* Circuit equivalence
  + Two circuits that produce the same output for identical input
  + Boolean algebra allows us to apply provable mathematical principles
* DeMorgan’s Law
  + States that the NOT operator applied to the AND of two variables is equal to the NOT applied to each of the two variables with an OR between. Thus inverting the output of an AND gate is equivalent to inverting the individual sign first and then passing them through an OR gate  
    NOT (P OR Q) = (NOT P) AND (NOT Q)  
    NOT (P AND Q) = (NOT P) OR (NOT Q)
  + IF NOT (A1 = B2) AND (C4 < D3) OR (V2 >= V7)) becomes  
    IF NOT (A1 != B2) OR (C4 >= D3) AND (V2 < V7))
* Adders
  + At the digital logic level, addition is performed in binary
  + Addition operations are carried out by special circuits called, appropriately **adders**
  + Half-adder doesn’t accept a carry in
  + Full-adder can account for a carry in
  + Truth table for full adder

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A | B | CARRY IN | SUM | CARRY OUT |
| 0 | 0 | 0 |  |  |
| 0 | 1 |  |  |  |

* Multiplexer
  + A circuit that uses a few input control signals to determine which of several output data lines is routed to its output
* CIRCUITS as memory
  + Digital circuits can be used to store information
  + These circuits perform a sequential circuit
  + Most common is the S-R Latch
    - There are several ways an S-R latch circuit can be designed using various kinds of gates
* Latch
  + An electronic device that can start temporarily a single bit of data. The storage is controlled by a clock signal, a given transmission of which fixes the contents of the latch at the current value of its input. The contents remained fixed until the next transmission of the clock
* Integrated circuit (a.k.a chip)
  + A piece of silicon on which multiple gaets have been embedded.
  + Silicon pieces are mounted on a plastic or ceramic package with pins along the edgeos that can be soldered onto circuit boards or inserted into appropriate sockets
  + if a chip has no CPU, then it is useless
* CPU chips
  + The most important integrated circuit in any computer is the Central Processing Unit
  + Each CPU chip has a large number of pins through which essentially all communication in a computer
* Ethical issues
  + Email
* Nano science
* DeMorgan didn’t discover DeMorgan’s laws
* GPS are used by archeologists to use to locate digs, old cities, etc.