CS 4120 - Design and Analysis of Algorithms

BGSU Computer Science **Fall 2014 Syllabus**

Instructor: Dr. Robert Dyer
E-mail: **rdyer@bgsu.edu**
Office: HAYES 238
Phone: (419) 372–3469

Office Hours: MWF 9:30am – 10:30am, 11:20am – 12:00pm
T 1:00pm – 3:00pm
R 10:45am – 12:00pm
OR by appointment (email me)

Class Meeting Time: Mondays, Wednesdays, and Fridays: 10:30am - 11:20am, HAYES 117

Textbook: "Introduction to Algorithms," by Cormen, Leiserson, Rivest, and Stein, MIT Press, 3rd Edition, 2009, ISBN-Hardcover: 978-0-262-03384-8, ISBN-Paperback: 978-0-262-53305-8.

Learning Outcomes for the Course: After successfully completing CS 4120, students will be able to say:

- I can determine the complexity of an algorithm.
- I can explain and implement different types of algorithms (e.g., Divide-and-Conquer, Dynamic Programming, Greedy Algorithms).
- I can explain and implement different graph algorithms.
- **I understand the classes of algorithms (P, NP, and NP- complete) and the role of polynomial-reduction in establishing NP-completeness.**
- *I understand the implications of algorithm design in real-world applications.*

[Note: The outcomes in *italics* are emphasized for CS 4120 more, because those in CS 5120 are expected to be quite familiar with the technique. The outcomes in **bold** are emphasized more for CS 5120, since they are more advanced; however, CS 4120 students are NOT "off the hook" for the **bold** outcomes.]

Student Outcomes for the BSCS Program Supported by the Course

- Program in a higher-level language; and
- Develop a plan to integrate hardware and software into a particular environment.

[Note: A complete list of outcomes may be found at http://www.bgsu.edu/catalog/A_S/A_S42.html]

Grading: The final grade will be composed of the following weights.
(The instructor reserves the right to make changes at any time.)

Assessments

Item	*Weight*
2 Midterm Exams	20%+10% = 30%
Final Exam	20%
Best 4 of 5 Homeworks[#]	4*6% = 24%
2 Projects	13%+13% = 26%

Grading Scale

Range	*Grade*
[90–100]%	A
[80–90)%	B
[70–80)%	C
[60–70)%	D

[#]**All homework sets must be submitted**, and the *best four* will count toward the final grade.
Any missing or incomplete homework will be graded ***as is*** and count as one of the 4 graded homeworks.

Homework and Projects: Homework is essential to learning the materials, and you are expected to submit all homework assignments. The best four of five homework sets will be counted toward the final grade, each allowed one week for you to work on. Although the lowest homework grade will be dropped, you are expected

to put in reasonable effort toward all of them. To ensure that, if a homework is not turned in or reflects substantially incomplete work, at the instructors discretion, that homework will count as one of the four graded homeworks. Two projects involving programming will be given during the semester, to be completed outside of class. You will be given three weeks to complete each project. You are responsible for planning ahead to allow yourself enough time to complete all homework sets and projects by the deadlines. **Start your work early**. Homework and projects are due at the BEGINNING of the class on the due date.

Course Objectives: This course teaches key algorithm development methodologies: greedy approach, divide and conquer, dynamic programming; important graph algorithms, several canonical problem types, and fundamentals of computational complexity.

Prerequisites: CS 3350 (Data Structures) and MATH 2220 (Discrete Math), or equivalent, including the basics of arrays, linked lists, stacks, queues, trees, and recursion.

Withdrawal Deadline: Friday, November 14, 2014. University policy states that after this date, anybody withdrawing from the course will have the grade automatically turn into an F.

Canvas: The syllabus, schedule, and course policies will be available on Canvas. Your grades will also be available on Canvas throughout the semester.

Class Notes/Handouts: Every student is responsible for taking notes in the class, collecting class handouts, and generally keeping up with the class, even if they must miss a class meeting for any reason. I do not post class notes, so if you miss a class please borrow notes from another student.

Office Hours and Help: Please check your Canvas course site, Canvas messages, and your BGSU email **regularly**. *[You may have your Canvas messages forwarded to your BGSU/other email, and have your BGSU email forwarded to another favorite email address, if necessary, but do check it (multiple times) daily.]* I do forward my own Canvas messages to my BGSU email and check my BGSU email multiple times everyday (with rare exceptions). I check BGSU email more often than I access Canvas, so if you need to contact me urgently, use both Canvas and BGSU email, if necessary multiple times. I will do my best to accommodate you ASAP, even if outside my posted office hours and without appointment. In general, if you need to see me in my office outside of my regular office hours, please make an appointment.

Attendance: Students are expected to attend each class and be on time. I do not believe in any specific grade incentives for class attendance, or penalties for absence.

Academic honesty: All coursework for this class is expected to be YOUR OWN work. The MINIMUM penalty for copying someone's work (including current classmates, students from a previous offering of the course, or postings found on the web) or knowingly allowing someone to copy your work is a zero for the homework/project/exam/paper/presentation. The offense is also reported to the dean of your college. *Turnitin*, a plagiarism detection tool, will be used in this course. I will follow the University's general codes of conduct defined in the *BGSU Student Handbook*. For details refer to:

1. *BGSU Student Handbook,* page 33 (http://www.bgsu.edu/content/dam/BGSU/student-affairs/documents/2014-15-Student-Handbook.pdf)
2. *The Academic Charter*, section B-I.G (http://www.bgsu.edu/content/dam/BGSU/faculty-senate/documents/academic-charter/B-I-G-Academic-Honesty-Policy.pdf)

Make-up policy: If you cannot take an exam as scheduled, you (or an authorized person, only in case you are unable to do so) must contact me ahead of time with the reason. Make-ups are considered typically for health emergencies only. Taking the FINAL exam at a time other than the university-scheduled time requires approval by the CS Adviser. If you feel that you have a valid reason to request a change in FINAL exam time, inform

me and obtain the request form in the Computer Science department office, Hayes 221. You must sign an academic honesty statement specifically in connection with the exam.

Disability Policy: In accordance with the University policy, students with disabilities must verify their eligibility through the Office of Disability Services for Students, 38 College Park Office Building, 419–372–8495 (http://www.bgsu.edu/disability-services.html). Contact me as soon as possible this semester to arrange any accommodations needed to assist with your success in this course.

Religious Holidays: It is the policy of the University to make every reasonable effort allowing students to observe their religious holidays without academic penalty. In such cases, it is the obligation of the student to provide the instructor with reasonable notice of the dates of religious holidays on which he or she will be absent. Absence from classes or examinations for religious reasons does not relieve the student of responsibility for completing required work missed. Following the necessary notification, the student should consult with the instructor to determine what appropriate alternative opportunity will be provided, allowing the student to fully complete his or her academic responsibilities (*The Academic Charter*, section B–I.F–4.b at: http://www.bgsu.edu/content/dam/BGSU/faculty-senate/documents/academic-charter/B-I-F-Classroom-Related-Responsibilities.pdf).

Tentative Course Schedule

Week	Day	Date	Topics / Important Dates	Assigned	Due
1	M	Aug 25	Introduction to course; Ch 1 – The Role of Algorithms in Computing		
	W	Aug 27	Ch 2 – Insertion sort; Analyzing algorithms		
	F	Aug 29	Ch 2 – Analyzing algorithms; Designing algorithms		
2	M	Sep 1	No Class - Holiday		
	W	Sep 3	Ch 3 – Growth of Functions – Asymptotic notation	**HW #1**	
	F	Sep 5	Ch 3 – Standard notations and common functions		
3	M	Sep 8	Ch 4 – Maximum subarray		
	W	Sep 10	Ch 4 – Maximum subarray; Strassen's matrix multiplication		
	F	Sep 12	Ch 4 – Strassen's matrix multiplication	**HW #2**	**HW #1**
4	M	Sep 15	Ch 4 – Methods for solving recurrences		
	W	Sep 17	Ch 6 – Heapsort		
	F	Sep 19	Ch 6 – Heapsort		**HW #2**
5	M	Sep 22	Ch 7 – Quicksort		
	W	Sep 24	Review for exam		
	F	Sep 26	**Exam #1**		**Exam #1**
6	M	Sep 29	Ch 7 – Quicksort	**Project #1**	
	W	Oct 1	Ch 8 – Sorting in Linear Time		
	F	Oct 3	Ch 8 – Sorting in Linear Time	**HW #3**	
7	M	Oct 6	Ch 12 – Binary Search Trees		
	W	Oct 8	Ch 12 – Binary Search Trees		
	F	Oct 10	No Class – Fall Break		
8	M	Oct 13	Ch 15 – Matrix chain multiplication		**HW #3**
	W	Oct 15	Ch 15 – Elements of dynamic programming		
	F	Oct 17	Ch 15 – Longest common subsequence	**HW #4**	
9	M	Oct 20	Ch 16 – Activity selection		**Project #1**
	W	Oct 22	Ch 16 – Elements of the greedy strategy		
	F	Oct 24	Ch 16 – Huffman codes		**HW #4**
10	M	Oct 27	Ch 22 – Representation of graphs; BFS		
	W	Oct 29	Ch 22 – BFS; DFS		
	F	Oct 31	Review for exam		
11	M	Nov 3	**Exam #2**		**Exam #2**
	W	Nov 5	Ch 22 – Topological sort		
	F	Nov 7	Ch 22 – Strongly connected components		
12	M	Nov 10	Ch 23 – Minimum Spanning Trees	**Project #2**	
	W	Nov 12	Ch 23 – Minimum Spanning Trees		
	F	Nov 14	Ch 24 – Single-Source Shortest Paths (SSSP)		
13	M	Nov 17	Ch 24 – Dijkstra's algorithm		
	W	Nov 19	Ch 34 – NP-Completeness (Overview; Polynomial time)		
	F	Nov 21	Ch 34 – NP-Completeness (Polynomial-time verification)		
14	M	Nov 24	Ch 34 – NP-Completeness continued	**HW #5**	
	W	Nov 26	No Class – Holiday		
	F	Nov 28	No Class – Holiday		
15	M	Dec 1	Ch 34 – NP-completeness and reducibility		**Project #2**
	W	Dec 3	Ch 34 – NP-completeness proofs and NP-complete problems		
	F	Dec 5	Ch 34 – NP-Completeness continued		
16	M	Dec 8	**CS 5120 Presentations** (CS 4120 students required to attend)		**HW #5**
	W	Dec 10	**CS 5120 Presentations** (CS 4120 students required to attend)		
	F	Dec 12	Review for final exam		
17	W	Dec 17	**Final Exam 8:30-10:30am (Hayes 117)**		**Final Exam**

NOTE: If there is a discrepancy between the due dates here and on actual assignments, the one on the assignment applies.