

# CS 520: Computer Architecture and Organization

## Spring 2018

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**Class Hours:** Tuesday & Thursday, 8:30AM to 9:55AM, Fine Arts 212

**Instructor:** Timothy Normand Miller  
Office Q01, Engineering Building (3rd floor, Computer Science suite)  
millerti@binghamton.edu  
**Office Hours:** Tuesday & Thursday 12:00PM to 2:00PM in EB Q01  
And by appointment

**Course Materials:** Distributed using Blackboard, accessible to all enrolled students.

**Text:** Course reading material will be provided in PDF form. We will also use reprints of classic and recent papers in the area covered by this course. Hennessy & Patterson's *Computer Architecture: A Quantitative Approach, 4th or 5th Edition* (Morgan-Kaufman) will be a good background reading. The course will cover material **at a more advanced level** than this book.

**Teaching Asst:** TBA

### Course Outline:

- *Pipelined CPU Design*: Basic Principles, Prefetching, Multiple Function Units, Forwarding, Hardware and Compiler-Based Scheduling/Control, Branch-Handling Techniques, Precise Interrupts
- *Advanced Pipelined CPU Design*: Superscalar and Super-pipelined Machines, Decoupled execute-access machines, advanced dynamic scheduling techniques for exploiting instruction-level parallelism, trace caches.
- *High-Speed Memory System Design*: Caches, TLBs, Inter-leaving, Data Mapping. Newer RAM technologies.
- *VLIW machines*: architectures, compilation techniques and case studies.
- *Emerging alternatives*: EPIC, multi-threaded processors, chip multiprocessors.

### Grading:

Below is a guideline for how assignments and exams will be weighted. Actual weights will be adjusted based on outcomes and to maximize fairness.

ASSIGNMENT/TESTS	WEIGHT	COMMENTS
Homework	25%	Assigned as needed, some ungraded, some coding
Midterm Exam	25%	In class
Final Exam	25%	During finals week, date TBD.
Projects	25%	Small projects spread out over the semester
Class participation	Extra credit	Attendance, asking questions, etc.

### Homework:

Four homework assignments will be issued, with written and/or coding elements. Exams may contain variants of homework problems. Expect design questions, where you have to solve an architectural problem.

### Exams:

The midterm exam will cover material up to the middle of the course. The final exam will cover material presented after the midterm. Note that later concepts build on earlier ones, so the final is cumulative to a limited degree. Be prepared for the occasional pop quiz. Exams tend to focus on design problems, so be prepared to solve problems and "think outside the box."

**Projects:**

The course project will have two phases, one due around mid-term, one due in finals week.

**Class Participation:**

Students who participate actively in class AND who are on the borderline between two letter grades will be given the higher grade. This to provide a boost to students who perhaps don't test well but ask good questions in class and take the subject material seriously. The general rule of thumb is that you should make yourself known to the instructor, make an impression, and attempt to contribute to the learning of others. Some examples of things you can do to earn your participation score include:

- Ask questions in class!
- Help answer questions in class.
- Make appointments to meet with the instructor. Make sure I know your name and something about you.
- Demonstrate an interest in Computer Architecture and do extra reading.
- Get involved in research in Computer Architecture.
- Suggest ways to help other students learn the material.
- Criticize! I am always looking for ways to improve my teaching. Please make suggestions.
- Many other things...

**Assignment submission policy:**

Some assignments (and other course objectives) will have due dates, and you should strive to turn them in on time. When turning in assignments, employ the following guidelines:

- For written assignments, you can turn in your assignment to the instructor during class. Otherwise you have to hand-deliver it to the grader. (Note: Some assignments will be electronic and will be sent by email to the grader.)
- It is best to turn in assignments on time. Consistent punctuality can help boost borderline final grades.
- Consistently late assignments will cost you points. Be responsible.
- Do not inconvenience the grader. If you have to turn in an assignment late, put it in the grader's hand at a time that he chooses. Making life difficult for the grader will cost you points.
- If you are ill or struggling with an assignment, note that fact on your paper and turn it in late. Copying someone else's work will be dealt with severely. It is better to just turn it in late.
- It is polite to contact the grader in advance if you know you'll have to turn in an assignment late.
- If this flexible policy is abused, the instructor and TA reserve the right to change it.

Note: Some graded course objectives may require appointments to see the TA or instructor. If you fail to arrange an appointment or miss your appointment, you are likely to score a zero for that objective.

**Honesty Policy:**

All assignments for this course should be done individually. For ungraded assignments, collaborate at your own risk, because homework concepts will be tested on exams. ***Any case of cheating on graded assignments will be dealt with severely. Any and all work that you turn in for this course must be your own.*** I encourage students to talk to each other about course content. But collaboration on assignments is forbidden. The Watson school and campus have policies in place that deal with instances of academic dishonesty – these policies will be enforced. These Watson School policies are available at:

<https://www.binghamton.edu/watson/about/honesty-policy.pdf>

You are required to read this document to get an understanding of what constitutes academic violations.