

DESIGN A CIUCUIT

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Sept. 4th, 2017

CMPEN 271

Design a circuit for nuclear power plant alarm

Screen shot of the problem page

Design Problem

You have been hired at a **nuclear power plant** to design a **logic circuit** that will activate an **alarm** in the event that dangerous conditions are present. There are a series of sensors throughout the plant that monitor conditions such as core temperature (high or normal), fuel rod placement (up or down), control rod placement (up or down), cooling system status (normal or failed). These sensor values (5 volts or 0 volts) will be the **inputs** to your circuit. The **output** of your circuit will be the alarm (on or off).

IF core temperature = **HIGH** **and** fuel rods = **DOWN** **and** control rods = **UP**
or if cooling system status = **FAILED**,
THEN The alarm should be **ACTIVATED** (turned on)

Is the solution software or hardware? We are looking for a hardware (circuit) solution in this course

(c) R. Avanzato 2

Solution:

Core Temperature (High: 1 or low: 0) => CT

Fuel Rod Replacement (Up: 1 or down: 0) => FRR

Control Rod Placement (Up: 1 or down: 0) => CRP

Cooling System Status (fail: 1 or normal: 0) => CSS

Input: 5V or 0V || Output: Alarm (On: 1 or off: 0)

Equation: $CT * FRR * CRP + CSS = \text{alarm}$

a) Truth Table

Input				Output
CT	FRR	CRP	CSS	Alarm
0	0	0	0	0
0	0	0	1	1

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0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

b) Boolean Experssion:

By the question and the shown example, CT, FRR, and CRP are connected by “And” and they connect CSS by “or”. The outcome should be alarm. In this way, we can make: $CT * FRR * CRP + CSS = \text{alarm}$

c) d)

