CISC 501 Computer Organization and Architecture
(3 credits)

Winter 2015 (January 5 – April 26)
Course Format: Online

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Office Hours: By appointment via Email
Class Format: Online
Class Web Site: https://sharklearn.nova.edu

Course Description

A comprehensive examination of the fundamental concepts, organization, and architectural structures of contemporary computers. Topics include: logic design, fundamental structure of computer hardware systems (CPU/ALU, memory, cache, registers, I/O), instruction sets, assembly language programming, computer arithmetic, pipelining, and memory hierarchy.

Required Textbook

Computer Organization and Design, the Hardware/Software Interface, 5th Edition by David Patterson & John Hennessy, Morgan Kaufmann 2013

Print Book ISBN: 9780124077263
eBook ISBN: 9780124078864

textbooks.elsevier.com/9780124077263
Course Outline

1. Computer Abstractions and Technology
   - Eight Great Ideas in Computer Architecture
   - Technologies for Building Processors and Memory
   - Computer Performance
   - The Power Wall
   - The Switch from Uniprocessors to Multiprocessors

2. Instructions: Language of the Computer
   - Operations and Operands of the Computer Hardware
   - Signed and Unsigned Numbers
   - Representing Instructions in the Computer
   - Logical Operations and Instructions for Making Decisions
   - Supporting Procedures in Computer Hardware
   - Translating and Starting a Program

3. Arithmetic for Computers
   - Addition and Subtraction
   - Multiplication and Division
   - Floating Point

4. The Processor
   - Building a Datapath
   - Overview of Pipelining
   - Pipelined Datapath and Control
   - Data Hazards, Control Hazards and Branch Hazards
   - Exceptions
   - Parallelism via Instructions

5. Memory Hierarchy
   - Memory Technologies
   - The basic of Caches
   - Virtual Machines
   - Virtual Memory
   - A common Framework for Memory Hierarchy

6. Parallel Processors from Client to Cloud
   - SISD, MIMD, SIMD, SPMD, and Vector
   - Multicore and Other Shared Memory Multiprocessors
   - Graphics Processing Units
   - Clusters, Warehouse Scale Computers, and Other Message-Passing Multiprocessors
Learning Outcomes

By completion of CISC501, the students are expected to:

- Describe how different metrics are used to evaluate the computer performance
- Understand the relationship among high-level language, assembly language, machine language and instruction set
- Explain how fixed-point and floating-point numbers are represented in a computer
- Understand the basics of logic design including gates, truth table, logic equation, combinational logic
- Learn arithmetic operations, logical operations and be familiar with the device that performs those operations, arithmetic logic unit (ALU)
- Understand how to build datapath for various types of instructions such as R-type, load/store, branch
- Learn the concepts of pipelining, structure hazards, data hazards, control hazards and various approaches to resolve those hazards
- Understand how memory is organized in a modern computer, including concepts of virtual and physical memory, translation-lookaside buffer (TLB), cache structures such as direct-mapped and set-associative cache, page table.
- Describe ways to measure and analyze cache performance, techniques for improving cache performance
- Understand the differences among shared memory multiprocessor (SMP), Graphics Processing Unit (GPU), and message-passing multiprocessors such as clusters

Tentative Course Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics</th>
<th>Chapters covered and HW Due Dates</th>
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<tbody>
<tr>
<td>1</td>
<td>1/5-1/10</td>
<td>Chapter 1: Computer Abstractions and Technology</td>
<td>Chapter 1</td>
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<tr>
<td>2</td>
<td>1/11-1/17</td>
<td>Appendix A: Assemblers, Linkers</td>
<td>Appendix A Online meeting: 1/14</td>
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<tr>
<td>3</td>
<td>1/18-1/24</td>
<td>Chapter 2: Instructions: Language of the Computer</td>
<td>Chapter 2</td>
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<td>Chapter 2: Instructions: Language of the Computer</td>
<td>Chapter 2 Online meeting: 1/28</td>
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<td>2/1-2/7</td>
<td>Chapter 3: Arithmetic for Computers</td>
<td>Chapter 3 HW#1 due: 2/1</td>
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<td>2/8-2/14</td>
<td>Chapter 3: Arithmetic for Computers</td>
<td>Chapter 3 Online meeting: 2/11</td>
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<td>7</td>
<td>2/15-2/21</td>
<td>Appendix B: The basics of Logic Design</td>
<td>Appendix B</td>
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<td>8</td>
<td>2/22-2/28</td>
<td>Chapter 4: The Processor</td>
<td>Chapter 4 Online meeting: 2/25</td>
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<tr>
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<td>3/1-3/7</td>
<td>Chapter 4: The Processor</td>
<td>HW#2 due: 3/1</td>
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<td>Week</td>
<td>Dates</td>
<td>Chapters/Assignments</td>
<td>Notes</td>
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<td>10</td>
<td>3/8-3/14</td>
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<td>12</td>
<td>3/22-3/28</td>
<td>Chapter 5: Memory Hierarchy</td>
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<td>Chapter 5</td>
<td>Online meeting: 3/25</td>
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<tr>
<td>13</td>
<td>3/29-4/4</td>
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<td>Chapter 5</td>
<td>HW#3 due: 3/29</td>
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<td>14</td>
<td>4/5-4/11</td>
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<td>Chapter 5</td>
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<td>15</td>
<td>4/12-4/18</td>
<td>Chapter 6: Parallel Processors from Client to Cloud</td>
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<td>Chapter 5</td>
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<td>16</td>
<td>4/19-4/26</td>
<td>Final Exam</td>
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<td>Chapter 1-6</td>
<td>Appendix A&amp;B</td>
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<td>HW#4 due: 4/19</td>
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<td>Final Exam: 4/22</td>
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**Grading Criteria**

Assignments (4 in total): 72%
Final Examination: 20%
Online Class Participation: 8%

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<tr>
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<tr>
<td>[90, 93)</td>
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<tr>
<td>[87, 90)</td>
<td>B+</td>
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<tr>
<td>[83, 87)</td>
<td>B</td>
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<tr>
<td>[78, 83)</td>
<td>B-</td>
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<tr>
<td>[73, 78)</td>
<td>C+</td>
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<tr>
<td>[67, 73)</td>
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<tr>
<td>[60, 67)</td>
<td>C-</td>
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**Assignments and Final Exam**

Assignments will be from textbook exercises, which will be posted in Blackboard. Students are also required to submit their homework to Blackboard.

Final examination will be held online. Students will be asked to answer a set of questions within three hours.

**Online Class Participation**

We will use the discussion board and collaboration sessions in Blackboard as the environment in which students and the professor discuss computer organization and
architecture issues throughout the term. Students will be given topical areas pertinent to computer organization and architecture in the discussion board. Class participation points are earned on the basis of steady effort and meaningful contribution to the discussions and the attendance of online collaboration sessions throughout the term. A total of 8 points is attributed to online class participation, so timely and meaningful participation in the discussion forums and online collaboration sessions is important to earn full points.

**Course Rules**

1. Penalties for late submission:
   - Submitting 1 day later than due date costs 10% of your points;
   - Submitting 2 days later than due date costs 20% of your points;
   - Submitting 3 days later than due date costs 30% of your points;
   - Assignment submitted 4 or more days later than due date will not be accepted and will receive 0 point if there is no proper excuse.
2. A student may not do additional work or repeat an examination to raise a grade.

**Email Communication**

Blackboard’s internal emails (course messages) are preferred for course related issues. Emails will be usually answered within 24 hours except for weekends and holidays. If I'm out of town, you will get an automated respond and I will answer your emails when I am back or have access to the Internet.

**School and University Policies and Procedures:**

Students must comply with the policies published in the school’s *Graduate Catalog* and the *NSU Student Handbook*, some of which are included or referenced below. The catalog is at [http://www.scis.nova.edu/documents/catalog.pdf](http://www.scis.nova.edu/documents/catalog.pdf)  
The handbook is at [https://www.nova.edu/publications/ustudenthandbook/](https://www.nova.edu/publications/ustudenthandbook/)

1. **Standards of Academic Integrity**  
For the university-wide policy on academic standards, see the section Code of Student Conduct and Academic Responsibility in the *NSU Student Handbook*. Also see the section Student Misconduct in the *Graduate Catalog*.  
Each student is responsible for maintaining academic integrity and intellectual honesty in his or her academic work. It is the policy of the school that each student must:
   - Submit his or her own work, not that of another person
   - Not falsify data or records (including admission materials and academic work)
   - Not engage in cheating (e.g., giving or receiving help during examinations; acquiring and/or transmitting test questions prior to an examination; or using unauthorized materials, such as notes, during an examination)
   - Not receive or give aid on assigned work that requires independent effort
• Properly credit the words or ideas of others according to accepted standards for professional publications (see the next section Crediting Words or Ideas)

• Not use or consult paper writing services, software coding services, or similar services for the purpose of obtaining assistance in the preparation of materials to be submitted for course assignments or for theses or dissertations.

• Not commit plagiarism (Merriam-Webster’s Collegiate Dictionary (2004) defines plagiarism as “stealing or passing off ideas or words of another as one’s own” and “the use of a created production without crediting the source.”) (see Crediting Words or Ideas below)

Crediting Words or Ideas

When using the exact words from another work, quotation marks must be used for short quotations (fewer than 40 words), and block quotation style must be used for longer quotations. In either case, a proper citation must also be provided. Publication Manual of the American Psychological Association, Sixth Edition, contains standards and examples on quotation methods.

When paraphrasing (summarizing, or rewriting) the words or ideas from another work, a proper citation must be provided. (Publication Manual of the American Psychological Association, Sixth Edition contains standards and examples on citation methods. The New Shorter Oxford English Dictionary (1993) defines paraphrase as “An expression in other words, usually fuller and clearer, of the sense of a written or spoken passage or text…Express the meaning (of a word, phrase, passage, or work) in other words, usually with the object of clarification…”. Changing word order, deleting words, or substituting synonyms is not acceptable paraphrasing—it is plagiarism, even when properly cited. Rather than make changes of this nature, the source should be quoted as written.

Original Work

Assignments, exams, projects, papers, theses, dissertations, etc., must be the original work of the student. Original work may include the thoughts and words of others, but such thoughts or words must be identified using quotation marks or indentation and must properly identify the source (see the previous section Crediting Words or Ideas). At all times, students are expected to comply with the school’s accepted citation practice and policy. The school and its faculty are committed to maintaining high standards of academic integrity. Student work will be routinely submitted to plagiarism detection tools (such as those at www.turnitin.com) for review.

Work is not original when it has been submitted previously by the author or by anyone else for academic credit. Work is not original when it has been copied or partially copied from any other source, including another student, unless such copying is acknowledged by the person submitting the work for the credit at the time the work is being submitted, or unless copying, sharing, or joint authorship is an express part of the assignment. Exams and tests are original work when no unauthorized aid is given, received, or used before or during the course of the examination, reexamination, and/or remediation.
2. Writing Skills

Students must demonstrate proficiency in the use of the English language. Grammatical errors, spelling errors, and writing that fails to express ideas clearly will affect their grades and the completion of their academic programs. The faculty will not provide remedial help concerning grammatical errors or other writing difficulties. It is the student’s responsibility to proofread and edit his or her work, which, in both form and content, should be letter-perfect. Work that is not properly edited will be rejected.

3. Disabilities and ADA

NSU complies with the American with Disabilities Act (ADA). The university’s detailed policy on disabilities is contained in the NSU Student Handbook. Student requests for accommodation based on ADA will be considered on an individual basis. Students with disabilities should discuss their needs with NSU’s ADA Coordinator before the commencement of classes if possible.

4. Communication by Email

Students must use their NSU email accounts when sending email to faculty and staff and must clearly identify their names and other appropriate information, e.g., course or program. When communicating with students via email, faculty and staff members will send mail only to NSU email accounts using NSU-recognized usernames. Students who forward their NSU-generated email to other email accounts do so at their own risk. GSCIS uses various course management tools that use private internal email systems. Students enrolled in courses using these tools should check both the private internal email system and NSU’s regular email system. NSU offers students web-based email access. Students are encouraged to check their NSU email account and their course management email daily.

5. The Temporary Grade of Incomplete (I)

The temporary grade of Incomplete (I) will be granted only in cases of extreme hardship. Students do not have a right to an incomplete, which may be granted only when there is evidence of just cause. A student desiring an incomplete must submit a written appeal to the course professor at least two weeks prior to the end of the term. In the appeal, the student must: (1) provide a rationale; (2) demonstrate that he/she has been making a sincere effort to complete the assignments during the term; and (3) explain how all the possibilities to complete the assignments on time have been exhausted. Should the course professor agree, an incomplete contract will be prepared by the student and signed by both student and professor. The incomplete contract must contain a description of the work to be completed and a timetable. The completion period should be the shortest possible. The completion date will not typically extend beyond 30 days from the last day of the term for master’s courses or beyond 60 days from the last day of the term for doctoral courses. The incomplete contract will accompany the submission of the professor’s final grade roster to the program office. The program office will monitor each incomplete contract. When the incomplete contract ends the course professor will assign
a grade based upon the work completed. No student may graduate with an I on his or her record.

6. Grade Policy Regarding Withdrawals

Course withdrawal requests must be submitted to the program office in writing by the student. Requests for withdrawal must be received by the program office by the withdrawal deadline (see dates in the academic calendar in the catalog and program brochures or websites). Withdrawals sent by email must be sent from the student’s assigned NSU email account. Requests for withdrawal received after 11:59 p.m. EST on the withdrawal deadline date will not be accepted. Failure to attend class or participate in course activities will not automatically drop or withdraw a student from the class or the university. Students who have not withdrawn by the withdrawal deadline will receive letter grades that reflect their performance in the course. When a withdrawal request is approved, the transcript will show a grade of W (Withdrawn) for the course. Students with four withdrawals will be dismissed from the program. Depending on the date of withdrawal, the student may be eligible for a partial refund (see the appropriate catalog section Refund Policy Regarding Withdrawals).

7. Acceptable Use of Computing Resources

Students must comply with the university’s Policy on Acceptable Use of Computing Resources (see NSU Student Handbook).

8. Academic Progress, Grade Requirements, and Academic Standing

Students must be familiar with the school’s policies, which are contained in its catalog.

9. Student Research Involving Human Subjects

Students must be familiar with the university’s policy (see paragraph in catalog).

10. Responsibility for Payment of Tuition and Fees

Once registered, students are personally responsible for the payment of their tuition and fees. Returned checks, cancelled credit cards, employer or agency refusal to pay, ineligibility for financial aid, and other reasons for non-payment may result in a direct bill to the student, and/or referral to a collection agency.

Payment and refund policies are based on the view that a student registering for a class is reserving a place in that class and that tuition and fees cover the opportunity to secure that place in the class. Since no other person can purchase that place, the student is responsible for the tuition and fees associated with it. Simply not attending does not constitute a reason for non-payment.