# Lecture 4

## or “It’s time for some Carolina Football!”

# Examples

| | Product term | SOP | Sum term | POS |
|---|---|---|---|---|
| a’b | | | | |
| a+bc’ | | | | |
| a(bc’ + d) | | | | |
| (a+b’)(a’+c+d’) | | | | |
| c | | | | |

# Examples

| | Product term | SOP | Sum term | POS |
|---|---|---|---|---|
| a’b | O | O | X | O |
| a+bc’ | X | O | X | X |
| a(bc’ + d) | X | X | X | X |
| (a+b’)(a’+c+d’) | X | X | X | O |
| c | O | O | O | O |

# More properties of Switching Algebra

Adjacency

P9a. $ab + ab' = a$

P9b. $(a+b)(a+b') = a$

Simplification

P10a. $a + a'b = a + b$

P10b. $a(a' + b) = ab$

DeMorgan

P11a. (a + b)’ = a’b’  P11b. (ab)’ = a’ + b’

Note that (ab)’ =/= a’b’

DeMorgan can be extended to more than 2 operands

(a+b+c+...) = a’b’c’

(abc…)’ = a’+b’+c’+...

f=ab’(c+de)+a’bc’

How do we get the complement?

f’=(ab’(a+de)+a’bc)’

x = ab’(a+de)

y = a’bc

# Properties of DeMorgan

All non complemented need to be complemented and vice versa

All 0s need to be made into 1s and vice versa

All AND need to be changed to OR and vice versa

# From Truth Table to Expression

| a | b | f |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

f is 1 if a=0 AND b=1 OR
if a=1 AND b=0 OR
if a=1 AND b=1

f is 1 if a’=1 AND b=1 OR
if a=1 AND b’=1 OR
if a=1 AND b=1

f is 1 if a’b = 1 OR
if ab’ = 1 OR
if ab = 1

f = a’b + ab’ + ab

# Why isn’t that equal to a + b?

It is!

| | |
|---|---|
| a’b + ab’ + ab | Initial |
| a’b + (ab’ + ab) = a’b + a | Adjacency |
| a’b + a = a + b | Simplification |

# Minterms for this

| a | b | minterm | # |
|---|---|---|---|
| 0 | 0 | a’b’ | 0 |
| 0 | 1 | a’b | 1 |
| 1 | 0 | ab’ | 2 |
| 1 | 1 | ab | 3 |

Can use minterm numbers since the product terms are minterms

For example, the previous function can be written as:

$$f(a, b) = m_1 + m_2 + m_3$$

$$f(a, b) = \Sigma(1,2,3)$$

Use separate sigma to represent don’t cares