CO 454 SCHEDULING, Spring 2011

Instructor: Levent Tunçel, MC6066, ext. 35598, e-mail: ltuncel@math, office hrs.: W. 9--10 a.m., 2--3 p.m.

Please send your course related email messages through UW-ACE. If you send them directly to ltuncel@math, then you must send them from your uwaterloo email account. Other messages may be ignored.

Class Times and Place: T, Th 1:00--2:20 p.m., MC 4064

TA: Gary Au, MC6101, e-mail: yau@uwaterloo.ca, office hr.: T. 2:45—3:45 p.m.

WEB SITE: on UW-ACE.

CONTENTS:

1. *Introduction:* An overview of practical optimization problems that can be posed as scheduling problems. Framework for deterministic scheduling problems: Common assumptions, objective functions, models and notation.

2. *Basic Scheduling Problems:* Characterizations of optimal schedules. Simple and efficient combinatorial algorithms for finding an optimal solution.

3. *Hard Scheduling Problems and General Computational Methods:* Study of hard scheduling problems (*NP-hard*) for which there are no efficient algorithms yet. A brief overview of computational complexity, definitions of *P*, *NP*, *NP*-Complete, *NP*-hard and polynomial-time reductions. Integer programming formulations, the Traveling Salesman Problem, heuristics, *dynamic programming* and *branch-and-bound* approaches. Partial characterizations of optimal schedules and their usages in developing more efficient algorithms based on general dynamic programming and branch-and-bound approaches.

4. *Deterministic Models for Scheduling Problems on Parallel Machines:* Parallel identical machine models. Uniform machine models. Unrelated machine models. Longest path problems. Bin-packing problems. Efficient algorithms based on matching and maximum flow techniques. Efficient heuristics which deliver approximately optimal solutions for hard parallel machine problems.

5. *Polynomial-time Approximation Algorithms for Various Scheduling Problems*

6. *Deterministic Flow Shops and Flexible Flow Shops*

7. *Deterministic Open Shops and Job Shops*

8. *Practical General Purpose Procedures*

Textbook: *Scheduling: Theory, Algorithms and Systems (Third Edition)* by Pinedo (2008). Available at the bookstore.

Other References: In addition to the above, the following books and articles will be on overnight reserve at the Library:

1. *Sequencing and Scheduling: An Introduction to the Mathematics of the Jobshop* by French.
2. *Theory of Scheduling* by Conway, Maxwell and Miller.
3. *Sequencing and Scheduling: Algorithms and Complexity* by Lawler et al. (also in: *Logistics of Production and Inventory* edited by Graves, Rinooy Kan and Zipkin).
4. *Introduction to Sequencing and Scheduling* by K. R. Baker.

Assignments: There will be five assignments. They are due on the stated date **at the beginning of class** unless another arrangement has been made with me **in advance**. Late submissions will receive a grade of zero. Assignment solutions and copies of other course handouts will be available on UW-ACE. You will find a discussion board on the UW-ACE site. We will visit the board on a regular basis and will try to answer questions in a timely manner. Except the textbook, in-class notes, discussion board, the instructor and the TA for the course, you may not consult with anything else (dead or alive) in doing your assignments. In particular, NO collaboration is allowed.

Midterm Exam: June 20, 2011 Monday, 7:00--9:00 p.m. at room: MC2038. Students having a conflict with this time may write the exam on the same day from 5:00 to 7:00 p.m. at room: MC4060. If you have such a conflict you must obtain my permission (to obtain such permission, please email me a note describing the conflict in detail by June 15, 2011) to take the exam at the earlier time. Also note that you must be in the exam room by 6:55 p.m.; if you do take the exam early, you cannot leave the exam room before 7:00.

Final Grade: Assignments 20%, Midterm 20%, Final Exam 60%. A missed assignment or midterm will be treated the same as a mark of zero unless the cause is illness (a medical note is necessary), or a similar good reason given promptly in writing, in which case the corresponding weight will normally be transferred to the final exam.

INC grade:
A grade of INC (incomplete) will be *only* awarded to students who cannot write the final exam for reasons acceptable to the instructor, such as a medical certificate by a recognized medical professional. In addition such students need to be in *good standing* prior to the final exam. To be in good standing a student must

- submit and pass at least 3 of the assignments,
- write and pass the midterm exam, and
- attend classes regularly.

Academic Integrity:

See www.uwaterloo.ca/accountability/documents/courseoutlinestmts.pdf
We reproduce the text on this site below:
Academic Integrity: In order to maintain a culture of academic integrity, members of the University of

Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check www.uwaterloo.ca/academicintegrity/ for more information.]

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4, http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm. When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline: A student is expected to know what constitutes academic integrity to avoid committing academic offenses and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course professor, academic advisor, or the undergraduate associate dean. For information on categories of offenses and types of penalties, students should refer to Policy 71, Student Discipline, http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm. For typical penalties check Guidelines for the Assessment of Penalties, http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm.

Appeals: A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals, http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm.

Note for students with disabilities: The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.
