Interrups

I/O

HW

ISR

sw

state

ISR

App

count to 100m

print result

Shared variables between ISRs & App

State

buffer

InIdx

OutIdx

put buffer out 0x1fff 0000

char buffer[20]?

14

18

1) find/use stdlib

- link against

- copy code (C or assembly)

2) print SW_RTC in hex

Count/50000000 in hex
Adder

Last time: ripple carry

carry select

Carry bypass

<table>
<thead>
<tr>
<th>a, b, c</th>
<th>p, g, k, i</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0 0</td>
<td>0 0 0</td>
</tr>
<tr>
<td>0 1 1</td>
<td>0 0 0</td>
</tr>
<tr>
<td>1 0 1</td>
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</table>

Carry is either generated, propagated, or killed at each bit

G, P are independent of Cin

Group Prop, gen

\[ b_3 \quad a_3 \quad b_2 \quad a_2 \quad b_1 \quad a_1 \quad b_0 \quad a_0 \]

C_{21} = C_1 + C_1 \cdot P_1 + C_1 \cdot P_1 + C_1 \cdot P_1 + C_1 \cdot P_1 + C_1 \cdot P_1 + C_1 \cdot P_1 + C_1 \cdot P_1 + C_1 \cdot P_1 + C_1 \cdot P_1

\[ G_{21} = G_{21} \quad \text{p-s block} \quad P_{21} \]

= G_{21} + Cin \quad P_{21}

Don't care much about how fast sum comes in

C_{i-1} \rightarrow C_i \quad \text{or} \quad \ast \rightarrow P_0, C_i

Vitter optimized

\[ N \text{ bits} \]

K-bit blocks

Lookahead

Carry bypasses

add outputs for each stage

\[ C_6 \]

\[ C_7 \]

\[ C_8 \]

\[ C_9 \]

\[ C_{30} \quad P_{30} \]

\[ T = t + t_{\text{p-s block}} + \left( \frac{N-1}{N} \right) t_{\text{AND2OR}} + \left( N-1 \right) t_{\text{FA}} \]
Why groups of 4? TTL

2 level

\[ T_{64} = t_{pq} + 3 \cdot t_{ps, block} + 3 \cdot t_{an/ro} + t_{HA} \]

CARRY Bypass

\[ T_{32} = t_{pq} + t_{ps, block} + 8 t_{mux} + 2 t_{ripple, 4} \]

Not as fast, but small can combine

Unfold & compare to previous adder in Fig 5.7
\[ V = C_{31} + C_{32} \]

- If \( V = \text{overflow} \) then \( C = C_{31} \).
- \( Z = \text{nor}(5) \).

\[ 0 \leq x \leq y \]

\[ 0 \leq |x| \leq y \]

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