Computer Science 605.411

Problem Set 4

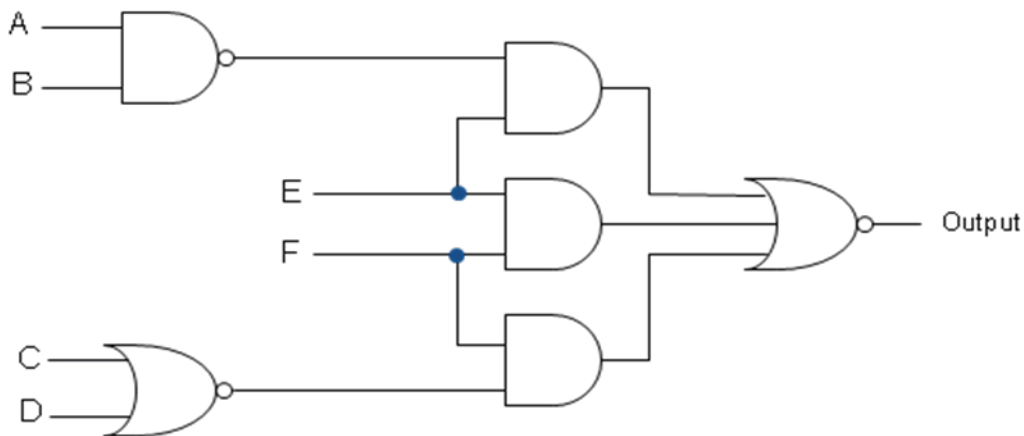1. (20) In the expression:

$$\overline{X \oplus Y} \qquad \oplus \ denotes \ the \ exclusive - OR \ operator.$$

Rewrite this expression as the logical sum of two logical product terms involving only X and Y.

2. (10) a) A full adder takes 3 inputs: the data bits X and Y, as well as an input carry CI. It produces the arithmetic sum $S = X$ plus Y along with an output carry CO. Construct the truth table for S using X, Y and CI as inputs.

(10) b) Also construct the truth table for the logic function $\quad Z = X \wedge Y \wedge CI \quad$ where the operator "^" denotes the XOR function.

3. (20) Consider the following logic circuit:

Which of the expressions listed below correctly describes the output generated by this circuit (there may be zero or more correct answers):

a) $\ \overline{A}\,\overline{B}\,E + E\,F + \overline{C}\,\overline{D}\,F$

b) $\ (\overline{E} + A\,B\,\overline{F})(\ C + D + \overline{F}\ )$

c) $\ (\overline{A}\ B + E)(\overline{E} + \overline{F})(C + D + \overline{F})$

d) $\ (A + B)\overline{E} + \overline{E}\,\overline{F} + C\,D\ \overline{F}$

e) $\ (\overline{A} + \overline{B})\,E + E\,F + \overline{C}\,\overline{D}\,F$

4. (10) a) For the function F(x,y,z) defined by the truth table below, list each of the nonzero minterms.

x	y	z	F
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

(10) b) List each of the zero maxterms for the same function.

5. (5) a) In the truth table below, A and B are inputs and C is the output of the circuit shown. Complete this truth table by filling in the entries for C.

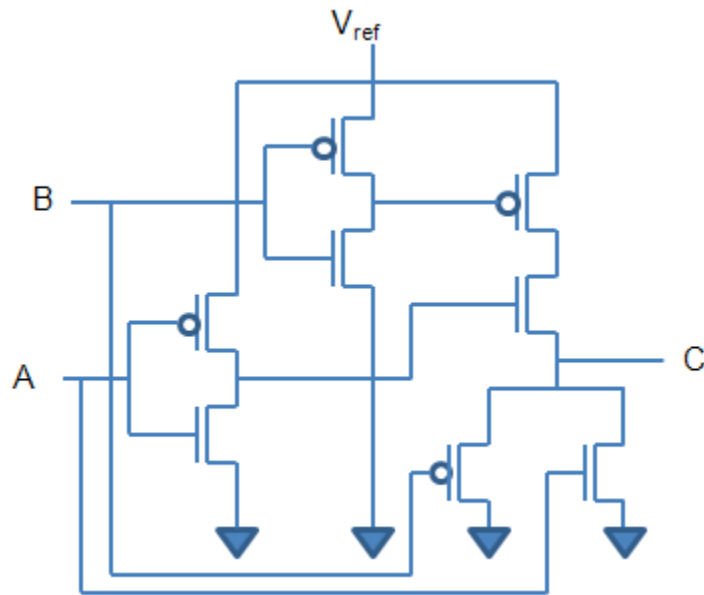| A	B	C
0	0	
0	1	
1	0	
1	1	
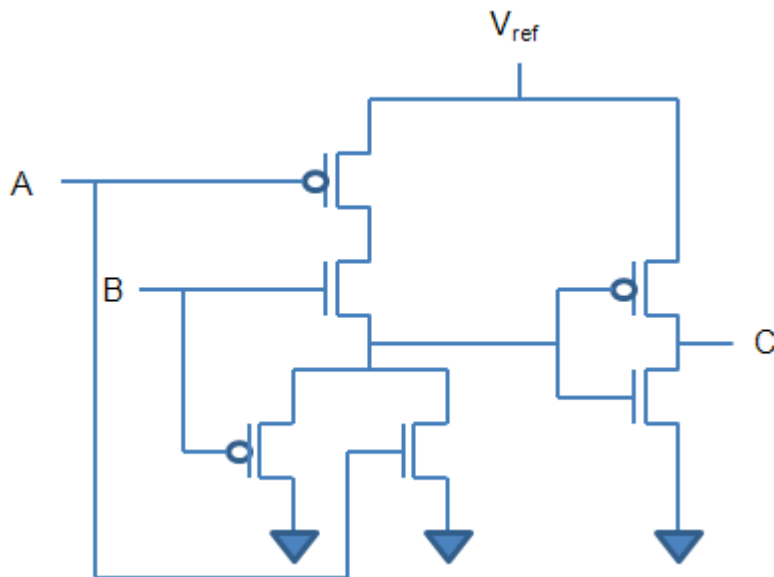
b) (5) Express C as a logic function the inputs (A, B) for this circuit.

C= _____

(5) c) Do the same for the following truth table and circuit pair:

A	B	C
0	0	
0	1	
1	0	
1	1	

d) (5) Express C as a logic function the inputs (A, B) for this circuit.

C= _____