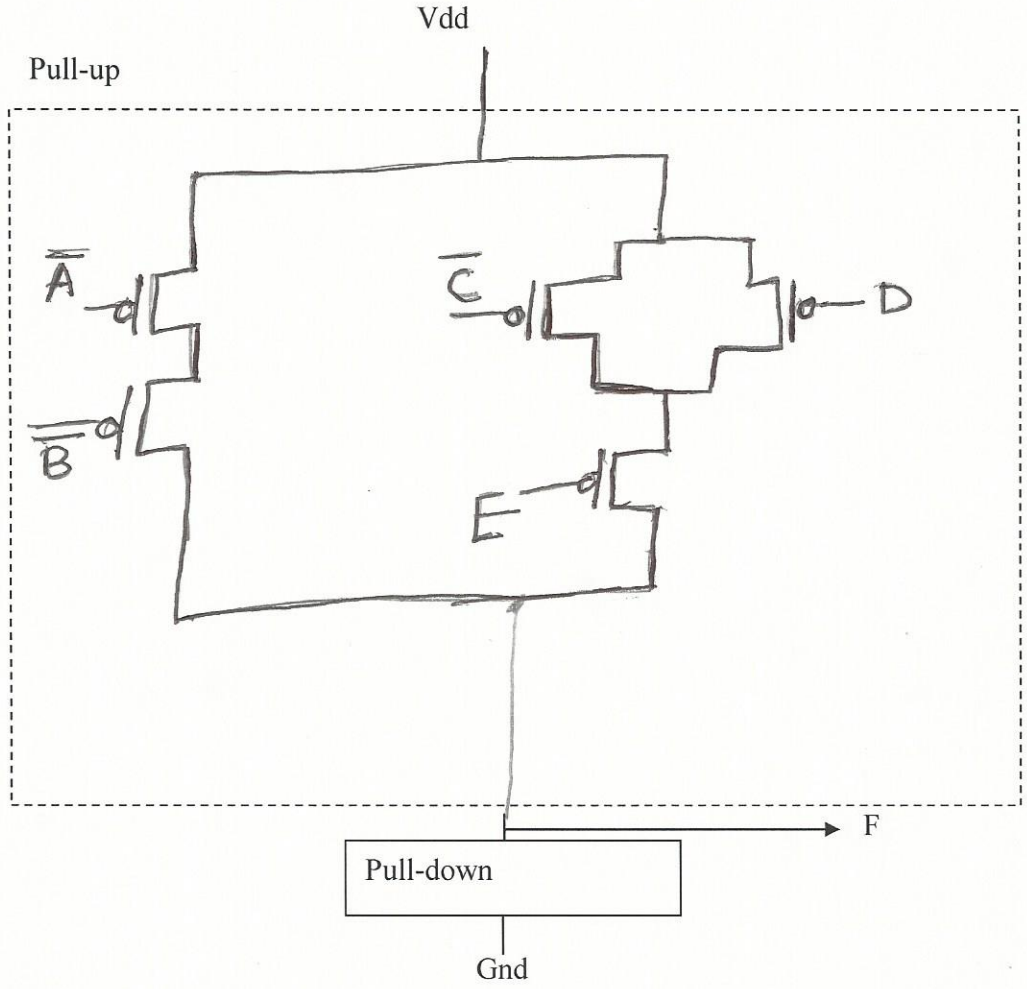
Binary representation = 1000011.0101

$2 \mid 67$
$2 \mid 33 \; 1$
$2 \mid 16 \; 1$
$2 \mid 8 \; 0$
$2 \mid 4 \; 0$
$2 \mid 2 \; 0$
$1 \; 0$

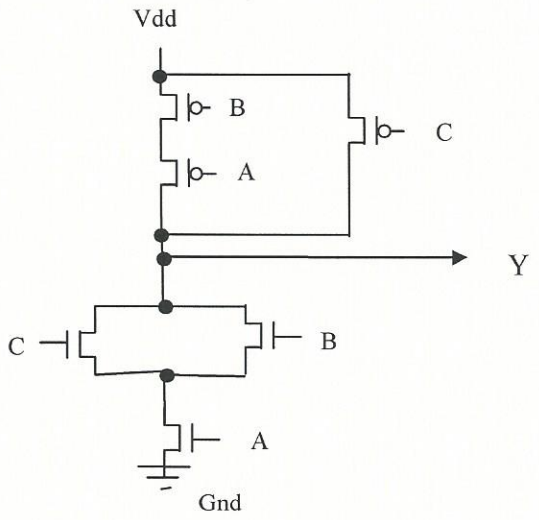
$.35 \times 2 = 0.7$
$0.7 \times 2 = 1.4$
$0.4 \times 2 = 0.8$
$0.8 \times 2 = 1.6$

Problem 3 (14 points):

(a) For the complex gate implementation of the function $F = (A \bullet B) + ((C + \overline{D}) \bullet \overline{E})$, draw the pull-up chain below. We assume that the pull-dn chain has already been designed correctly. You may assume that the complemented values of variables are available directly.



(b) For the following circuit,



(a) Does this circuit contain a "short" condition ? i.e. for any input combination does there exist a path from Vdd to Gnd ? If yes, give *all input combinations* that result in shorts.

Contains shorts ? (Yes) | No (circle one)

Input combinations (ABC) : 110

ABC	PULL-UP $\overline{A}\overline{B}+\overline{C}$	PULL-DOWN $A\cdot(B+C)$	
000	1	0	
001	1	0	
010	1	0	
011	0	0	FLOAT
100	1	0	
101	0	1	
110	1	1	SHORT
111	0	1	

(b) Does this circuit contain an "open/float" condition ? i.e. for some input combination there does not exist any path from Vdd to Y AND there does not exist any path from Y to Gnd ? If yes, give *all input combinations* that result in floats.

Contains floats ? (Yes) | No (circle one)

Input combinations (ABC): 011

Problem 4 (6 points):

Simplify the expression $F = \overline{Z} + XY + (\overline{X} + \overline{Y})Z$ to the smallest number of literals. Show what Boolean identity you used in each step of the reduction.

$$F = \overline{Z} + X \cdot Y + (\overline{X} + \overline{Y}) \cdot Z$$

$$= \overline{Z} + X \cdot Y + (\overline{X} + \overline{Y}) \quad (A + \overline{A}B = A + B)$$

$$= \overline{Z} + \underbrace{X \cdot Y + \overline{X \cdot Y}}_{=1} \quad (A + \overline{A} = 1)$$

$$= 1 + \overline{Z} \quad (A + 1 = 1)$$

$$= 1$$