

Data Structures

COMP 2100

Who am I?

- Dr. Barry Wittman
- **Not Dr. Barry Whitman**
- Education:
 - PhD and MS in Computer Science, Purdue University
 - BS in Computer Science, Morehouse College
- Hobbies:
 - Reading, writing
 - Enjoying ethnic cuisine
 - DJing
 - Lockpicking
 - Stand-up comedy

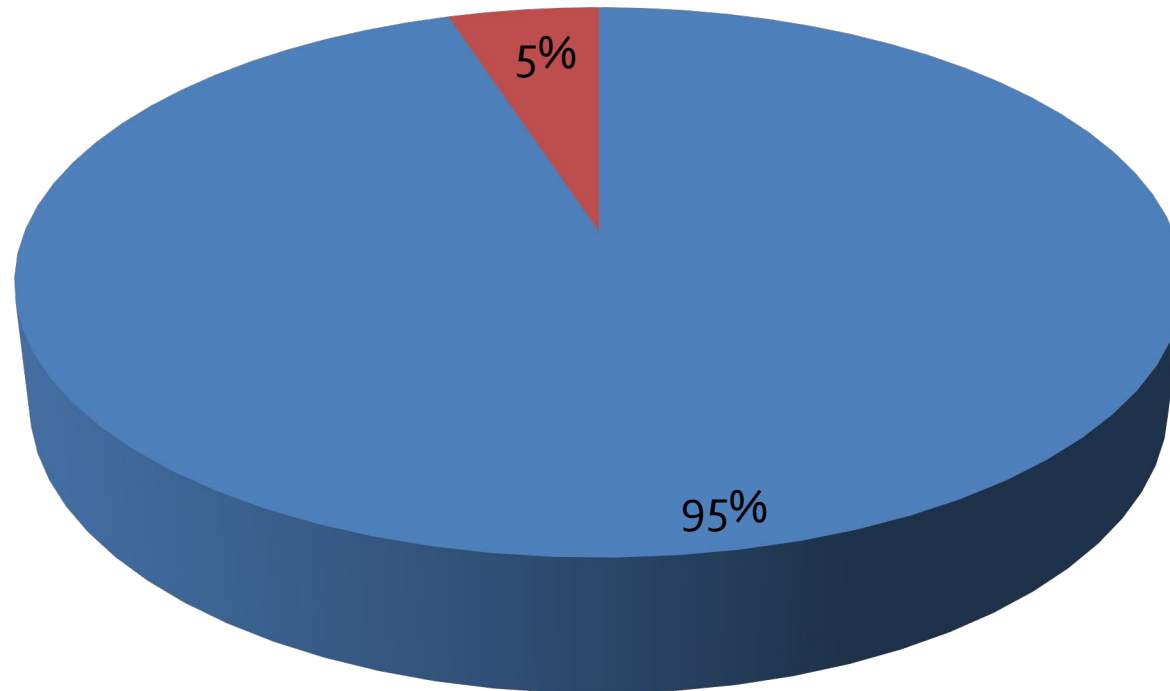
How can you reach me?

- **E-mail:** wittman1@otterbein.edu
- **Office:** C123 (Art & Communication Building)
- **Phone:** (614) 823-2944
- **Office hours:** **MWF** 9:00 – 10:15 a.m.
MWF 1:45 – 2:45 p.m. (in C142)
W 4:00 – 5:00 p.m.,
TR 10:00 – 11:30 a.m.,
TR 2:00 – 4:00 p.m.,
and by appointment
- **Website:**
<http://faculty.otterbein.edu/wittman1/>

Who are you?

Major

■ Computer Science ■ Chemistry



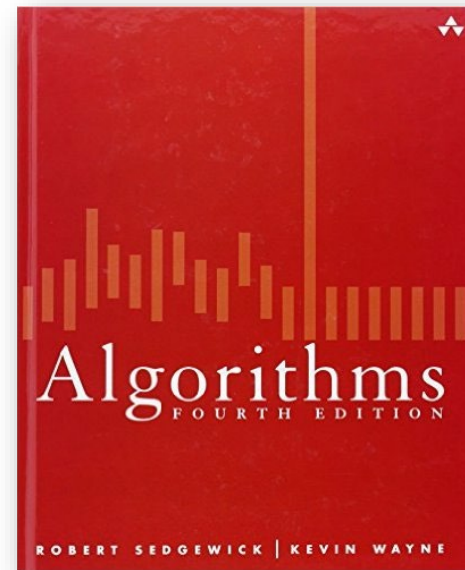
Why are we here?

- State your name, and give the salutation you would prefer:
Mr., Ms., or another
- What's the purpose of this class?
- What do you want to get out of it?
- Do you want to be here?

Course Overview

Textbook

- Robert Sedgwick and Kevin Wayne
- ***Algorithms***
- 4th Edition, 2011, Addison-Wesley Professional
- ISBN-10: 032157351X
- ISBN-13: 978-0321573513



You have to read the book

- You are expected to read the material before class
- If you're not prepared, you may be asked to leave
 - You will forfeit the opportunity to take quizzes
 - Much more importantly, you will forfeit the education you have paid so much money to get

Course focuses

- Java expertise
- Computational complexity
- Recursion
- Sorting
- Graph algorithms

- Data structures
 - Stacks
 - Queues
 - Binary trees
 - Hash tables
 - Undirected graphs
 - Directed graphs
 - Priority queues

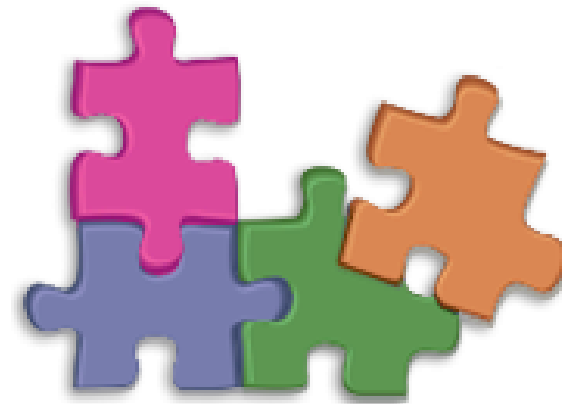
Ass load of content

- This class is serious business
- Big theoretical component
- Big coding component



Imagine you're given a puzzle

- If you can solve the puzzle, you're given a harder one
- Once you start getting puzzles so hard you can't solve it, are you:
 - Discouraged and ready to give up?
 - Excited and eager for more?



Fixed vs. growth mindsets

- People with **fixed** mindsets believe that they are unchanging
 - Either smart or stupid, good at CS or not
- People with **growth** mindsets believe that they can change and improve
- People who are excited by puzzles they can't solve have a growth mindset
- Guess which mindset leads to greater happiness and success?

A note about help

- This course is tough
- Projects and assignments have a difficulty such that most students are **expected** to need help
- **Good students** come to office hours for help
- **Good students** ask questions in class if they don't understand things
- Historically, the **best students** have asked the **most questions**
- If you want to become a **better student**, ask **more questions**

A Taste of Data Structures

Linked lists

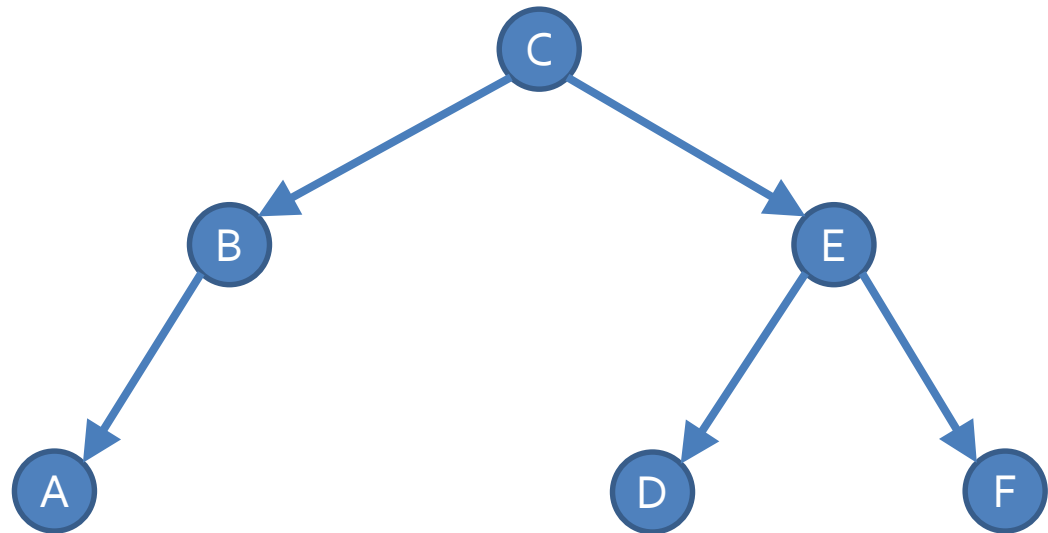
- Singly linked
- Doubly linked
- Circular
- Pros and cons?

Stacks and queues

- Stacks
 - First-in-last-out data structure
- Queues
 - First-in-first-out data structure

Trees

- Binary search trees
- Red-black trees
- Tries
- B-trees



Hash tables

- Hash functions
- Strategies for collisions

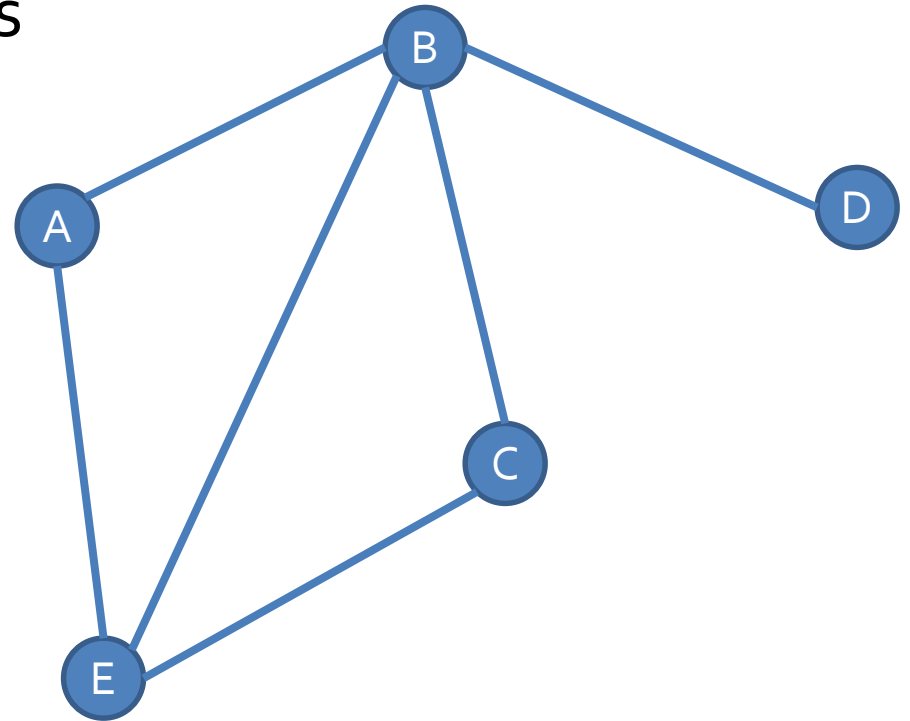
Sorting and searching

- Linear search
- Binary search

- Heap sort
- Quicksort
- Merge sort
- Counting sort
- Radix sort

Graphs

- Nodes and edges
 - Model for representing many problems
- Traversals
- Shortest paths
- Spanning trees
- Eulerian tours
- Hamiltonian tours
- NP-completeness
- Network flow



More information

- For more information, visit the webpage:
`http://faculty.otterbein.edu/wittman1/comp2100`
- The webpage will contain:
 - The most current schedule
 - Notes available for download
 - Reminders about projects and exams
 - Syllabus (you can request a printed copy if you like)
 - Detailed policies and guidelines

Projects

Four projects

- 36% of your grade will be four equally weighted projects
- Each will focus on a different major area from the course:
 - Arrays and memory management
 - Stacks and queues
 - Trees
 - Graphs
- You will work on each project in two-person teams

Teams

- All projects are done in teams of two
- You may pick your partners
 - But you have to have a different partner for each project!
 - Use Brightspace to form teams
- Projects must be uploaded to Brightspace
(<https://otterbein.brightspace.com/>)

Turning in projects

- Projects must be uploaded to Brightspace **before** the deadline
- Late projects will not be accepted
 - Exception: Each team will have 3 grace days
 - You can use these grace days together or separately as extensions for your projects
 - You must inform me **before** the deadline that you are going to use grace days
 - If two people in a team don't have the same number of grace days, the number of days they will have available will be the **maximum** of those remaining for either teammate

Assignments

Weekly assignments

- 14% of your grade will be from assignments, given roughly once every two weeks
- 4 of the assignments will be probably be written, and about 3 will be coding
- There will be 7 assignments total
- Assignments will not be due on weeks when projects are due
- Each written assignment typeset in LaTeX is worth **1% extra credit** applied to your final grade

Quizzes

Pop Quizzes

- 5% of your grade will be pop quizzes
- These quizzes will be based on material covered in the previous one or two lectures
- They will be graded leniently
- They are useful for these reasons:
 1. Informing me of your understanding
 2. Feedback to you about your understanding
 3. Easy points for you
 4. Attendance

Exams

Exams

- There will be two equally weighted in-class exams totaling 30% of your final grade
 - **Exam 1:** 09/23/2024
 - **Exam 2:** 11/11/2024
- The final exam will be worth another 15% of your grade
 - **Final:** 10:15 a.m. – 12:15 p.m.
12/13/2024

Exam format

- Conceptual portion
 - Short answer or matching questions
- Programming portion
 - Short programming problems you will write code for

Course Schedule

Tentative schedule

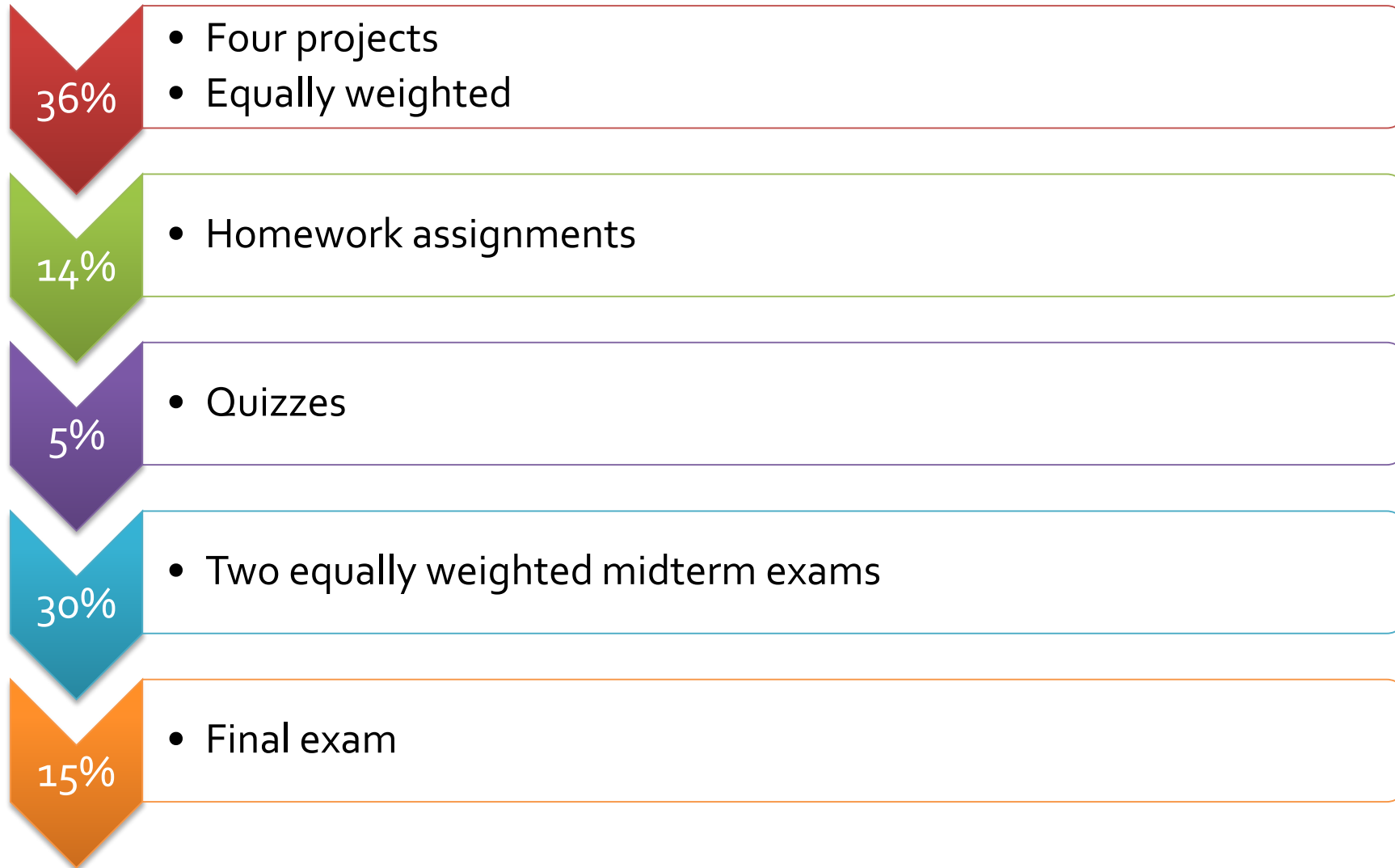
Week	Starting	Topics	Chapters	Notes
1	08/26/24	Java, OOP, and generics	Notes, 1.1	
2	09/02/24	Complexity	1.4, 1.2	Labor Day
3	09/09/24	Stacks and queues	1.3	
4	09/16/24	Linked lists	1.3	Project 1 Due
5	09/23/24	Recursion	Notes	Exam 1
6	09/30/24	Binary trees	Notes, 3.1	
7	10/07/24	Balanced binary search trees	3.2, 3.3	Project 2 Due
8	10/14/24	Hash tables	3.4	October Break
9	10/21/24	Graph Basics	4.1, 4.3	
10	10/28/24	Graph Algorithms	4.4, 6.2	
11	11/04/24	B-trees and Network Flow	6.4	Project 3 Due
12	11/11/24	Sorting	2.1, 2.2, 2.3	Exam 2
13	11/18/24	Heaps	2.4, 5.1, 5.2	
14	11/25/24	Strings	5.3	Thanksgiving
15	12/02/24	Review	All	Project 4 Due

Project schedule

- **Project 1:** **9%**
Tentatively due **09/20/2024**
- **Project 2:** **9%**
Tentatively due **10/11/2024**
- **Project 3:** **9%**
Tentatively due **11/08/2024**
- **Project 4:** **9%**
Tentatively due **12/06/2024**

Policies

Grading breakdown



36%

- Four projects
- Equally weighted

14%

- Homework assignments

5%

- Quizzes

30%

- Two equally weighted midterm exams

15%

- Final exam

Grading scale

A	93-100	B-	80-82	D+	67-69
A-	90-92	C+	77-79	D	60-66
B+	87-89	C	73-76	F	60-62
B	83-86	C-	70-72		

Attendance

- You are expected to attend class
- You are expected to have read the material we are going to cover **before** class
- Missed quizzes cannot be made up
- Exams must be made up **before** the scheduled time, for excused absences

R-E-S-P-E-C-T

- I hate having a slide like this
- I ask for respect for your classmates and for me
- You are smart enough to figure out what that means
- A few specific points:
 - Silence communication devices
 - **Don't use the computers in class unless specifically told to**
 - No food or drink in the lab

Computer usage

- We will be doing work on the computers together
- However, students are always tempted to use the Internet, etc.
- Research shows that it is nearly impossible to do two things at the same time (e.g. use Reddit and listen to a lecture)
- For your own good, I will enforce this by taking **1% of your final grade** every time I catch you using your computer for anything other than course exercises

Academic dishonesty

- Don't cheat
- **First offense:**
 - I will try to give you a zero for the assignment, then try to lower your final letter grade for the course by one full grade
- **Second offense:**
 - I will try to fail you for the course and try to kick you out of Otterbein
- Refer to the syllabus for the school's policy
- Ask me if you have questions or concerns
- **You are not allowed to look at another student's code, except for group members in group projects (and after the project is turned in)**
- **Don't use AI tools like ChatGPT to write *any* code you turn in**
- **I will use tools that automatically test code for similarity**

Disability Services

- The University has a continuing commitment to providing access and reasonable accommodations for students with disabilities, including mental health diagnoses and chronic or temporary medical conditions. Students who may need accommodations or would like referrals to explore a potential diagnosis are urged to contact Disability Services (DS) as soon as possible. DS will facilitate accommodations and assist the instructor in minimizing barriers to provide an accessible educational experience. Please contact DS at DisabilityServices@otterbein.edu. More info can also be found [here](#). Your instructor is happy to discuss accommodations privately with you as well.

Upcoming

Next time...

- I will do a refresher on:
 - Java syntax
 - Types
 - Libraries
 - Strings
 - OOP
 - Interfaces
 - Exceptions
- Read 1.1
 - Ignore stuff about the **StdIn** and **StdOut** libraries the book provides

Reminders

- Read section 1.1
- Brush up on Java