Imperial College London Lecture 4: Bo Department of EEE (Floyd 4 (Toc	Polean Algebra r Peter Cheung , Imperial College London .1-4.4, 5.2-5.4) ci 3.8-3.14)	 Points Addressed in this Lecture Theorems & rules in Boolean algebra DeMorgan's Theorems Universality of NAND & NOR gates Active low & Active high Digital Integrated Circuits 				
E1.2 Digital Electronics I 4.1	Oct 2007	E1.2 Digital Electronics I	Oct 2007			
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Implications of DeMorgan's Theorems(I)





(b)

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Example

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 Determine the output expression for the below circuit and simplify it using DeMorgan's Theorem



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Implications of DeMorgan's Theorems(II)



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Review Questions

• Using DeMorgan's Theorems to convert the expressions to one that has only single-variable

inversions.

$$\overline{R\overline{ST} + \overline{Q}} \quad \longrightarrow \quad y = (\overline{R} + S + \overline{T})Q$$
$$\overline{A + B} \cdot \overline{C} \quad \longrightarrow \quad z = \overline{AB} + C$$

• Use DeMorgan's theorems to convert below expression to an expression containing only single-variable inversions.

y =

z = (z

$$y = \overline{A + \overline{B} + \overline{C}D} \longrightarrow y = \overline{A}B(C + \overline{D})$$

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Universality of NAND gates





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Basic Characteristics of Digital ICs

- Digital ICs (chips): a collection of resistors, diodes and transistors ٠ fabricated on a single piece of semiconductor materials called substrate.
- Dual-in-line package (DIP) is a common type of packages. ٠



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Logic Level LOW HIGH INDETERMINATE* PULSING * Includes open or floating condition

Logic probe is used to monitor the logic level activity at an IC pin or any other accessible point in a logic circuit







Sun How to represent th Logical statements Truth tables Traditional graphic Boolean algebra ex Timing diagrams	nmary: he basic logic functions in our own language logic symbols pressions	e	Imp Lon • • • • • • • • • •	erial College Boolean Alge and design of OR, AND, Ne OR: HIGH of AND: HIGH of NOT: output NOR: OR wi NAND: AND Boolean theo logic circuit a the circuit NAND, NOR Boolean ope	Su ebra: a mather of digital circui OT: basic Boo utput when an output only when is the opposit ith its output c with its output c orems and rul and can lead t and can lead t	mmary matical tool use its plean operation by input is HIGF hen all inputs a te logic level as onnected to an at connected to an at connected to an les: to simplify t to a simpler way	ed in the analy s f re HIGH the input INVERTER an INVERTER he expression y of implement any of the basic	sis of a ing c
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