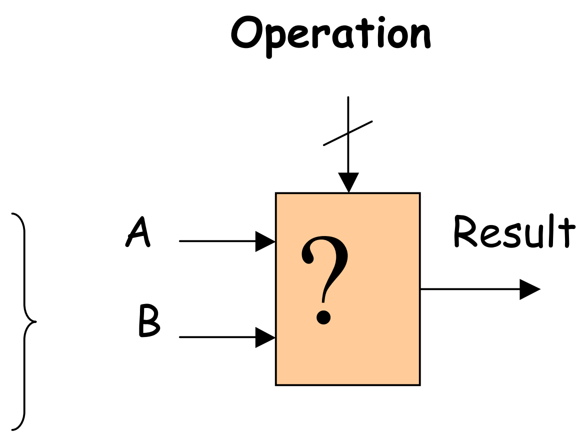
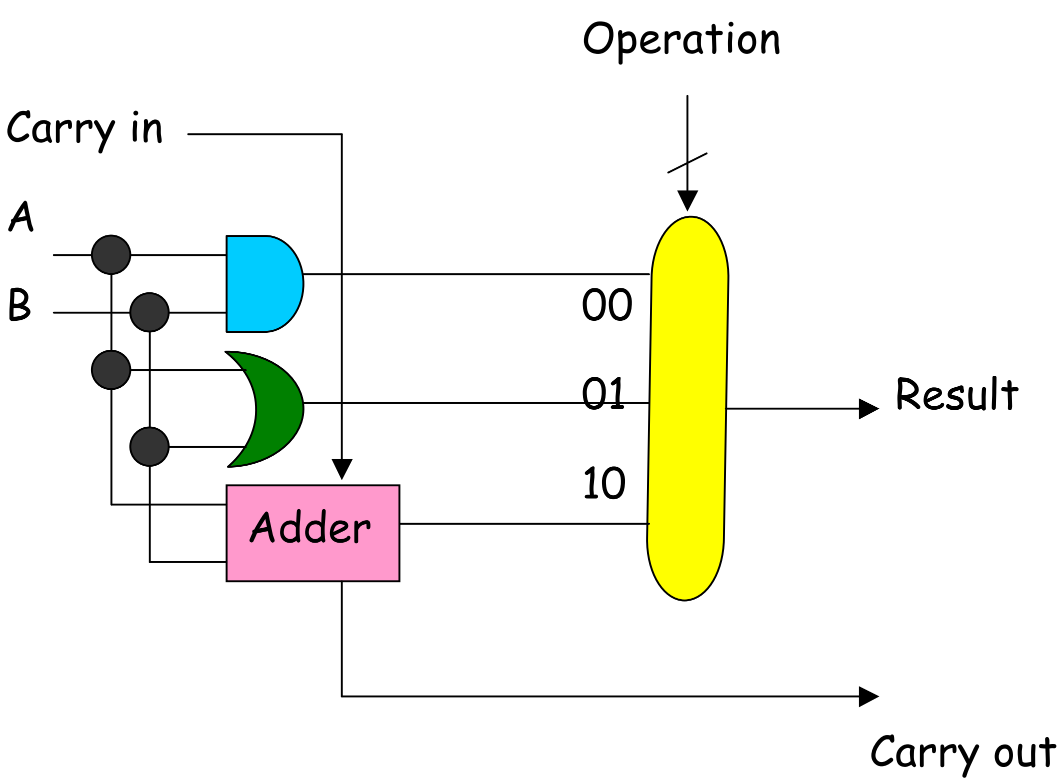
A 1-bit ALU

Operation = 00 implies AND

Operation = 01 implies OR

Operation = 10 implies ADD





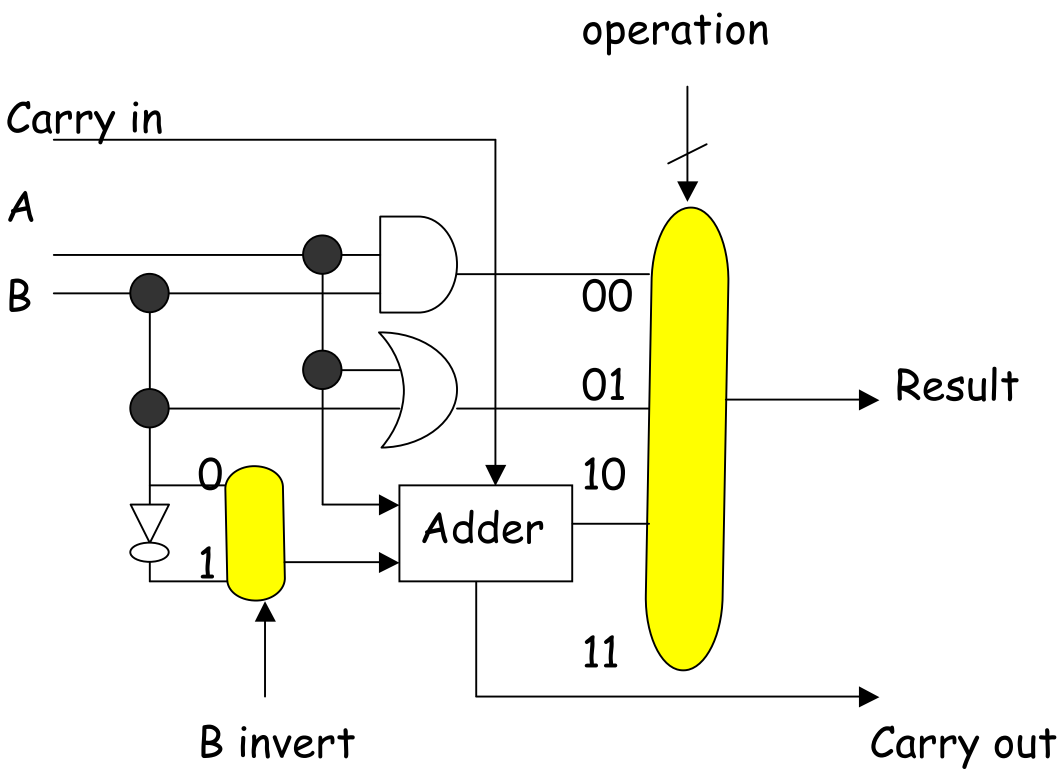
- Understand how this circuit works.
- Let us add one more input to the mux to implement **slt** when the Operation = 11

Converting an adder into a subtractor

A - B (here - means arithmetic subtraction)

= A + 2's complement of B

= A + 1's complement of B + 1

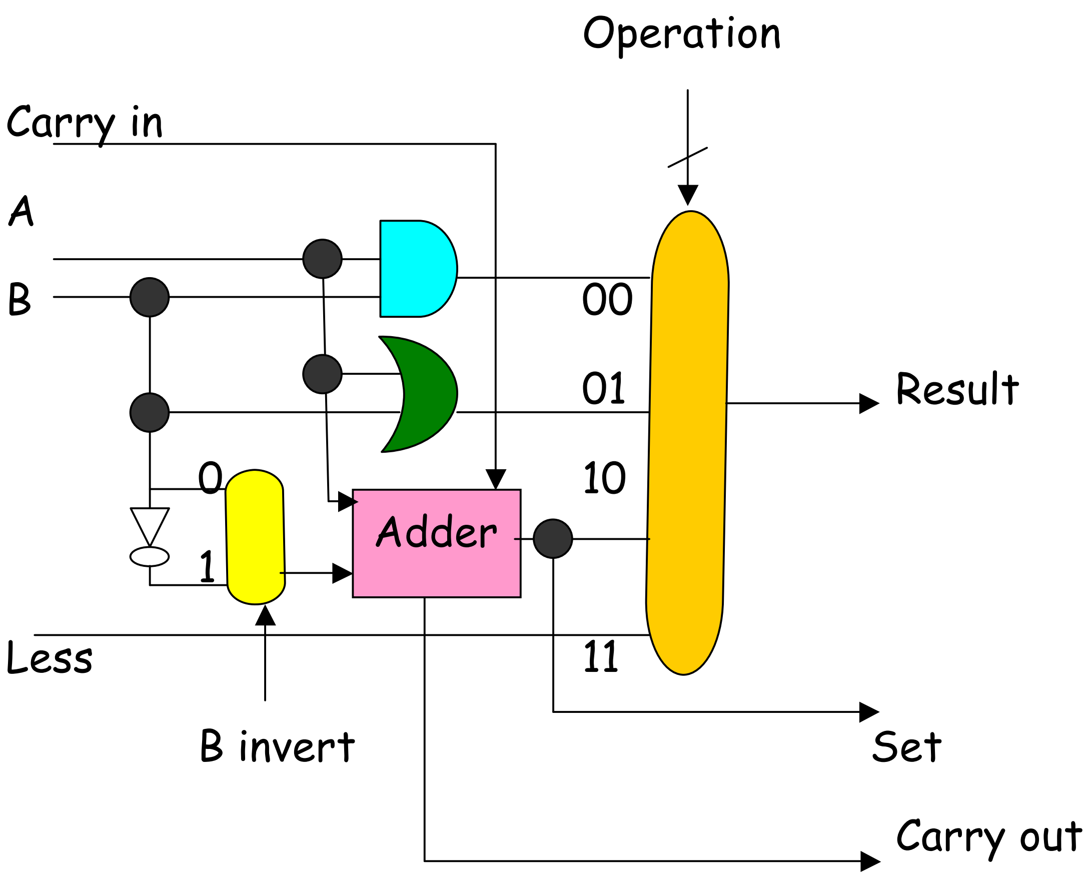


1-bit adder/subtractor

For subtraction, B invert = 1 and Carry in = 1

1-bit ALU for MIPS

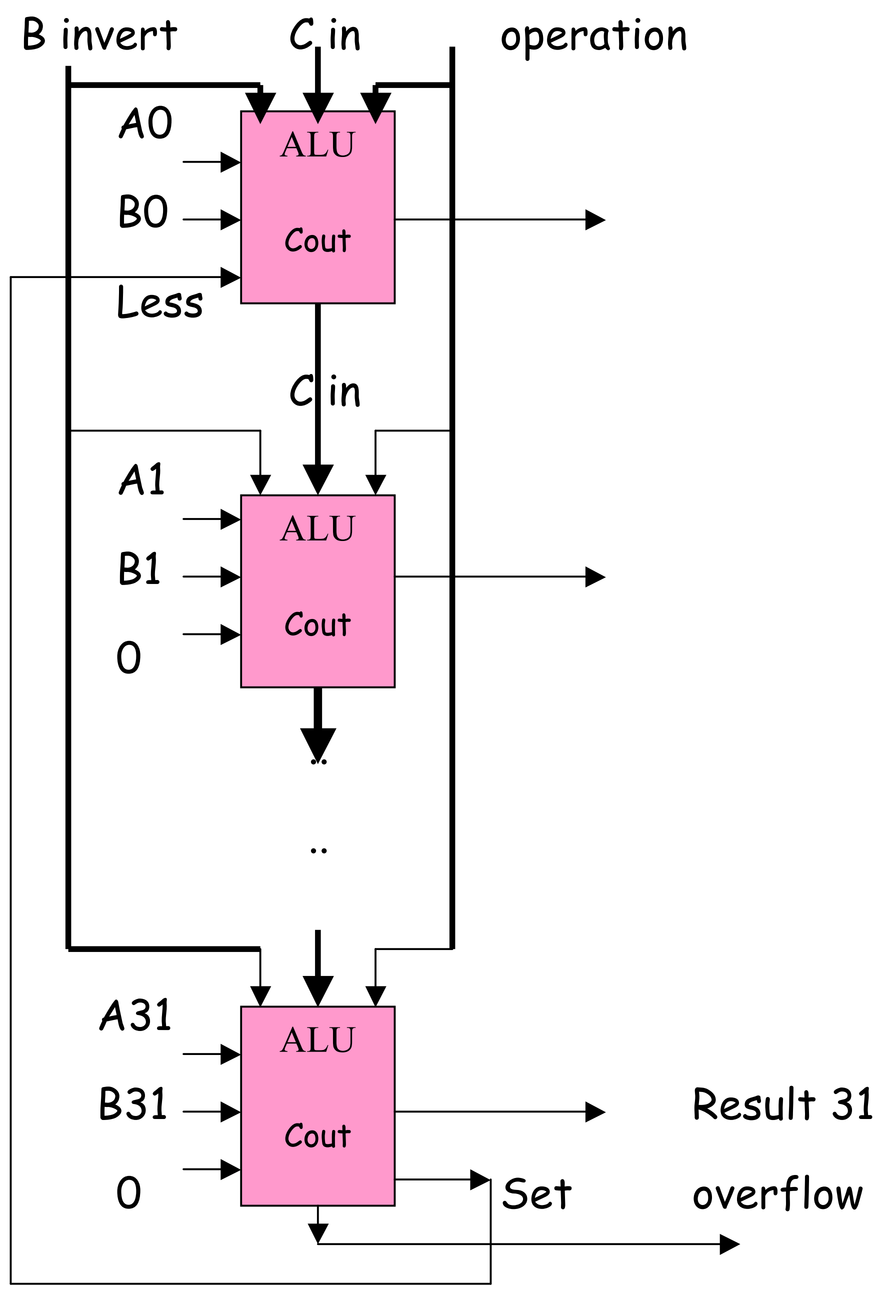
Assume that it has the instructions add, sub, and, or, slt.



Less = 1 if the 32-bit number A is less than the 32-bit number B. (Its use will be clear from the next page)

We now implement **slt** (If A < B then Set = 1 else Set = 0)

A 32-bit ALU for MIPS



Combinational vs. Sequential Circuits

Combinational circuits

The output depends only on the current values of the inputs and not on the past values. Examples are adders, subtractors, and all the circuits that we have studied so far

Sequential circuits

The output depends not only on the current values of the inputs, but also on their past values. These hold the secret of how to memorize information. We will study sequential circuits later.