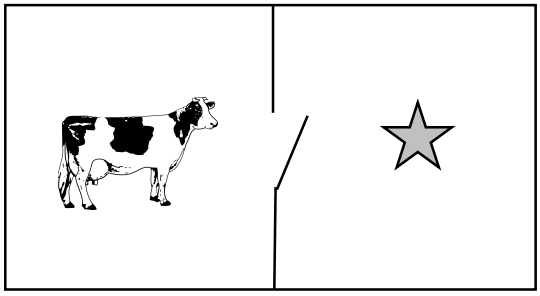
# PreLab PhyzJob: Haleh Cow!

**Complete before the Logic Gates PhyzLab**

This exercise is designed to guide you through the subtle points of AND and OR gate Boolean logic. You will find it helpful on sections 1-7 of the Logic Gates Lab. (students Haleh Partovi and Jay Draeger found this exercise very helpful.) It will **not** help you discover the design of the NOT gate.

We have a cow, Besse, that hopes to get to her pasture (marked with a star) to graze. Your challenge is to write the minimum conditions that must be met for Besse to get to her pasture. Consider case 1 shown to the right.

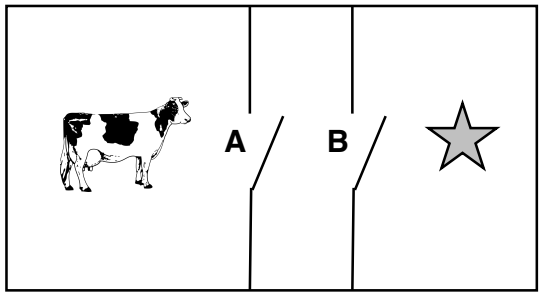


**1. Single gate**

IF the gate is open, THEN Besse can get through. If the gate is closed, Besse cannot get to her pasture. We call this an IF-THEN gate. The cases below also include a table to be completed. The table lists all possible combinations of open/closed gates and the corresponding results for the gate configuration under consideration.

Now consider the following situations. Cases 2 and 3 have been completed for you. Complete cases 4–7 by filling in the truth table, writing the descriptive statement, or sketching an appropriate pasture diagram.

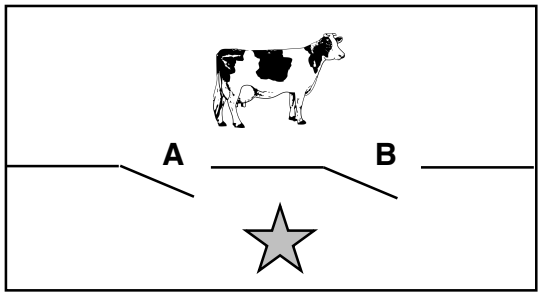
**2. Two gates in a row**




**Besse can get to pasture only if gate A AND gate B are open.**

| A open | B open | Graze? |
|---|---|---|
| *no* | *no* | *no* |
| *no* | *yes* | *no* |
| *yes* | *no* | *no* |
| *yes* | *yes* | *yes* |

**3. Two gates side by side**




**Besse can get to pasture only if gate A OR gate B is open.**

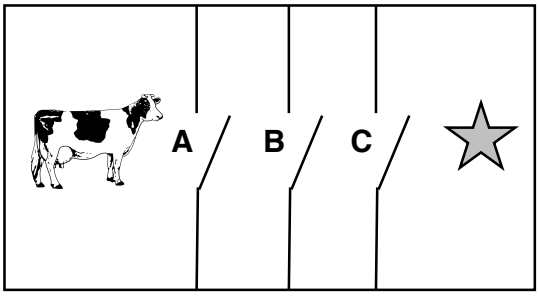
| A open | B open | Graze? |
|---|---|---|
| *no* | *no* | *no* |
| *no* | *yes* | *yes* |
| *yes* | *no* | *yes* |
| *yes* | *yes* | *yes* |

**READ AFTER COMPLETING THE JOB AND BEFORE GOING TO THE LAB**

*Please complete the* ***other*** *side of this sheet before reading this note.*

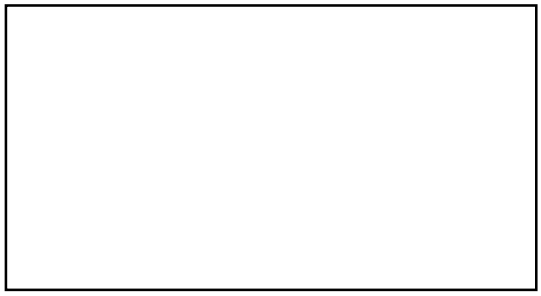
The cow's gates are analogous to our switches. But a word of caution: The cow can pass through a gate if the gate is OPEN; current can pass through a switch only if the switch is CLOSED! A closed gate is to the cow what an open switch is to electric current.

### 4. Three gates in a row




| A open | B open | C open | Graze? |
|---|---|---|---|
| *no* | *no* | *no* | |
| *no* | *no* | *yes* | |
| *no* | *yes* | *no* | |
| *no* | *yes* | *yes* | |
| *yes* | *no* | *no* | |
| *yes* | *no* | *yes* | |
| *yes* | *yes* | *no* | |
| *yes* | *yes* | *yes* | |

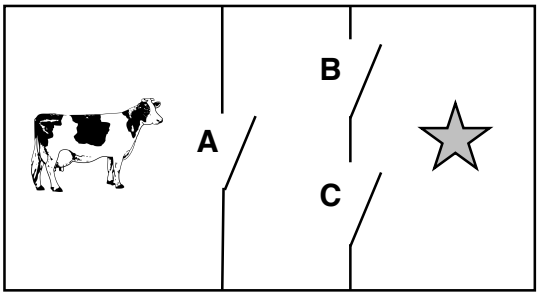
### 5. Three gates side by side



**Besse can get to pasture only if gate A OR gate B OR gate C is open.**

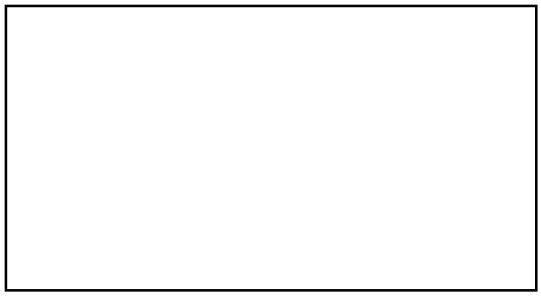
| A open | B open | C open | Graze? |
|---|---|---|---|
| *no* | *no* | *no* | *no* |
| *no* | *no* | *yes* | *yes* |
| *no* | *yes* | *no* | *yes* |
| *no* | *yes* | *yes* | *yes* |
| *yes* | *no* | *no* | *yes* |
| *yes* | *no* | *yes* | *yes* |
| *yes* | *yes* | *no* | *yes* |
| *yes* | *yes* | *yes* | *yes* |

### 6. Three Gate Combo Alpha




| A open | B open | C open | Graze? |
|---|---|---|---|
| *no* | *no* | *no* | *no* |
| *no* | *no* | *yes* | *no* |
| *no* | *yes* | *no* | *no* |
| *no* | *yes* | *yes* | *no* |
| *yes* | *no* | *no* | *no* |
| *yes* | *no* | *yes* | *yes* |
| *yes* | *yes* | *no* | *yes* |
| *yes* | *yes* | *yes* | *yes* |

### 7. Three Gate Combo Beta



**Besse can get to pasture only if gate A OR gate B AND gate C is open.**

| A open | B open | C open | Graze? |
|---|---|---|---|
| *no* | *no* | *no* | |
| *no* | *no* | *yes* | |
| *no* | *yes* | *no* | |
| *no* | *yes* | *yes* | |
| *yes* | *no* | *no* | |
| *yes* | *no* | *yes* | |
| *yes* | *yes* | *no* | |
| *yes* | *yes* | *yes* | |