**CS4100 Computer Architecture**

**Fall, 2024**

**Outlines (Sep. 2)**

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| Week 1  (9/2) | Introduction  [Ch1-1 Computer: A historical perspective, abstractions (10:03) (page 1-12)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=355&vid=2668) | |
| Week 2  (9/9)  助教：  林承賢 | **Chapter 1: Computer Abstractions and Technology**  [Ch1-2.1.1 Technology - Performance (1) (11:09) (page 13-21)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=355&vid=2669)  [Ch1-2.1.2 Technology - Performance (2) (11:08) (page 22-31)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=355&vid=2670)  [Ch1-2.2 Power trends, measuring performance, cost (13:32) (page 32-49)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=355&vid=2671) | **H1:** Bench-  marking |
| Week 3  (9/16)  助教：  王睿杰 | **Chapter 2: Instruction Set Architecture**  [Ch2-1 Instruction set architecture (5:15) (page 1-6)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=356&vid=2672)  [Ch2-2.1 Operands - Register operands and their organization (13:37) (page 7-14)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=356&vid=2673)  [Ch2-2.2.1 Operands - Memory operands, data transfer (1) (11:19) (page 15-21)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=356&vid=2674)  [Ch2-2.2.2 Operands - Memory operands, data transfer (2) (8:27) (22-26)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=356&vid=2675)  [Ch2-2.3 Operands - Immediate operands (6:04) (page 27-31)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=356&vid=2676) | |
| Week 4  (9/23)  助教：  唐梧遷 | [Ch2-4 Representing instructions (19:30) (page 32-43)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=356&vid=2677)  [Ch2-5.1 Operations - Logical (10:47) (page 44-54)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=356&vid=2678)  [Ch2-5.2 Operations - Decision making and branches (15:55) (page 55-63)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=356&vid=2679) | **H2:**(MIPS) if-then-else, loop inst. |
| Week 5  (9/30)  助教：  林承賢 | [Ch2-6.1 Supporting procedures in hardware (1) (16:01) (page 64-74)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=356&vid=2680)  [Ch2-6.2 Supporting procedures in hardware (2) (10:11) (page 75-79)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=356&vid=2681)  [Ch2-7 Communicating with people (4:00) (page 80-83)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=356&vid=2682)  [Ch2-8 Addressing for 32-bit addresses (15:31) (page 84-94)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=356&vid=2683)  [Ch2-9 ARM and x86 instruction sets (10:12) (page 95-103)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=356&vid=2684) | **H3**:(MIPS)  procedure call, recursive call |
| Week 6 (10/7)  助教：  王睿杰 | **Chapter 3: Computer Arithmetic**  [Ch3-1 Add, sub, and, or, nor (11:44) (page 1-14)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=357&vid=2685)  [Ch3-2.1 SOLT, overflow detection, zero detection (13:58) (page 15-26)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=357&vid=2686)  [Ch3-2.2.1 Cascaded carry look ahead adder (12:42) (page 27-35)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=357&vid=2687)  [Ch3-2.2.2 Multiple level carry look ahead adder (7:44) (page 36-43)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=357&vid=2688) | |
| Week 7 (10/14)  助教：  唐梧遷 | [Ch3-3.1 Unsigned multiply (18:47) (page 44-54)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=357&vid=2689)  [Ch3-3.2 Signed multiply (13:41) (page 55-60)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=357&vid=2690)  [Ch3-4 Division (21:35) (page 61-72)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=357&vid=2691)  [Ch3-5.1.1 Floating point representations (1) (15:48) (page 73-85)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=357&vid=2692)  [Ch3-5.1.2 Floating point representations (2) (8:34) (page 86-99)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=357&vid=2693)  [Ch3-5.2 Floating point addition and multiplication (15:26) (page 100-111)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=357&vid=2694) | |

| Week 8  (10/21) | **Midterm exam**, 1:20 – 3:10 PM, Chaps 1-3 | |
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| Week 9 (10/28)  助教：  林承賢 | **Chapter 4: Designing a Single-Cycle Processor**  [Ch4-1 Introduction to designing a processor (15:19) (page 1-12)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=358&vid=2695)  [Ch4-2 Analyzing the instruction set (10:08) (page 13-17)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=358&vid=2696)  [Ch4-3 Buliding the datapath (14:34) (page 18-28)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=358&vid=2697)  [Ch4-4 A single cycle implementation (8:51) (page 29-34)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=358&vid=2698)  [Ch4-5.1 Control of CPU operations (10:19) (page 35-45)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=358&vid=2699) | |
| Week 10 (11/4)  助教：  王睿杰 | [Ch4-5.2 ALU controller (9:26) (page 46-57)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=358&vid=2700)  [Ch4-6 Main controller and jump instruction (10:33) (page 58-68)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=358&vid=2701)  **Chapter 5: Pipelining**  [Ch5-1 An overview of pipelining (9:52) (page 1-8)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=359&vid=2702)  [Ch5-2 A pipelined datapath (15:21) (page 9-33)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=359&vid=2703)  [Ch5-3 Pipelined control (7:31) (page 34-51)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=359&vid=2704) | |
| Week 11 (11/11)  助教：  唐梧遷 | [Ch5-4 Hazard: types of hazards (8:23) (page 52-58)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=359&vid=2705)  [Ch5-5-1 Handling data hazard Inserting NOP (4:56) (page 59-62)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=359&vid=2706)  [Ch5-5-2 Handling data hazard Forwarding, R Type use (13:48) (page 63-73)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=359&vid=2707)  [Ch5-5-3 Handling data hazard Stall, load use (10:51) (page 74-82)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=359&vid=2708) | |
| Week 12 (11/18)  助教：  林承賢 | [Ch5-6 Handling branch hazards (10:23) (page 83-92)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=359&vid=2709)  [Ch5-7 Exceptions (7:17) (page 93-101)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=359&vid=2710)  [Ch5-8 Superscalar and dynamic pipelining (19:38) (page 102-119)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=359&vid=2711) | |
| Week 13  (11/25)  助教：  王睿杰 | **Chapter 6: Memory Hierarchy**  [Ch6-1 Memory hierarchy (14:32) (page 1-10)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=360&vid=2712)  [Ch6-2-1 Basics of caches - Direct mapped cache (11:46) (page 11-26)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=360&vid=2713)  [Ch6-2-2 Basics of caches - Address sub division (10:33) (page 27-34)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=360&vid=2714)  [Ch6-2-3 Basics of caches - Cache hit and miss (6:32) (page 35-40)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=360&vid=2715) | **Project:** (C/C++) Cache |
| Week 14 (12/2)  助教：  唐梧遷 | [Ch6-2-4 Basics of caches - Memory support (9:01) (page 42-47)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=360&vid=2716)  [Ch6-3 Measuring cache performance (6:36) (page 48-53)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=360&vid=2717)  [Ch6-4-1 Improveing cache performance - Set associative cache (17:00) (page 54-65)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=360&vid=2718)  [Ch6-4-2 Improveing cache performance - Multiple level cache (9:19) (page 66-72)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=360&vid=2719)  [Ch6-5-1 Virtual memory - Basic (10:33) (page 73-80)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=360&vid=2720) | |
| Week 15 (12/9)  助教：  林承賢 | [Ch6-5-2 Virtual memory - Issues in virtual memory (13:44) (page 81-90)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=360&vid=2721)  [Ch6-5-3 Virtual memory - Handling huge page table and TLB (11:20) (page 91-100)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=360&vid=2722)  [Ch6-5-4 Virtual memory - TLB and cache (9:37) (page 101-105)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=360&vid=2723)  [Ch6-6 A common framwork for memory hierarchy (11:27) (page 106-114)](http://mooc.nthu.edu.tw/sharecourse/course/content/chapter/26?chid=360&vid=2724) | |
| Week 16  (12/16) | **Final exam**, 1:20 – 3:10 PM, Chaps 4-6 | |