Joseph Martinsen

Pre-Lab 04

1) Half-Adder

Input		Output	
A	B	S	cout
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

S

	$\bar{B}$	B
$\bar{A}$	0	1
A	1	0

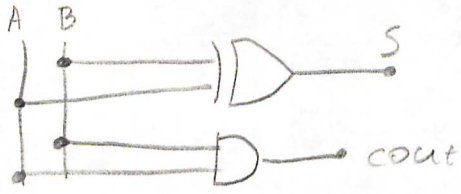
$S = A\bar{B} + \bar{A}B$

cout

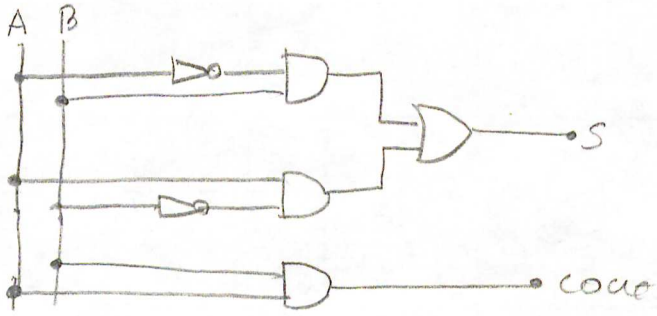
	$\bar{B}$	B
$\bar{A}$	0	0
A	0	1

$cout = AB$

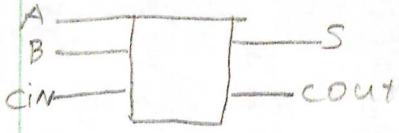
Using XOR



Using AND and OR



2) Full-Adder



A	B	CIN	S	COUT
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Sum

	CIN $\bar{B}$	CIN B	$\bar{CIN}$ $\bar{B}$	$\bar{CIN}$ B
$\bar{A}$	0	1	0	1
A	1	0	1	0

$S = A\bar{B}\bar{CIN} + \bar{A}\,CIN\bar{B} + A\,CIN\,B + \bar{A}\,B\bar{CIN}$

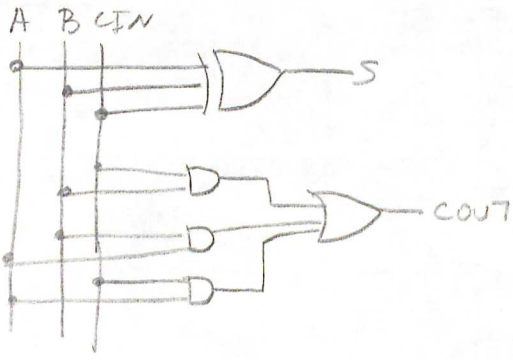
$S = A \oplus B \oplus C$

COUT

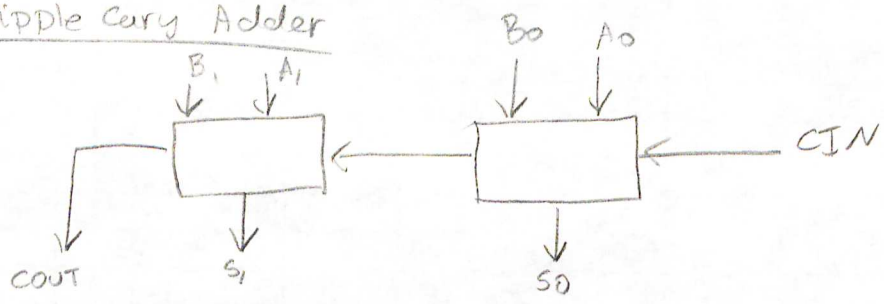
	COUT $\bar{B}$	COUT B	$\bar{COUT}$ $\bar{B}$	$\bar{COUT}$ B
A	0	1	1	1
$\bar{A}$	0	0	0	1

$COUT = AB + A\,COUT + B\,COUT$

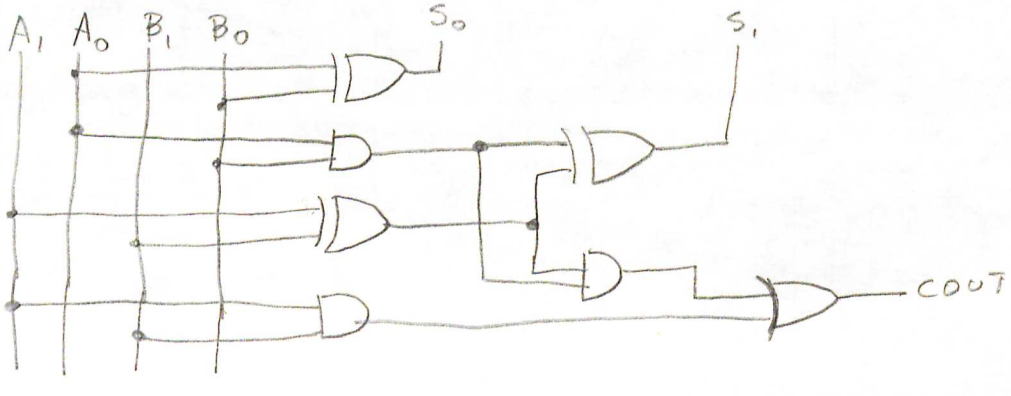
Diagram



3) Ripple Cary Adder



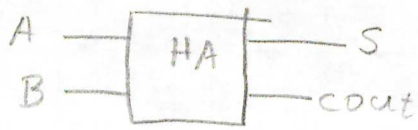
A_1	A_0	B_1	B_0	S_1	S_0	COUT
0	0	0	0	0	0	0
0	0	0	1	0	1	0
0	0	1	0	1	0	0
0	0	1	1	1	1	0
0	1	0	0	0	1	0
0	1	0	1	1	0	0
0	1	1	0	1	1	0
0	1	1	1	0	0	1
1	0	0	0	0	1	0
1	0	0	1	1	1	0
1	0	1	0	0	0	1
1	0	1	1	0	1	1
1	1	0	0	1	1	0
1	1	0	1	0	0	1
1	1	1	0	0	1	1
1	1	1	1	1	0	1



Joseph Martinsen

Pre-Lab 04

1) Half-Adder



Input A	Input B	Output S	Output cout
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

S

	$\bar{B}$	B
$\bar{A}$	0	1
A	1	0

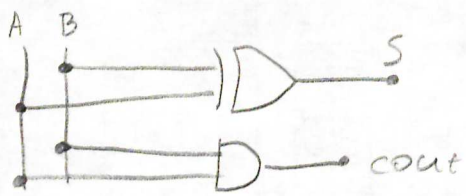
$S = A\bar{B} + \bar{A}B$

cout

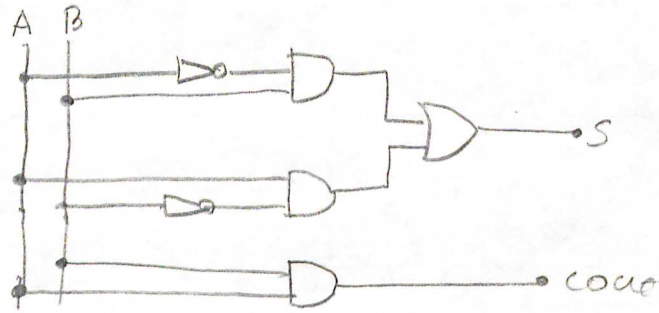
	$\bar{B}$	B
$\bar{A}$	0	0
A	0	1

$cout = AB$

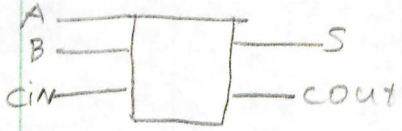
Using XOR



Using AND and OR



2) Full-Adder



A	B	CIN	S	COUT
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Sum

	CIN $\bar{B}$	CIN B	$\bar{CIN}$ B	$\bar{CIN}$ $\bar{B}$
$\bar{A}$	0	1	0	1
A	1	0	1	0

COUT

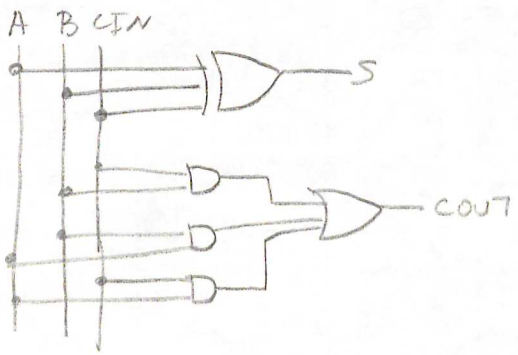
	COUT B	$\bar{COUT}$ B	$\bar{COUT}$ $\bar{B}$	COUT $\bar{B}$
A	1	1	1	0
$\bar{A}$	0	1	0	0

$S = A\bar{B}\,\bar{CIN} + \bar{A}\,CIN\bar{B} + A\,CIN\,B + \bar{A}\,B\,\bar{CIN}$

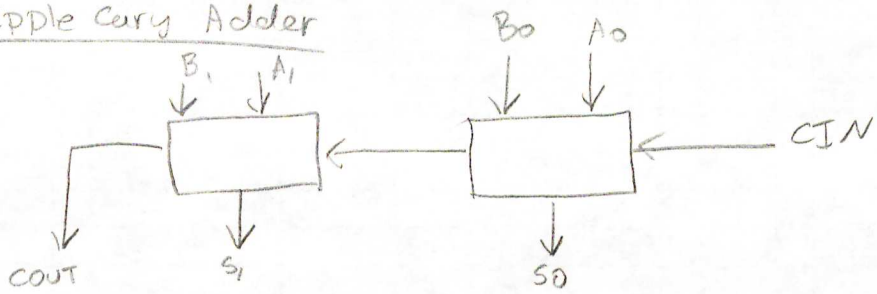
$S = A \oplus B \oplus C$

$COUT = AB + A\,COUT + B\,COUT$

Diagram



3) Ripple Cary Adder



A_1	A_0	B_1	B_0	S_1	S_0	COUT
0	0	0	0	0	0	0
0	0	0	1	0	1	0
0	0	1	0	1	0	0
0	0	1	1	1	1	0
0	1	0	0	0	1	0
0	1	0	1	1	0	0
0	1	1	0	1	1	0
0	1	1	1	0	0	1
1	0	0	0	0	1	0
1	0	0	1	1	1	0
1	0	1	0	0	0	1
1	0	1	1	0	1	1
1	1	0	0	1	1	0
1	1	0	1	0	0	1
1	1	1	0	0	1	1
1	1	1	1	1	0	1