Key Notions – Microarchitecture

* Balanced Design
* Break & Build Design
* Critical Path Design
* The Science of Tradeoffs
  - Design Point (Cost, Performance, Area, Power)
  - Performance
    * Superscalar/Superpipelined
    * Branch Prediction
    * Value, Address Prediction
    * Fast execute, slow commit
    * Trace cache
    * Memory enhancements (latency, bandwidth)
  - Cycle time vs. Parallelism in march
  - Tailored vs. General purpose
    * Functionality
  - Compile-time vs. Run-time
The Microarchitecture (under the hood)

CPI vs. cycle time (or, IPC vs. frequency)
in-order vs. out-of-order execution
Speculate vs. stand around and wait
Issue-width
ASIC vs. programmed control
Use of chip real estate
   Better branch predictor
   Accelerators
   Microcode
Pipeline depth
Cache structures