Homework 1

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128 64 32 16 8 4 2 1

Q1

- +49: **00110001 = 49**
- +29: **00011101 = 29**
- −49: 00110001 → 11001110 + 00000001 = 11001111 → −49; **−49 = 11001111**
- −29: 00011101 → 11100010 + 00000001 = 11100011; **−29 = 11100011**

a) 29 + (−49)

  00011101
+ 11001111
= 11101100

11101100

b) (−29) + 49

  11100011
+ 00110001
= 00010100

00010100

c) (−29) + (−49)

  11100011
+ 11001111
= 10110010

10110010

Q2

1001 = −7 = 11111001
+ 17 = + 00010001
= 10 = 00001010

00001010 = 10

Q3

a) 00001001 + 00000001 = 00001010; 10001011 + 00001011 — no overflow

b) 00111001 + 00000001 } 2's complement; 00111010 + 00111111 } addition = 01111001 — no overflow

c) 00111101 → 00000001, 00111110 + 01000001 = 01111111 — no overflow

d) 00111111 + 00000001 = 01000000; 01000000 + 01000000 = 10000000 — overflow

> D has overflow b/c the msb of the first and second digit are both 0, but the msb of the output is 1 ∴ ovf occurs

Q4

1\. i.

A	B	C	Y
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

= A'B'C' + AB'C + A'BC' + ABC

ii)

A	B	C	Y
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

= A'B'C' + AC + A'BC'

iii)

A \ BC	00	01	11	10
0	1	0	0	1
1	0	1	1	0

A'C' + AC — iii) not equal to i)

A'C' + AC ≠ A'C' + A'C

i) and ii) are equal b/c AC is true for B' and B, can replace ↺ A'B'C' + AB'C + A'BC' + ABC → AC

Q5

a) F(A,B,C,D) = Σm(2,4,7,10,12,14)

↳ 16 total minterms

F'(A,B,C,D) = Σm(1,3,5,6,8,9,11,13,15,16)

b) F(x,y,z) = ΠM(3,5,7)

↳ Maxterm is opposite minterm

F'(x,y,z) = Σm(3,5,7)

Q6

C	D	Out
0	0	1
0	1	0
1	0	0
1	1	1

00 → 1: C'D'; 11 → 1: CD

XNOR →

A	Y
0	XNOR
1	1

→ A'

A	Y
0	C'D' + CD
1	1

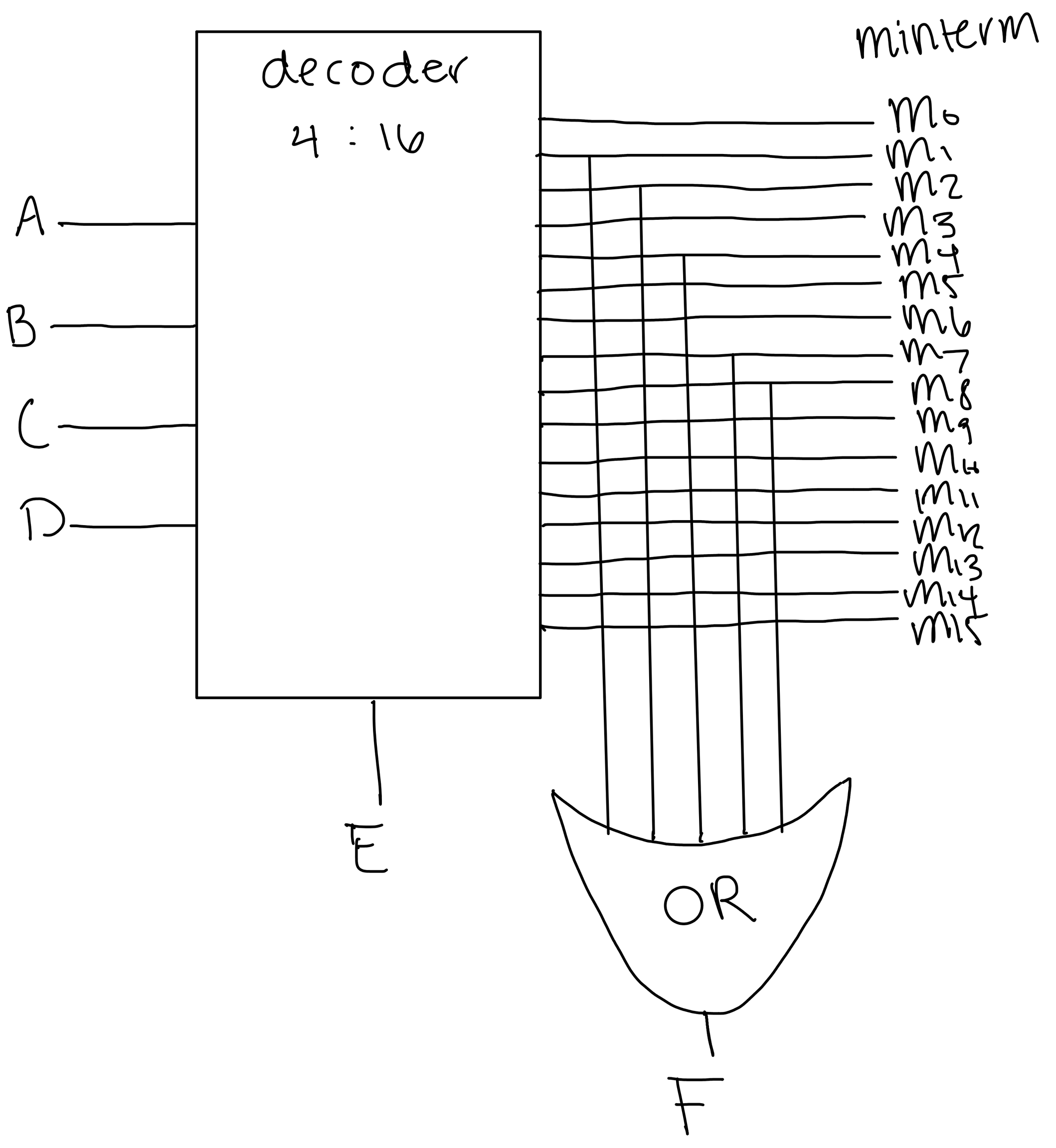
∴ answer is

ii A' + CD + C'D'

Q7

F = Σm(1,2,4,7,8)

E	A	B	C	D	F	minterm
0	0	0	0	0	0	m0
1	0	0	0	1	1	m1
1	0	0	1	0	1	m2
1	0	0	1	1	0	m3
1	0	1	0	0	1	m4
1	0	1	0	1	0	m5
1	0	1	1	0	0	m6
1	0	1	1	1	1	m7
1	1	0	0	0	1	m8
1	1	0	0	1	0	m9
1	1	0	1	0	0	m10
1	1	0	1	1	0	m11
1	1	1	0	0	0	m12
1	1	1	0	1	0	m13
1	1	1	1	0	0	m14
1	1	1	1	1	0	m15



Q8

F(A,B,C,D) = Σ(3,5,7,8,11,14,15)

S2 = A, S1 = B, S0 = C

	A	B	C	D	F
0	0	0	0	0	0
	0	0	0	1	0
	0	0	1	0	0
	0	0	1	1	1
	0	1	0	0	0
	0	1	0	1	1
	0	1	1	0	0
	0	1	1	1	1
	1	0	0	0	1
	1	0	0	1	0
	1	0	1	0	0
	1	0	1	1	1
	1	1	0	0	0
	1	1	0	1	0
	1	1	1	0	1
15	1	1	1	1	1

$I_0 = 0$, $I_1 = D$, $I_2 = D$, $I_3 = D$, $I_4 = \overline{D}$, $I_5 = D$, $I_6 = 0$, $I_7 = 1$