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# Parallel Computer Architectures

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# Flynn's Taxonomy

# Flynn's Taxonomy (of parallel architectures)

- Best known classification scheme for serial and parallel computer architectures
  - Multiplicity="Maximum possible no of simultaneous operations (instructions) on operands (data) being in the same phase of execution at the most constrained component of the organization"
- Four classes of computer architectures
  - Single Instruction Single Data (SISD)
    - Only one instruction is decoded in unit time
  - Single Instruction Multiple Data (SIMD)
    - Processor arrays: Connection Machine CM-200,
    - GPUs
  - Multiple Instruction Single Data (MISD)
    - Least intuitive.
  - Multiple Instruction Multiple Data (MIMD)
    - Most multicore/multiprocessor systems

# SISD Architectures

- Performance of a single processor can be improved through either architectural or technological advances.
  - Architectural advances → increase amount of work performed per instruction cycle
  - Technological advancement → reduce time needed per instruction cycle
- Several techniques are used in computer architectures to increase amount of work
  - Instruction Pipelining
  - Reordering of instructions to avoid stalls
  - Branch prediction
  - Speculative execution

# Instructions per cycle

Processor / System	MIPS	instructions per clock cycle	instructions per clock cycle per core	Year
<a href="#"><u>AMD Ryzen 7 1800X (8-core)</u></a>	304,510 MIPS at 3.7 GHz	82.3	10.29	2017
<a href="#"><u>Intel Core i7-8086K (6-core)</u></a>	221,720 MIPS at 5.0 GHz	44.34	7.39	2018
<a href="#"><u>Intel Core i9-9900K (8-core)</u></a>	412,090 MIPS at 4.7 GHz	87.68	10.96	2018
<a href="#"><u>AMD Ryzen 9 3950X (16-core)</u></a>	749,070 MIPS at 4.6 GHz	162.84	10.18	2019
<a href="#"><u>AMD Ryzen Threadripper 3990X (64 core)</u></a>	2,356,230 MIPS at 4.35 GHz	541.66	8.46	2020
<a href="#"><u>Sitara AM64x ARM Cortex A53 (2-core)</u></a>	5,992 MIPS at 1 GHz	6	3	2021

# Q&A





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**Thank You**