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COE506 (DIGITAL SYSTEMS DESIGN WITH VHDL)

Question 1: Define the following acronyms as they apply to digital logic circuits:

- ASIC
- PAL
- PLA
- PLD
- CPLD
- FPGA

Solution

- ASIC: Application Specific Integrated Circuit
- PAL: Programmable Array Logic
- PLA: Programmable Logic Array
- PLD: Programmable Logic Device
- CPLD: Complex Programmable Logic Devices
- FPGA: Field Programmable Gate Array

Question 2: How granularity of logic block influences the performance of an FPGA?

Solution

Higher granularity level results in lesser delay between input and output. As the granularity of logic block increases, number of levels of logic in critical path decreases, and hence delay in critical path decreases. On the flip side with increase in granularity level average fan out increases and number of switches also increases as each block has more pins. Also the length of wires increases with increase in size of logic block.

Question 3: Why would anyone use programmable logic devices (PLD, PAL, PLA, CPLD, FPGA, etc.) in place of traditional "hard-wired" logic such as NAND, NOR, AND, and OR gates? Are there any applications where hard-wired logic would do a better job than a programmable device?

Solution

(a)

The devices typically offer a higher degree of integration as compared to discrete 7400series or 4000-series components; they are smaller, and consume less power. Some of them are reprogrammable, they can be upgraded without changing the PCB.

(b) Yes.

In the embedded world where electronics are being controlled there are many places wher a hard wired solution is the only way to go as there is a critical timing constraint. Working on a motor controller where the current in the coils has to be measured controlled, real time, in nanoseconds whilst other measurements and algorithms are being calculated. This is easy to do in hardwire

Question 4: Some programmable logic devices (and PROM memory devices as well) use tiny fuses which are intentionally "blown" in specific patterns to represent the desired program. Programming a device by blowing tiny fuses inside of it carries certain advantages and disadvantages - describe what some of these are.

Solution

The stored program is non-volatile, but it also read-only. This is why fuse programmed devices are sometimes called" OTP" (One-Time Programmable)

OTP (one time programmable) memory is a special type of non-volatile memory that permits data to be written to memory only once. Once the memory has been programmed, it retains its value upon loss of power.

Question 5

