DICE
DEPARTMENT OF INTERDISCIPLINARY COURSES IN ENGINEERING

CHITKARA UNIVERSITY

TOPIC:

Computer Organization and Architecture

RISC and CISC Characteristics

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What is RISC?

- **RISC?**
  RISC, or *Reduced Instruction Set Computer*. is a type of microprocessor architecture that utilizes a small, highly-optimized set of instructions, rather than a more specialized set of instructions often found in other types of architectures.
- **History**
  The first RISC projects came from IBM, Stanford, and UC-Berkeley in the late 70s and early 80s. The IBM 801, Stanford MIPS, and Berkeley RISC 1 and 2 were all designed with a similar philosophy which has become known as RISC. Certain design features have been characteristic of most RISC processors:
  - *one cycle execution time*: RISC processors have a CPI (clock per instruction) of one cycle. This is due to the optimization of each instruction on the CPU and a technique called PIPELINING
  - *pipelining*: a techique that allows for simultaneous execution of parts, or stages, of instructions to more efficiently process instructions;
  - *large number of registers*: the RISC design philosophy generally incorporates a larger number of registers to prevent in large amounts of interactions with memory

RISC Attributes

The main characteristics of RISC microprocessors are:

- Extensive instructions.
- Micro encoding of the machine instructions.
- Extensive addressing capabilities for memory operations.
- Relatively few registers.

In comparison, RISC processors are more or less the opposite of the above:

- Reduced instruction set.
- Less complex, simple instructions.
- Hardwired control unit and machine instructions.
- Few addressing schemes for memory operands with only two basic instructions, LOAD and
- STORE
- Many symmetric registers which are organized into a register file.

What is CISC?

- CISC is an acronym for **Complex Instruction Set Computer** and are chips that are easy to program and which make efficient use of memory. Since the earliest machines were programmed in assembly language and memory was slow and expensive, the CISC philosophy made sense
- Most common microprocessor designs such as the Intel 80x86 and Motorola 68K series followed the CISC philosophy.
- But recent changes in software and hardware technology have forced a re-examination of CISC and many modern CISC processors are hybrids, implementing many RISC principles.
- CISC was developed to make compiler development simpler. It shifts most of the burden of generating machine instructions to the processor. For example, instead of having to make a compiler write long machine instructions to calculate a square-root, a CISC processor would have a built-in ability to do this.

CISC hardware architectures characteristics

Most CISC hardware architectures have several characteristics in common:

- Complex instruction-decoding logic, driven by the need for a single instruction to support multiple addressing modes.
- A small number of general purpose registers. This is the direct result of having instructions which can operate directly on memory and the limited amount of chip space not dedicated to instruction decoding, execution, and microcode storage.
- Several special purpose registers. Many CTSC designs set aside special registers for the stack pointer, interrupt handling, and so on. This can simplify the hardware design somewhat, at the expense of making the instruction set more complex.
- A 'Condition code" register which is set as a side-effect of most instructions. This register reflects whether the result of the last operation is less than, equal to, or greater than zero and records if certain error conditions occur.

CISC versus RISC

CISC	RISC
Emphasis on hardware	Emphasis on software
Includes multi-clock complex instructions	Single-clock, reduced instruction only
Memory-to-memory: "LOAD" and "STORE" incorporated in instructions	Register to register: "LOAD" and "STORE" are independent instructions
Small code sizes, high cycles per second	Low cycles per second, large code sizes
Transistors used for storing complex instructions	Spends more transistors on memory registers

Thank You !!!