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UART & Interrupts

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Driving Question for the Day (LEETCODE 840)

A 3 x 3 magic square is a 3 x 3 grid filled with distinct numbers **from** 1 **to** 9 such that each row, column, and both diagonals all have the same sum.

SAMPLE INPUT:

4	3	8	4
9	5	1	9
2	7	6	2

Jinyao's Approach:

- What's the pattern for 9 grids to have each row, col, diagonals to have the same sum?

  What's the middle value must be? Why

  What must be the summation?

- How many ACTUAL calculations we must do, given the input n?

  Do we have to go through all?

CAN WE DO BETTER?

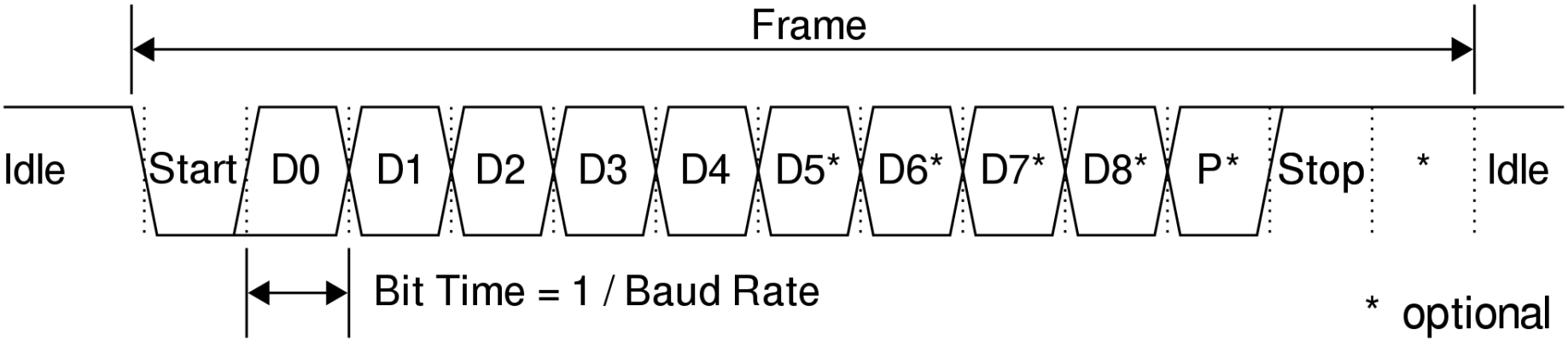
- What happen if we put all (2n+1)^2 rather than 1-9?

UART (Universal Async Receiver/Transmitter)

- ***General Idea*: As simple as it shows: UART just transmit a bunch of bits in a 8-bit packet.**
- ***Start Bit:* A longer 0 bit signals the starting of transmission, the other party gets ready.**
- ***Stop Bit:* A longer 1 bit signals the end of transmission**
- ***Baud Rate:* Bits per second, so the other party knows when/what to sample.**

Issue: Async, so it's possible that a party misses a few bits (deadly and Fatal)

* P stands for parity here: a error-detection and correction technique that we will not be covering



Activation of UART on MCU

- Uses simply 2 pins (TX/RX): can also be as simple as one
- Write Just Like Printf/print/System.Out, if you package it well
- Recommended: Use Interrupts to Avoid Package Loss

https://microcontrollerslab.com/uart-interrupt-tm4c123g-tiva-c-launchpad-programming/

General Procedures (More during :

Activate UART Clock Gating (Remember the first LED project)

Setup designated pins for UART functions

Write interrupt handlers (OHHHHH ICS-53 OHHHHHHH)

Algorithmic Reduction

- Functional thinking: solving problems with known knowledge.
- Easy to determine the complexity level for a problem
- Prove the security of an encryption algorithm?

Example 01 (Source→ Shindler ICS 46 Winter 2023 Slide Graph I)

1. We have two containers: one has a capacity of three gallons of water, the other five gallons. Both are initially empty, although we have access to a large water fountain. We can take a non-full container and fill it completely up with the water, or we can completely empty a container (with water in it) into the fountain, or we can pour the contents of one container into the other until either the first is empty or the second is full. Our goal is to find a sequence of actions we can take to end up with exactly four gallons of water in one container (and none in the other container).

SAT Problem (Karp's 21 NP Complete)

F=(a V b)(a V -b)(-a V c)(-c V b) --> abc=111

F=(a V b)(a V -b)(-a V c)(-c V -a) --> NO SOLUTION

- *Decision Problem:* Is there an assignment to make it return True?
- *Dual Problem:* Find an assignment to make it return True?
- Both are NP-Complete, solvable with brute force.

Proof: 1. Show it's NP

2. Show it's NP-Hard by reducing Circuit-SAT to it

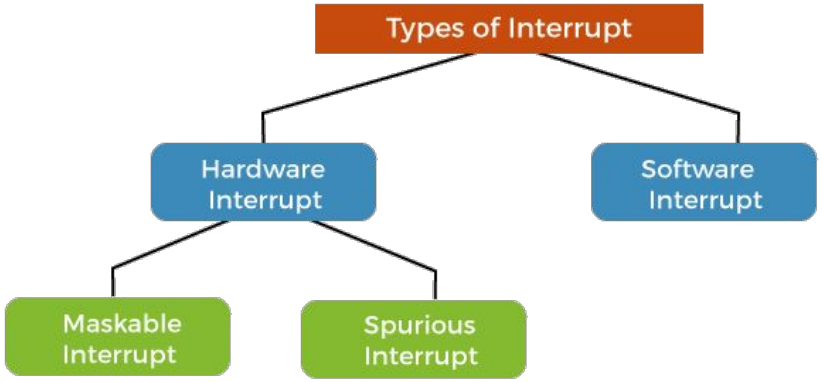
What are Interrupts? FOR MCU

Analogy: Clock Alarm

Advantages?

- Efficient

- No Time Delay (comp to query)



Disadvantages?

- Hard to program (with priority level)

https://microcontrollerslab.com/gpio-interrupts-tm4c123-tiva-launchpad-edge-level-triggered/

Kerckhoffs Principle

The security of a cryptosystem must lie in the choice of its keys only; everything else (including the algorithm itself) should be considered public knowledge.