

Z3 - Tutorial

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- 1 Smartphone company OnePluZ3 is about to launch their new flagship phone
- 2 You are facing several issues that need to be solved ASAP

Problem 1 - What to produce?

- You can produce 3 different items
 - Phone cases, chargers, and smartphones
- Each take different amounts of resources to produce and generate a different amount of profit
- You have limited labor hours, machine hours and material available

Problem 1 - What to produce?

Resources available:

- 500 labor hours
- 800 machine hours
- 600 units of material

Name	Profit	Labor Hours	Machine Time	Raw Materials
Phone Case	10	3	3	4
Phone Charger	30	5	3	2
Smartphone	50	4	5	6

Problem 1 - Formalization

This can be expressed as a linear programming problem.

$$\max f(x) = 10 * A + 30 * B + 50 * C \quad (1)$$

$$\text{with constraints} \quad (2)$$

$$3 * A + 5 * B + 4 * C \leq 500 \quad (3)$$

$$3 * A + 3 * B + 5 * C \leq 800 \quad (4)$$

$$4 * A + 2 * B + 6 * C \leq 600 \quad (5)$$

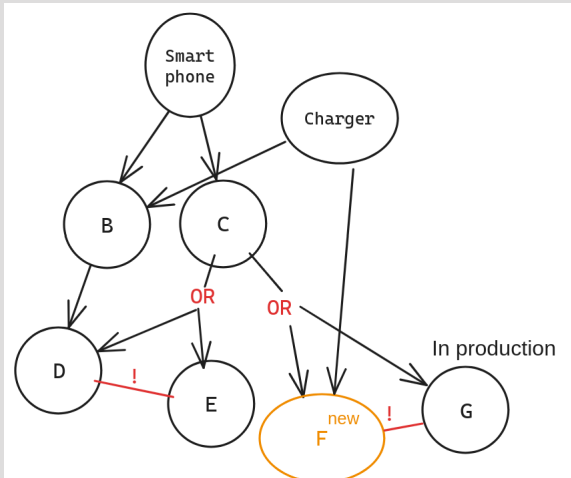
$$A \geq 0 \quad (6)$$

$$B \geq 0 \quad (7)$$

$$C \geq 0 \quad (8)$$

Problem 2 - Dependency Chaos

As part of the production line, you need to manage different parts and chips that are used in different devices.



Problem 2 - Formalization

- Each part is represented by a boolean variable
 - True if in production
 - False if not in production
- A depends on B : $A \implies B$
- A conflicts with B : $\neg A \vee \neg B$

Problem 3 - Code Verification

The day 1 patch is currently in code review. You notice a strange function written by a coworker.

```
// Magic function
uint32_t f(int32_t v) {
    int32_t const mask = v >> 31;
    uint32_t r = (v + mask) ^ mask;
    return r;
}
```


- SMT solver
- open-source
- from Microsoft Research

The logo consists of the characters 'Z' and '3' in a bold, blue, sans-serif font. The 'Z' has a slight 3D effect with a lighter blue highlight on its top-left edge. The '3' is also blue and has a similar highlight on its top-left curve. Both characters have a thin black outline.