

Aug 24

Note Title

24-08-2011

Thursday - Seminar Room (501)
Bharti Building

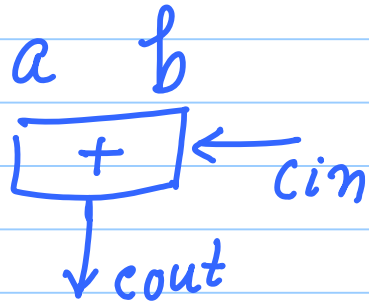
11-12

Carry Lookahead Adder

Ripple Carry Adder: Time Space
 $O(n)$ $O(n)$

Carry Select Adder: Time Space
 $O(\sqrt{n})$ $O(2n)$

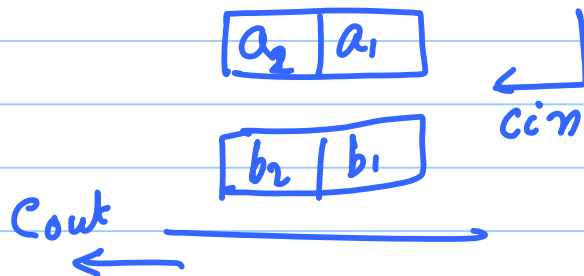
Carry Lookahead Adder: Time $O(\log(n))$ space $\Theta(2n)$



$$G = ab$$

$$P = a + b \quad [a\bar{b} + \bar{a}b]$$

$$C_{out} = G + P \cdot C_{in}$$



$$P = P_1 \cdot P_2$$

$$C_{out} = G_2 + P_2 C_{in_1}$$

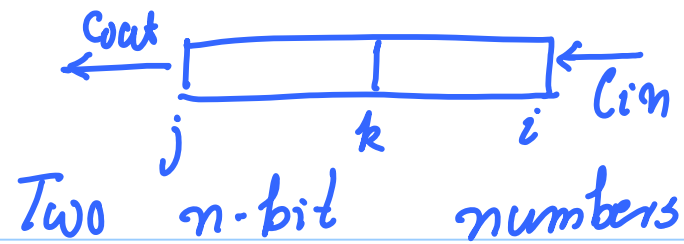
$$= G_2 + P_2 (G_1 + P_1 C_{in})$$

$$= \underbrace{(G_2 + P_2 G_1)}_G + \underbrace{(P_1 P_2)}_P C_{in}$$

n-bit adder.

$$P = P_2 \dots P_n$$

$$G = G_n + P_n G_{n-1} + P_n \cdot P_{n-1} \cdot G_{n-2} \\ + P_n \dots - P_2 G_1$$



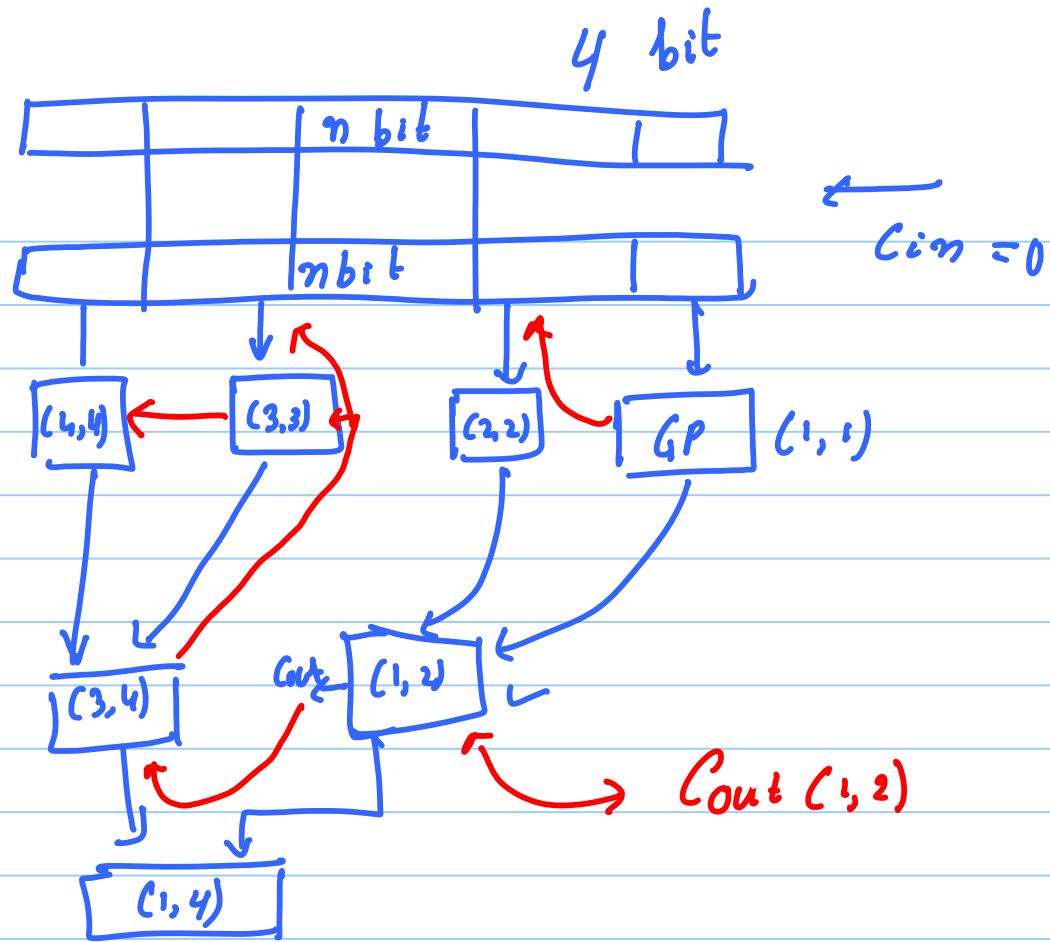
$j \dots i \quad (i < j)$

P_{ij} — G_{ij}

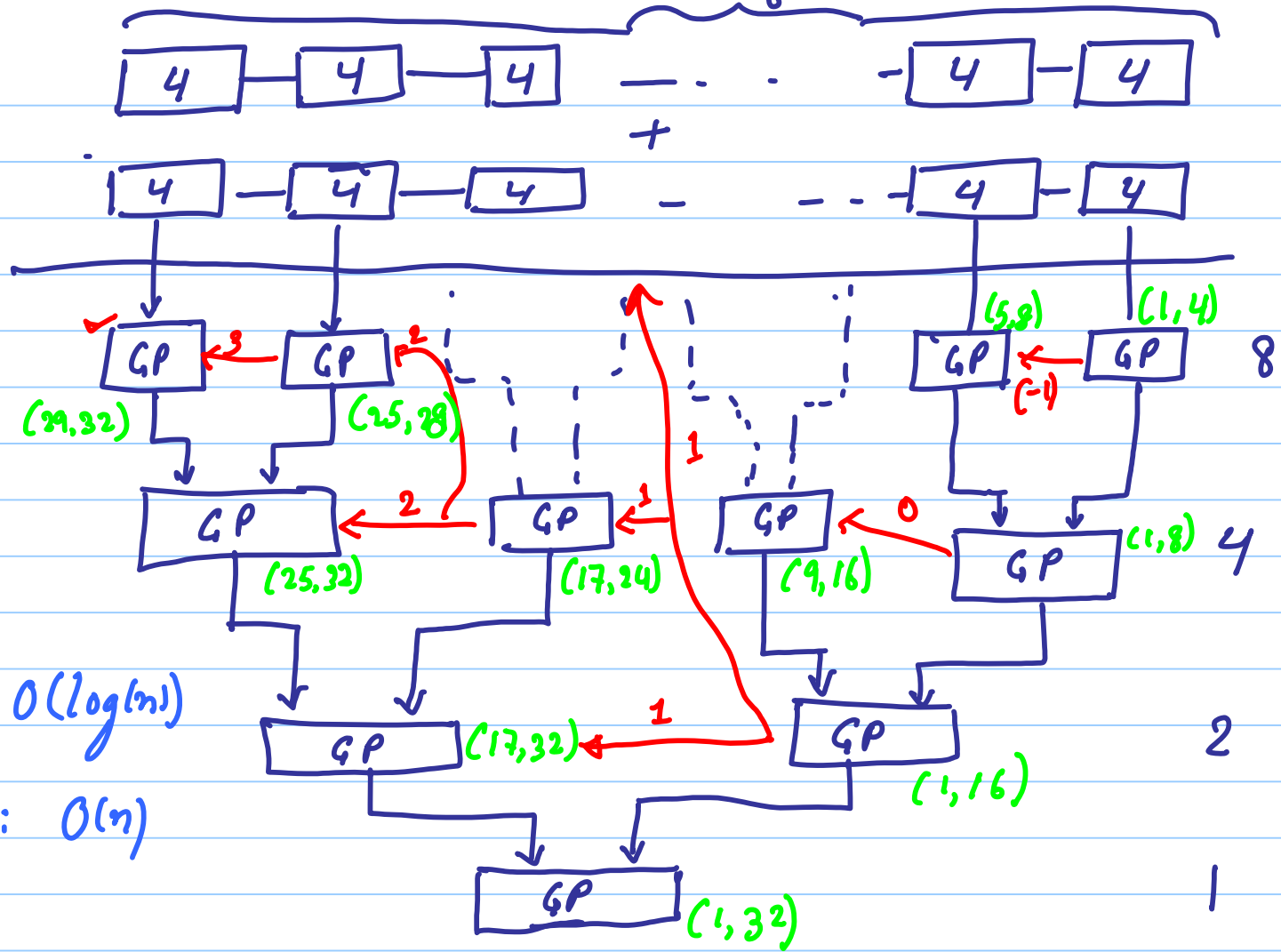
$$P_{ij} = P_{ik} \cdot P_{kj}$$

$(i < k < j)$

$$G_{ij} = G_{kj} + P_{kj} G_{ik}$$



32 bit addition

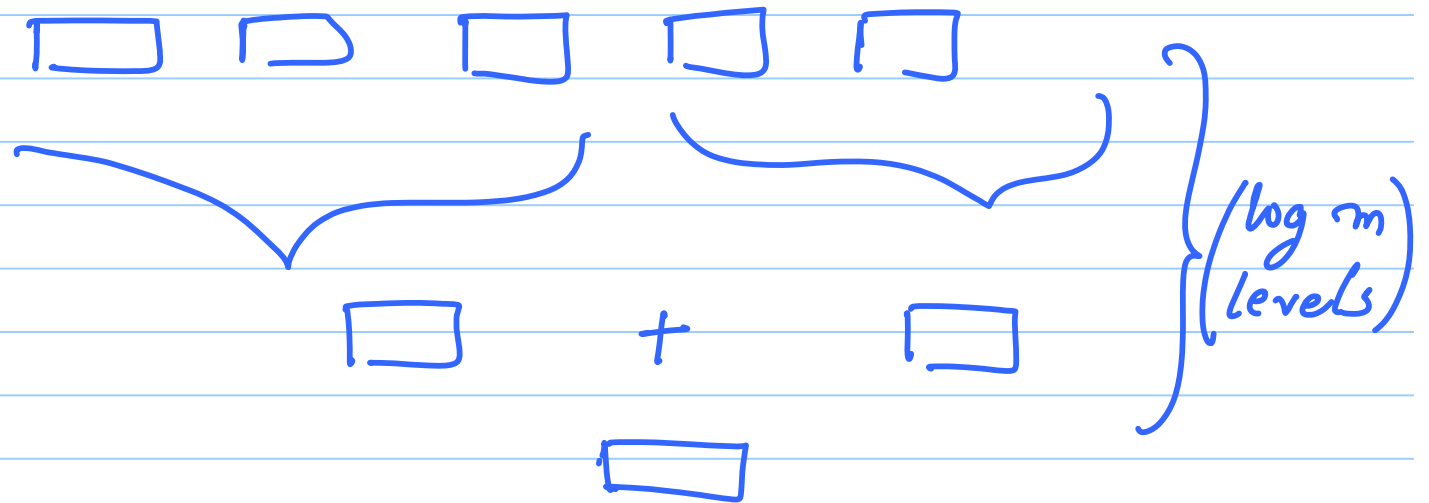


Time: $O(\log(n))$

Space: $O(n)$

Add m n -bit numbers.

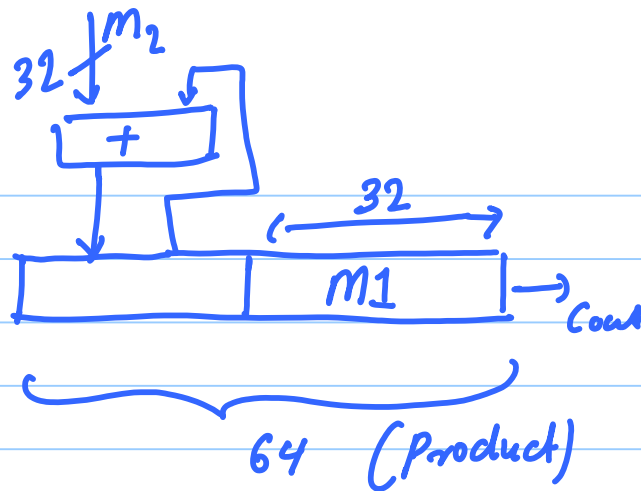
$$\rightarrow O(\log(m) \log(n + \log(m)))$$



Multiplication

$$\begin{array}{r} 1100 \\ \times 0011 \\ \hline 1100 \checkmark \\ 1100 \\ 0000 \\ 0000 \\ \hline 0100100 \end{array}$$

Time
 $O(n \log(n))$



m_1
 $\times m_2$

What about
signed numbers?

Every cycle

1) Right shift the product)

2) Based on cout
if (cout = 0)
Do nothing

if (cout == 1)
Add m_2 to the left half.

Yes,
Do a sign
extension in
the right
shift.