

## HW2 Prob 8 Again: *Even More On Metaproducts*

### ▼ What you know

- ▶ That Rob should *never* have tried to put a metaproducts problem on this homework...
- ▶ That middle-aged CAD faculty should *ask* their TAs before releasing their Powerpoint slides...
- ▶ That there is *another* bug on another BDD in the “More on Metaproducts” previous version of this explanation
- ▶ That you are really, *really* looking forward to getting on to HW3...

### ▼ What you don't know

- ▶ How to fix this bug
- ▶ If you're actually going to read this, or just go watch another rerun of “Friends” on channel 9...

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## *Even More On Metaproducts*

### ▼ Suppose I have a Boolean function of 2 vars: $F(x,y)$

- ▶ If I want to consider writing an SOP equation for  $F(x,y)$ , how many possible product terms could there be?

### ▼ Can enumerate: there are $3^2 = 9$ terms:

- ▶ Every product has 2 “slots” for literals in it
- ▶ The first slot can be one of  $\{\epsilon, x, x'\}$  where “ $\epsilon$ ” means “empty”
- ▶ The second slot can be one of  $\{\epsilon, y, y'\}$  where “ $\epsilon$ ” also means “empty”
- ▶ Why 9 terms max?  $|\{\epsilon, x, x'\}| \times |\{\epsilon, y, y'\}| = 3 \times 3 = 9$

### ▼ Examples

- ▶ Term  $xy'$  == (1<sup>st</sup> slot is  $x$ )(2<sup>nd</sup> slot is  $y'$ )
- ▶ Term  $x'$  == (1<sup>st</sup> slot is  $x'$ )(2<sup>nd</sup> slot is  $\epsilon$  -- empty)

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## Even More on Metaproducts

▼ Well, what are *all* 9 of these possible product terms?

1 <sup>st</sup> slot	2 <sup>nd</sup> slot	Product Term Represented
$\epsilon$	$\epsilon$	$\epsilon = \text{empty}$
x	$\epsilon$	x
x'	$\epsilon$	x'
$\epsilon$	y	y
$\epsilon$	y'	y'
x	y	xy
x	y'	xy'
x'	y	x'y
x'	y'	x'y'

▼ OK, what does this have to do with metaproducts...?

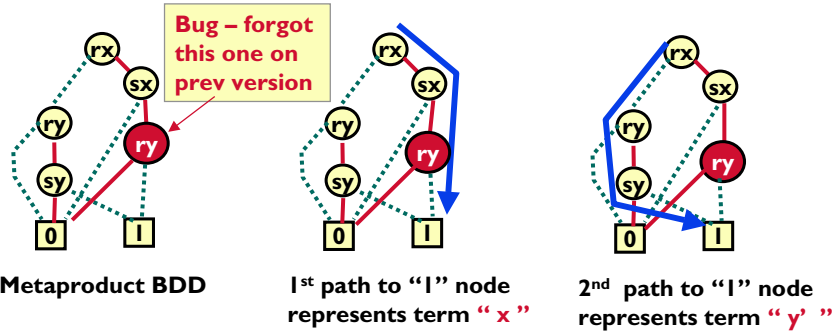
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## Even More on Metaproducts

▼ A metaproduct is really a BDD that represents a set

- The set it represents is some arbitrary set of product terms, chosen from the complete set of 9 (in this 2-variable case) on previous slide

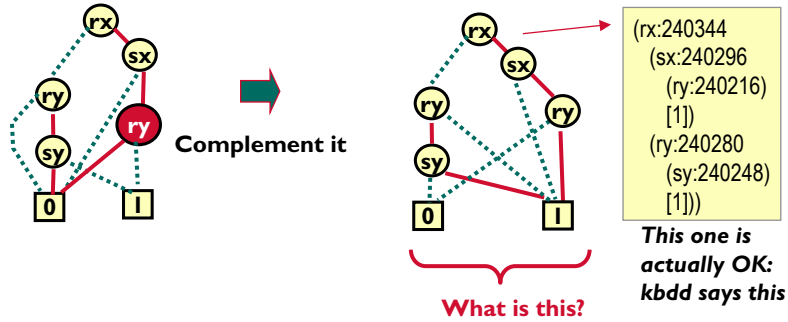
▼ Example:  $F(x,y) = x + y'$



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## Even More on Metaproducts

▼ So, what really happens when you complement this BDD?



It's the BDD for the set of all the **OTHER** product terms **NOT** in the original BDD...

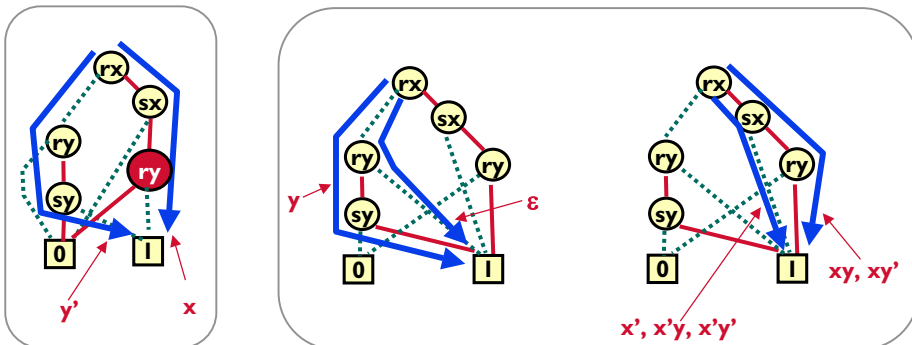
(Also, its just the same BDD as at left, with the 1 and the 0 flipped)

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## Even More on Metaproducts

▼ So, what really happens when you complement this BDD?

► You get a new BDD that represents the 7 other products **NOT** in original set

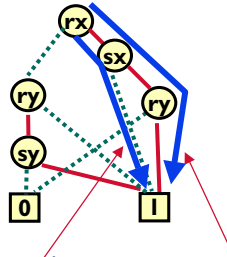


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## Even More on Metaproducts

### Subtle stuff

- Interpreting what happens when you see missing variables



**x** is here and negative, but no **y** occurrence var. Interpret as: all values of **y** are possible, including the empty “ $\epsilon$ ” **y** value. Result is:  $x', x'y, x'y'$

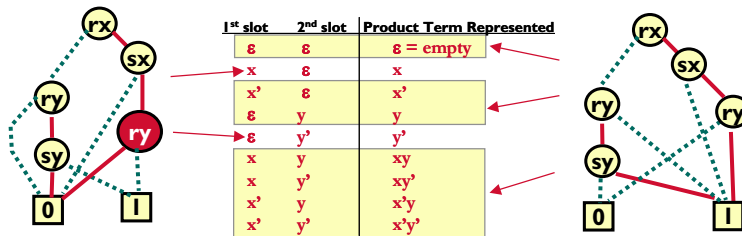
**x** is here and positive, **y** is here, but no **y** sign var. Interpret as: all “signed” values of **y** are possible, but not the empty “ $\epsilon$ ” **y** value. Result is:  $xy, xy'$

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## Even More on Metaproducts

### So both original metaproduct BDD and its complement are just sets of stuff. They represent subsets of these 9 terms

- When you complement one of these, you **don't** get  $F'()$ . You get a set that represents all the other terms you didn't represent originally



Represents these 2 of 9 possible terms

Represents these 7 of 9 possible terms

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## Back to Homework (Same as Previous Version)

### ▼ About HW2 Problem 8

- ▶ The part about “..complement it and explain it” was aimed at this, but with  $F() = 4$  variables, its just way too complicated to see. (Sorry...)
  
- ▶ Do this **instead** of the complicated 4-variable function:
  - ▷ Let  $F(x,y) = x'y + xy'$
  - ▷ Draw the **BDD** for the metaproduct form for  $F()$
  - ▷ Draw the complement **BDD** for this metaproduct **BDD**
  - ▷ Like in these notes, show that the complement really does represent all of the *other* product terms not in the original **BDD**.