Assignment One

Comparing the Instruction Set Architectures of ARM and AVR

This is an individual assignment. You are encouraged to work collaboratively to gather information, but you must write the report on your own.

The deadline of this assignment is Monday, April 9th. The assignment must be submitted at the lecture during week 6. An assignment cover sheet must be attached.

In this assignment, you will learn the ISA of another RISC microprocessor, ARM, and compare it with that of AVR and write a report of approximately 2-3 pages. As you are aware by now, an ISA consists of four components: memory models; registers; instructions; and, data types. Explore each component and present your comparisons in the report. **You should focus on 32-bit ARMv7 cores that target similar embedded markets to AVR (e.g. Cortex-M3).** The following sections will help you structure the report. The report should include appropriately formatted references for your information sources.

1. Overview (10%)

In this section, give an overview of ARM microprocessors. The overview should focus on the salient features of ARM architecture. Examples include pipelining, architecture, conditional execution, hardware support for power saving, caching and hardware support for floating point operations.

2. Memory models (20%)

How many memory spaces are there in ARM? What is the purpose of each memory space? What is the maximum memory size for each memory space?

3. Registers (20%)

What types of registers are available in the ARM architecture? How do the ARM general purpose registers compare with the AVR registers?

What is the ARM equivalent of AVR's SREG? How does it differ from AVR?

Compare ARM's interrupt system with AVR's.

4. Instruction Set (30%)

Give a brief overview of the two ARM instruction encoding schemes and compare with AVR.

Describe the function and operation of ARM's predicated instructions.

Compare the instructions used for stack operations in ARM and AVR processors.

Describe how ARM processors access I/O registers and compare with AVR.

What addressing modes are available with ARM load/store instructions? How are these different from the addressing modes available in AVR?

5. Data types (10%)

What data types can be natively represented by ARM's registers? Can the ARM instruction set be used to operate on 64-bit integers? What instructions would be used to implement a 64-bit signed integer addition?

7. Conclusion (10%)

After comparing the ISA of ARM and AVR, you should know what kind of embedded systems will benefit from AVR and ARM.

Discuss a) the main advantages and disadvantages of each architecture; and b) What applications each architecture is best suited to.