



智慧感知與視覺實驗室
intelligent perceptron and vision lab

Overflow

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(智慧感知與視覺實驗室)

Overflow Conditions

運算	運算元 A	運算元 B	產生溢位的結果
$A + B$	≥ 0	≥ 0	< 0
$A + B$	< 0	< 0	≥ 0
$A - B$	≥ 0	< 0	< 0
$A - B$	< 0	≥ 0	≥ 0

圖 3.2 加法與減法的溢位條件。

For signed addition ($\$t0 = \$t1 + \$t2$), the test is

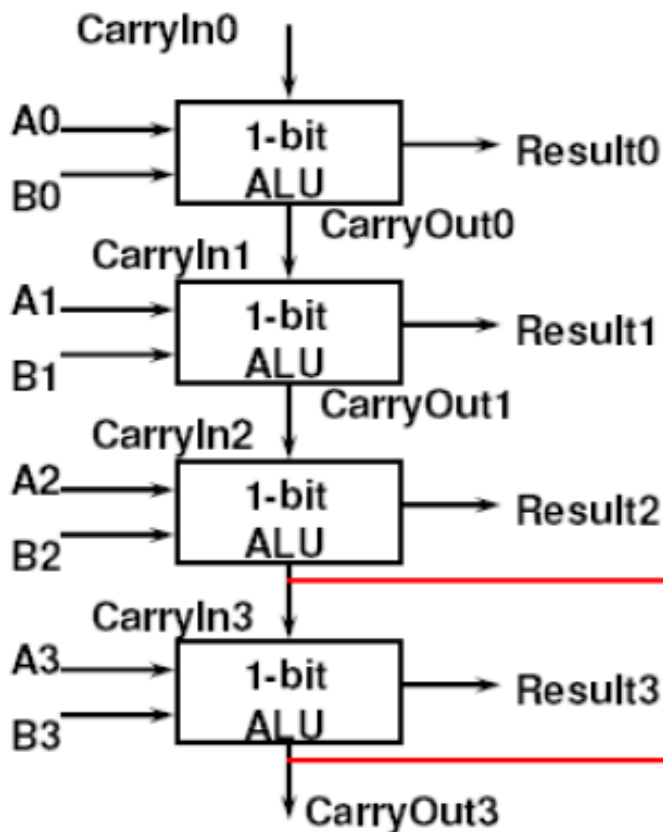
```
addu $t0, $t1, $t2 # $t0 = sum, but don't trap
xor  $t3, $t1, $t2 # Check if signs differ
slt  $t3, $t3, $zero # $t3 = 1 if signs differ
bne  $t3, $zero, No_overflow # $t1, $t2 signs ≠,
                                # so no overflow
xor  $t3, $t0, $t1 # signs =; sign of sum match too?
                                # $t3 negative if sum sign different
slt  $t3, $t3, $zero # $t3 = 1 if sum sign different
bne  $t3, $zero, Overflow # All 3 signs ≠; goto overflow
```

For unsigned addition (\$t0 = \$t1 + \$t2), the test is

```
addu $t0, $t1, $t2    # $t0 = sum
nor $t3, $t1, $zero    # $t3 = NOT $t1
                        # (2's comp - 1:  $2^{32} - \$t1 - 1$ )
sltu $t3, $t3, $t2     #  $(2^{32} - \$t1 - 1) < \$t2$ 
                        #  $\Rightarrow 2^{32} - 1 < \$t1 + \$t2$ 
bne $t3, $zero, Overflow # if( $2^{32}-1 < \$t1+\$t2$ ) goto overflow
```

Overflow Detection

$$\text{Overflow} = \text{CarryIn}[N-1] \text{ XOR } \text{CarryOut}[N-1]$$



X	Y	X XOR Y
0	0	0
0	1	1
1	0	1
1	1	0

Q&A



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