RUHR-UNIVERSITÄT BOCHUM

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Z3 - Tutorial

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Introduction

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.

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

$$\text{with contraints} \tag{2}$$

$$3 * A + 5 * B + 4 * C <= 500 \tag{3}$$

$$3 * A + 3 * B + 5 * C <= 800 \tag{4}$$

$$4 * A + 2 * B + 6 * C <= 600 \tag{5}$$

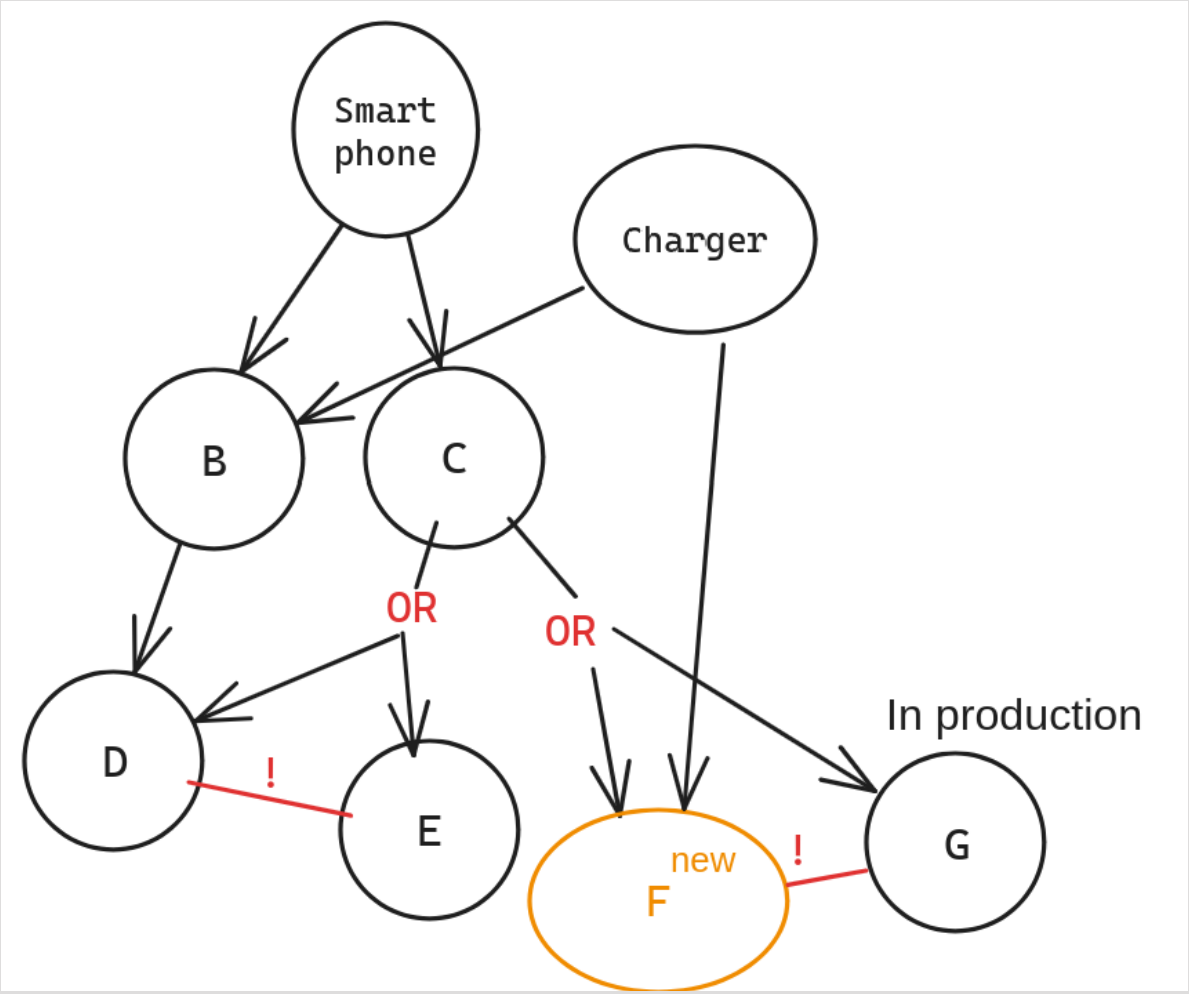
$$A >= 0 \tag{6}$$

$$B >= 0 \tag{7}$$

$$C >= 0 \tag{8}$$

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

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- 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;
}
```