BLG 322E Computer Architecture

Spring 2021

	CRN: 21159	CRN: 21158
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Course site: http://ninova.itu.edu.tr/
Course time and location: Thursday 8:30-11:30 AM (online)

Description: Pipeline. Instruction-level parallelism. RISC pipeline. Input-output organization. Interrupts. Direct memory access (DMA). Memory hierarchy, cache memory, virtual memory. RAID: (Redundant Array of Independent/Inexpensive Disks). Multiprocessor systems: Interconnection networks, cache coherence.

Prerequisites: BLG 222E Computer Organization with a grade of at least DD. To understand the more advanced topics in computer architecture, you will also need to remember what you learned in BLG 231E Digital Circuits and BLG 212E Microprocessor Systems.

Required texts:

- *Computer Organization and Architecture*, William Stallings, Prentice Hall, 2016. 10th ed.
- *Computer Architecture, A Quantitative Approach*, John L. Hennessy and David A. Patterson, Morgan Kaufmann, 2017. 6th ed.
- *Motorola, MC68000 16/32-bit Microprocessor User's Manual*

For each lecture, you should read the relevant sections in the lecture slides as listed in the weekly course schedule on the last page of this syllabus.

Homework (Take-home exams): There will be five homework assignments (5 x Take-home exams). You are expected to make an honest, independent attempt to solve and turn in your answers to each homework question. Computer architecture can only be mastered by solving problems, not just by listening to a lecturer. Therefore, doing the homework assignments is crucial to performing well in this class. If you are having considerable difficulty with the early assignments, this is a sign that you may be in over your head - you should contact us immediately. We can help you understand the parts you are confused about. The only way to pass the course is to work hard and get sufficient grades in exams and assignments. Do not contact us at the end of the semester to negotiate a better grade. The assignments will require a substantial time commitment over several days (several hours per week outside of class should be expected). Be sure to budget sufficient time to complete assignments before the deadline. You may not copy solutions from a classmate or from the Internet. This is considered cheating! Homework is individual. There are no group assignments in this course.

Attendance: It is imperative that you attend the online lectures and pay attention. You should not work on your laptop or read anything not related to the class during the lecture. You must attend the section for which you have officially registered. Please check your actual section by logging into `http://www.sis.itu.edu.tr`. You are required to attend 70% of the lectures in order to be allowed to take the final exam. (Since this semester has 14 weeks, you have to attend at least 10 lectures). Those who do not meet the attendance requirement will fail the course with a grade of VF (Article 23, Undergraduate Education Regulations, `https://www.sis.itu.edu.tr/TR/mevzuat/lisans-yonetmelik.php`). Note that the 70% attendance rule still applies **even if** you have taken this course before. There are NO exceptions. Zoom records your attendance at lectures. If you do miss class, it is your responsibility to find out (from a classmate) what you missed, including class notes, announcements, and worksheets. Check the exam date, and make sure you will be able to take the exam on the exam date. The midterm will be on Thursday, April 22, 2021.

Evaluation: The distribution of percentages for the course grade will be as follows:

Homework (Take-Home Exams) (5)	20 %
Midterm	40 %
Final	40 %

Course grade: Your grade for this course will be determined by your scores on the midterm, homework, and the final, not by any external circumstances which you think are "special" or "unique." There are no subjective criteria in this course. The exams and homework are graded based on the same objective rubrics for all students. The partial credit you receive on exam questions is at the sole discretion of the course instructors and assigned consistently across all students based on specific criteria. In case it is not already obvious, your grade in this course, or any course for that matter, is solely your own responsibility.

Eligibility to take the final exam: Students must meet the following criteria to take the final exam:

- Students must attend 70% of lectures.
- Students must have a mid-semester average grade of at least 35/100.

The average mid-semester grade is computed using the formula below:
Avg. mid-semester grade = (0.20 × Assignments + 0.4 × Midterm)*100/60

Any student who gets a grade lower than the required grade on any of these assessments will fail the course with a grade of VF and not be allowed to take the final exam.

Announcements on course site and by e-mail: You are expected to check the Ninova web site and your ITU e-mail for homework and announcements. In addition, you are responsible for all announcements that may be made on the course web site and in class (that may or may not be included in this syllabus).

E-mail etiquette: Your full name must appear in the e-mail. Please include your name in the "From:" line of the email message, not just your email address. To add your name to your ITU mail account, log into ITU Webmail. Hover over the cog (gear) icon at the center of the top banner of Webmail (to the right of "Yardım"). Choose "Preferences → Global Preferences." Under "Personal Information," in the "Your full name:" field, enter your full name. Click "Save."
The e-mail subject must be "BLG 322E". Do not send the same e-mail repeatedly. Your e-mails may be in English or Turkish. Regardless of which language you use, use proper grammar, lower-case/uppercase letters, and punctuation. You e-mails should not look like chat messages. Although it is easy for you to dash off an email question, be aware that it takes time to answer it.

Academic honesty: You are expected to read the Undergraduate Education Regulations (`https://www.sis.itu.edu.tr/TR/mevzuat/lisans-yonetmelik.php`) and ITU Academic Honesty Pledge (`https://www.sis.itu.edu.tr/TR/mevzuat/akademik-onur-sozu-esaslar.php`) and behave accordingly. Cheating on the exams or the homework will result in disciplinary action. Every piece of work that you turn in with your name on it must be yours and yours alone. No coworking is allowed on any test or homework. You must not turn in work that is not yours. Specifically, you are not allowed to copy someone else's work. This is plagiarism. You must not enable someone else to turn in work that is not his or hers. Do not share your work with anyone else.

Final: The final exam will be given during the final exam period (June 14-27, 2021), at the time and location determined by the University.

Last day for add/drop: The add/drop period ends on March 5, 2021.
You may withdraw from the course between March 8, 2021 and March 12, 2021.
There is no way to drop or withdraw from a course after March 12, 2021!

Tentative course schedule (subject to change):

	Date	Subject	Slides	HW Assigned	HW Due	HW Graded
1	4-Mar	Introduction: layered logical model of a computer system, CPU, computer evolution	1.1-1.35			
2	11-Mar	Pipeline: general structure, space-time diagram, throughput, speedup, instruction pipeline	2.1-2.21	HW 1: 11-Mar		
3	18-Mar	Pipeline: instruction pipeline, hazards (conflicts) and solutions, dealing with branches (branch prediction)	2.22-2.42			
4	25-Mar	Pipeline: hazards, dealing with branches (branch prediction)	2.47-2.60	HW 2: 25-Mar	HW 1: 24-Mar	
5	1-Apr	Pipeline: hazards, dealing with branches (branch prediction)	2.61-2.80			
6	8-Apr	I/O org. & bus operations: CPU–I/O interface, data trans. modes, data trans. modes, 68000 bus operations	3.1-3.24		HW 2: 7-Apr	HW 1: 8-Mar
7	15-Apr	Interrupts: Systems, vector address, priority interrupt HW, processing	4.1-4.24	HW 3: 15-Apr		
8	22-Apr	Midterm Exam&Recitation		Exam: 22-Apr	HW 3: 21-Apr Exam: 22-Apr	HW 2: 22-Apr
9	29-Apr	Interrupts: Exceptions Direct Memory Access (DMA): overview, controllers, transfer modes	4.25-4.36 5.1-5.11	HW 4: 29-Apr		
10	6-May	Direct Memory Access (DMA): 3-wire DMA, I/O processor Memory organization (internal/external): memory hierarchy, mem. gap	5.12-5.30 6.1-6.7		HW 4: 9-May	HW 3: 6-May
11	20-May	Memory organization: cache memory	6.8-6.29	HW 5: 20-May		Exam: 22-May
12	27-May	Memory organization: cache memory External memory: magnetic disk, RAID	6.30-6.36 7.1-7.15		HW 5: 26-May	HW 4: 27-May
13	3-Jun	External memory: error detection/correction in memories Memory management, Virtual Memory: paged mapping, segmented	7.16-7.25 8.1-8.13			
14	10-Jun	Memory management, Virtual Memory: paged mapping, segmented Multi-proc./core/computer: shared mem., dist. sys., cache cohererence	8.4-8.17 9.1-9.36			HW 5: 8-Jun
	14-Jun - 27-Jun	Final (Tentative)				