

HalfAdder

| a | b | Sum | Carry |
|---|---|-----|-------|
| 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 |

$$S = a \cdot \text{Not}(b) + \text{Not}(a) \cdot b$$

$$C = a \cdot b$$

FullAdder

| c | a | b | Sum | Carry |
|---|---|---|-----|-------|
| 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 |

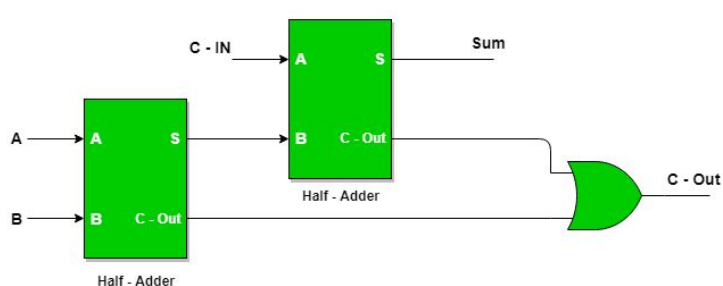
$$\text{Sum} = \text{Not}(c)\text{Not}(a)b + \text{Not}(c)a\text{Not}(b) + c\text{Not}(a)\text{Not}(b) + cab$$

$$\text{Sum} = c (\text{Not}(a)\text{Not}(b) + ab) + \text{Not}(c) (\text{Not}(a)b + a\text{Not}(b))$$

$$\text{Sum} = c \text{ XOR } (a \text{ XOR } b) \text{ eller } a \oplus b \oplus c$$

$$\text{Carry} = \text{Not}(c)ab + c\text{Not}(a)b + ca\text{Not}(b) + cab$$

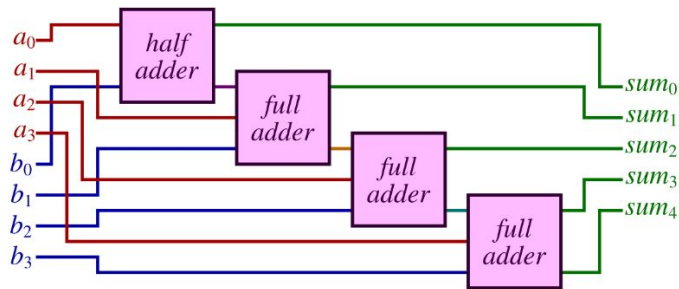
$$\text{Carry} = ab + c(a+b)$$



Add 16

| a | b | out |
|---------------------|---------------------|---------------------|
| 0000 0000 0000 0000 | 0000 0000 0000 0000 | 0000 0000 0000 0000 |
| 0000 0000 0000 0000 | 1111 1111 1111 1111 | 1111 1111 1111 1111 |
| 1111 1111 1111 1111 | 1111 1111 1111 1111 | 1111 1111 1111 1110 |
| 1010 1010 1010 1010 | 0101 0101 0101 0101 | 1111 1111 1111 1111 |

| | | |
|---------------------|---------------------|---------------------|
| 0011 1100 1100 0011 | 0000 1111 1111 0000 | 0100 1100 1011 0011 |
| 0001 0010 0011 0100 | 1001 1000 0111 0110 | 1010 1010 1010 1010 |



Inc16

| in | out |
|---------------------|---------------------|
| 0000 0000 0000 0000 | 0000 0000 0000 0001 |
| 1111 1111 1111 1111 | 1111 1111 1111 1111 |
| 0000 0000 0000 0101 | 0000 0000 0000 0110 |
| 1111 1111 1111 1011 | 1111 1111 1111 1100 |

Inc16 = Add16(in,1)

ALU

<http://georgefabish.com/the-alu/>

