HW #7 Summary chapter 5

▶ Digital Hardware Implementation

The digital circuits are constructed with Integrated Circuits. (IC), IC has significant influence on the number of gates that can be put on a chip. There're four typys of integrate packages: SSI, MSI, LSI, VLSL.

CMOS stands for Complementary metal oxide semiconductor The CMOS is the most common technology used in today's Digital Circuits.

The behavior of CMOS transistor is like a switch, and this is a good first-order model for an Metal oxide semiconductor.

The CMOS technology employs two types of transistor: the n-channel and the P-channel. They behavior differently. In the n-channel, 1 represent the high voltage range and 0 represent the low voltage range

In the P-channel, the path between source and drain exist for $X=1$ and not exist for $X=0$. Thus, the transistor model that represent the P-channel is a NOR function.

The characteristic of the CMOS gates is all the circuits implement inverting functions under DeMorgan's law.

The most important parameters used to characterize an implementation technology follow: Fan in, Fan out, Noise Margin, Cost, Propagation delay, power Consumption.

In the latter sections, the book introduced programmable logic devices, the Read-only memory, the programmable logic array, the programmable array logic and the field programmable gate array.

Summary of chapter 6. HW #7.

Registers And Register Transfers.

Registers includes a set of flip-flops, an n-bit register composed of n flip-flops is capable of storing n bits of binary information.

There're different kinds of registers. The simplest registers load inputs on every clock circle. In contrast, the complex one are controled by signals when they load new contents from input.

The transfer of new information into a register is referred as loading the register. The register transfer operation of digital system are specified by 3 basic component:

1. the set of registers in the system.
2. the operations that are performed on the data stored in the registers
3. the control that supervises the sequence of operations in the system.

After section 6.5, the book introduced the microoperations, which is performed on the data that stored in the memory. This operation does not change the binary data bit as move from the source register to the destination register.

Logic Microoperations are important to manipulate the bits stored in a register. It consists of four basic logic operations: NOT, AND, OR, XOR.

The + sign represent add operation in micro operation. The logic microoperation has the ability of change bit values, clear a group of bits or insert a new bit value into a register.

The shift microoperations are used for lateral movement of data. It shifts the data to the right or left. They are also used for manipulating the contents of registers in arithmetic, logic and control operations.

We call the rightmost bit of the destination register the incoming bit for left-shift. For the right shift, we define the leftmost bit of the destination register as the incoming bit.

In section 6, we discussed the implementation of one or more microoperations with a register as the destination of all primary result.
A simple technique using multiplexers for selection is introduced to allow multiple microoperations on a single register.

7-7 Register-Cell design

A Register-cell is consist of a single-bit cell of an iterative combinational circuit connected to a flip-flop.

The simple design of register-cell can be approched for multifunctional registers using flip-flops with parallel load. We can also do a custom register-cell design. In such designs, a critical factor is the definition of the lateral connections needed. Also different operations can be defined by controlling input to the least significant cell of the cell cascade.

7-8. In ordering to transfer data more efficient between different registers, we use bus. The Bus is a set of common lines, with each line driven by selection logic. If a set of multiplexer outputs is shared as a common path, these output lines are a bus.

The reason of use three-state buffers instead of a multiplexer is that many three-state buffer outputs can be connected together to form a bit line of a bus, and this bus is implemented using only one level of logic gates.

6-9 The serial transfer is contrast to the parallel transfer. It transfers or manipulates one bit at a time, information is transferred one bit at a time by shifting the bits out of one register and into a second register.

6-10 There's a master clock generator Controls the timing of all registers in a synchronous digital system.

The clock influences all the registers and flip-flops include those in the control unit.