Combinational Logic Implementation

ELEC 1202

What do we build circuits from?
Applications

Computer vision!!
Representation

Validity is represented with volts

TRUE = ‘1’ = +5V

FALSE = ‘0’ = 0V
AND

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>A · B</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
AND function

Positive power supply $V_{cc}$

Button pressed = '1', not pressed = '0'

Negative power supply 0V
### OR

#### Truth Table

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>A + B</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
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<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

#### OR Circuit Symbol

Inputs → Output
OR function

Positive power supply $V_{cc}$

Button pressed = '1', not pressed = '0'

Negative power supply 0V
NOT

Truth Table

<table>
<thead>
<tr>
<th>$A$</th>
<th>$\overline{A}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

NOT/ Inverter Symbol

Input  Output
Combination: NOT AND → NAND

Button pressed = '1', not pressed = '0'
NAND function

<table>
<thead>
<tr>
<th>( A )</th>
<th>( B )</th>
<th>( A \cdot B )</th>
<th>( \overline{A \cdot B} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
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<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

NAND Symbol

\[
\text{Inputs} \quad \text{Output}
\]
Combination: NOT OR → NOR

<table>
<thead>
<tr>
<th>$A$</th>
<th>$B$</th>
<th>$A + B$</th>
<th>$\overline{A + B}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
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<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

NOR Symbol

![NOR Symbol](image)
NOR function

Button pressed = '1', not pressed = '0'