Digital Design Using VHDL Systems Approach 1st edition Dally Solutions Manual

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Chapter 2

Solutions: The Practice of Digital System Design

2.1 Student solutions should include information about how the system connects to the TV (HDMI), resolution (1080p), the processor, DRAM, and video. The games could be burned into the system, on DVD, or downloadable (wired or wireless Internet?). The controllers could be wired or wireless, etc.

2.2 Version 2 of the console should probably be better than the first version, so upgrades to core components such as DRAM, graphics card, and processor are probably necessary. The controllers and video output can potentially remain the same. Another option is to take advantage of advances in fabrication technology to make a version of the console with the same performance. Presumably, this would make the device cheaper and draw less power.

2.4 In our example, we would buy the network interface and HDMI output since they are commodity parts that our team could only mess up. We would built the motherboard, for example, to tie together our components in a custom fashion.

2.9 To average the four inputs on every cycle we need 3 sets of 32 flip-flops (28.8kgrids) and 3 adders (90kgrids). We don't need any multipliers because we can shift the sum of the four numbers by 2 (in binary). The total is 118.8kgrids (or 488kgrids with a multiplier). To do the weighted average, we need 4 multipliers (1.2Mgrids) and storage for 128 bits of data (256 grids in ROM and 3072 in SRAM). The sum is approximately 1.3Mgrids regardless of the storage mechanism.

2.10 See answers below:

1. We need storage for 2.4×10^7 bits of SRAM. This is 5.76×10^8 grids, or 4.8mm^2.

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2. It would take $500^3 \times 5ns = 0.625$s to complete the full operation.
3. The remaining area is 5.2mm^2, enough area for 1890 functional units. The matrix multiplication takes 330μs.

2.17 In 2015 there would be over 15B transistors and in 2020, 115B.

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