3.15 Multiple outputs

Multiple output circuits

Many combinational circuits have multiple outputs for the same inputs. Each output can be treated as a unique function. F
each output becomes a new column. For equations, each output is a unique equation.
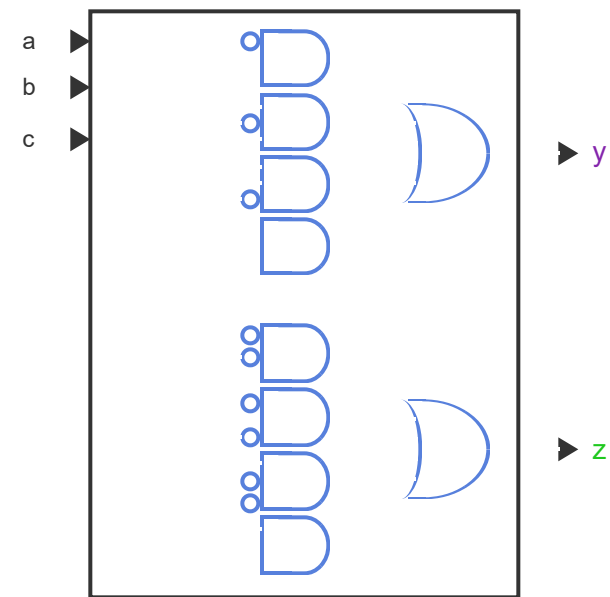

| PARTICIPATION ACTIVITY | 3.15.1: Multiple outputs: This circuit has three inputs and two outputs. |

Start   ☐ 2x speed

a	b	c	y	z
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	1	0	1	0
1	0	1	1	0
1	1	1	1	1

$y = a'bc + ab'c + abc' + abc$

$z = a'b'c + a'bc' + ab'c' + abc$

PARTICIPATION ACTIVITY   3.15.2: Multiple output circuits.

Consider the example above.

1) The truth table has 3 inputs, 8 rows, and _____ outputs.

   ○ 1

   ○ 2

   ○ 3

2) Output y is 1 for how many input combinations?

   ○ 1

   ○ 2

   ○ 4

3) When filling in 1's in the columns for y, z, a designer likely considers y, z _____

   ○ together

   ○ separately

4) When creating the equations, a designer considers y, z _____.

   ○ together

   ○ separately

5) When creating the circuit, the designer

kept the circuits _____.

- ○ intermingled
- ○ separate

6) For a different truth table with two outputs w, x, if three 1's exist in w's column, then ___ 1's exist in x's column.
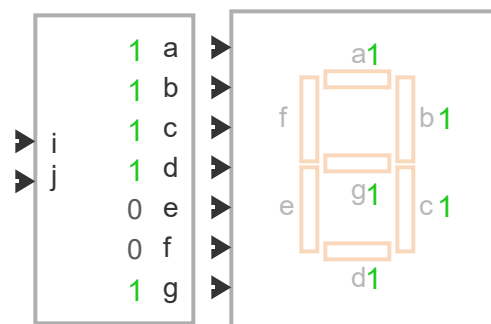
- ○ one
- ○ three
- ○ an unknown number of

Example: 7-segment display

A **7-segment display** is a common display device having 7 light segments that can be lit in different patterns to represent n some letters too.

PARTICIPATION ACTIVITY	3.15.3: 7-segment display, and use for displaying a 2-bit binary number as a decimal number.

Start ☐ 2x speed


```
i j   a b c d e f g

0 0   1 1 1 1 1 1 0


0 1   0 1 1 0 0 0 0


1 0   1 1 0 1 1 0 1


1 1   1 1 1 1 0 0 1
```

a = i'j' + ij' + ij

b = i'j' + i'j + ij' + ij

c = i'j' + i'j + ij

...

PARTICIPATION ACTIVITY	3.15.4: 7-segment display.

1) What is abcdefg to display a 2? Type as:
   0000000

   [   ]

   Check   **Show answer**

2) What is abcdefg to display an 8? Type
   as: 0000000

   [   ]

   Check   **Show answer**

3) If inputs ij are 00, what are outputs
   abcdefg?

   [   ]

   Check   **Show answer**

4) Is b an input or output of the circuit
   being designed? Type input or output.

   [   ]

   Check   **Show answer**

5) The designer created equation c = i'j' + i'j
    + ij. That equation can be simplified to c
    = i'j' + _____? Type one literal. Hint: i'j + ij
    = ?

    [   ]

    Check   Show answer

6) The designer created equation b = i'j' + i'j
    + ij' + ij. That equation can be simplified
    to b = ?

    [   ]

    Check   Show answer

7) A designer decides to display a 3-bit
    binary number (0-7). The circuit will
    have three inputs ijk. How many outputs
    will the circuit have?

    [   ]

    Check   Show answer

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