Mid Term Project

Part 1: MIPS Registers (10 Points)

1. Why is the instruction and data memory separated in MIPS_SS_v2 CPU? (2.5)
2. Explain the advantage and disadvantage of separate instruction and data memory (2.5)
3. MIPS_SS_v2's clock rate (5):
    1. What is the PLL's clock rate or frequency?
    2. What is the highest clock rate that could be achieved without any modifications?
    3. What limits the clock rate in the design?

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Part 2: Understanding Simple CPU (mips_ss_v2.qar) (20 Points)

Understanding Simple CPU (mips_ss_v2) is important to complete the rest of the midterm project. In this part you will write an assembly programs in binary and execute it in mips_ss_v2 CPU running in DE0-Nano.

Triangular Number Generator: (20)

1. Write a program that generates Triangular numbers up to n=20 and count backwards to 0.
2. Your program should display 8 least significant bits of each number you generate in the above part through the LEDs.
3. While counting back you should blink the LEDs whenever the count reaches 0 or 20

For this part you must submit the programs you wrote and signal tap II capture file.

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Part 3: Advanced Addressing modes (mips_ss_v2.qar) (70 Points)

As implemented, mips_ss_v2 only supports register and immediate addressing modes. For this part add the following addressing modes to mips_22_v2:

1. Displacement (30)
2. Register indirect (40)

You report should at least contain, but not limited to, the following: Instruction formats, implementation details, modification to control unit and signal, detailed description of any new modules you implemented.[1]

Refer to the last years midterm project report to understand what your report should contain.

[1] Partial credit (75% max) will awarded for a reasonable non-functional