

**Course Number and Name:**

CRN = 21149 CS 48600-01 – Analysis of Algorithms (3 cr.)

**Credits and contact hours:** 3 credits; 3 contact hours (Two 75 mins weekly lectures)

Spring 2025 [January 13, 2025 – May 11, 2025]

Monday, Wednesday, 01:30 pm – 02:45 pm, **ET 115**

**Instructor or Course Coordinator:**

Peter A. Ng, Ph.D.

Office: ETCS 125L

Phone: 260-481-6237 (office), 260-481-6803

E-mail: [ngp@pfw.edu](mailto:ngp@pfw.edu)

Office hours: **MW 10:30 am – 12:00 noon. TTh 03:00 pm – 04:00 pm, or by appointment.**

(Please call me before you come to ensure I will be in my office).

**Graduate  
Teaching**

**Assistants:**

**Catalog Description:**

Techniques for analyzing the time and space requirements of algorithms and problems. Application of these techniques to sorting, searching, pattern-matching, graph problems, and other selected problems. Brief introduction to the intractable (NP-hard) problems.

**Prerequisites:** CS 26000 Data Structures and MA 16600 Analytic Geometry and Calculus II

**Type of Course:** Required

**Textbook and Reading Materials:**

**Textbooks:**

Introduction to The Design & Analysis of Algorithms, Anany Levitin, Addison Wesley 2012.

**Supplemental Materials:**

- Introduction to Algorithms (3<sup>rd</sup> Edition), T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, MIT Press, ISBN 978-0-262-03384-8, 2009, McGraw-Hill
- The Art of Computer Programming (2<sup>nd</sup> Edition) (3 volumes), Donald Knuth, Addison-Wesley.

**Course Objectives & Learning Outcomes:**

The goal of this course is to introduce students to the modern study of computer algorithms, focusing on their analysis, implementation, and applications. Upon successful completion of the course, students will be able to:

1. Develop most standard algorithms for their common applications. (1, 2, 6)
2. Analyze an algorithm's expected performance within a specific context. (1, 6)
3. Demonstrate the correctness of an algorithm, ensuring it functions as intended. (1, 6)
4. Apply mathematical techniques to evaluate an algorithm's efficiency. (1, 6)
5. Modify familiar algorithms and design new ones to address unfamiliar contexts. (1, 2, 6)
6. Utilize techniques for analyzing and designing algorithms with complexity in mind. (1, 2, 6)
7. Apply algorithmic principles and relevant mathematical techniques in program design and analysis, demonstrating an understanding of tradeoffs in design and complexity. (1, 2, 6)
8. Apply algorithmic analysis and design to develop programs with varying complexity levels. (1, 2, 6)

### Course Learning Outcomes to Student Outcomes Mapping

| Course Learning Outcome | Program's Student Outcomes |   |   |   |   |   |
|-------------------------|----------------------------|---|---|---|---|---|
|                         | 1                          | 2 | 3 | 4 | 5 | 6 |
| 1                       | •                          | • |   |   |   | • |
| 2                       | •                          |   |   |   |   | • |
| 3                       | •                          |   |   |   |   | • |
| 4                       | •                          |   |   |   |   | • |
| 5                       | •                          | • |   |   |   | • |
| 6                       | •                          | • |   |   |   | • |
| 7                       | •                          | • |   |   |   | • |
| 8                       | •                          | • |   |   |   | • |

### Major Topics Covered

- Algorithms and Design (SDF)
  - Concept and properties of algorithms,
  - Role of algorithms,
  - Problem-solving strategies,
  - Separation of behavior and implementation
- Basis Analysis (AL)
  - Asymptotic Analysis, empirical measurement.
  - Differences among an algorithm's best, average, and worst-case behaviors.
  - Complexity classes include constant, logarithmic linear, quadratic, and exponential.
  - Recurrence Relations and their solutions.
  - Time and space trade-offs in algorithms.
- Algorithmic Strategies (AL)
  - Brute force, divide-and-conquer, transformation, greedy, dynamic programming, heuristics

- Fundamental Data Structures and Algorithms (AL)
  - Binary search, Insertion sort, Selection sort, Shell sort, Quicksort, Mergesort, Heapsort.
  - Binary heaps, Binary search trees, hashing.
  - Representations of graphs and Trade-offs
  - Fundamental graph algorithms, including BFS and DFS, Shortest paths, and Minimum spanning trees.
  - Substring search and pattern matching.
- Basic Automata, Computability and Complexity (AL)
  - Finite-state machines, Regular expressions
  - Complexity classes P, NP, NP-completeness, NP-complete problems, reductions
- Advanced Data Structures, Algorithms and Analysis (AL)
  - Balanced trees (e.g., Balanced search trees, AVL trees, Red-Black Trees, B-trees)
  - Graphs (Topological sort, Strongly connected components)
  - Advanced data structures (disjoint sets, mergeable heaps) [optional]
  - Network flows
  - Linear programming
  - Polynomials and the FFT
  - Number-theoretic algorithms, including Primality testing, RSA public-key cryptosystem
  - Approximation algorithms, including TSP
  - Computational geometry, including Convex hull, Geometric search, and intersection
  - Randomized algorithms such as Rabin-Karp string matching, String sorts, Tries
  - Data compression. [optional]
- Parallel algorithms, analysis, and programming (PD) [optional]
- Formal Models and Semantics (PD) [optional]

**Knowledge Areas that contain topics and learning outcomes covered in the course**

| Knowledge Area                          | Total Hours of Coverage |
|---|-------------------------|
| Algorithms and Complexity (AL)          | 35-38                   |
| Software Development Fundamental (SDF)  | 1.5                     |
| Parallel and Distributed Computing (PD) | 0-3                     |

**Requirements for the Grade of the Course**

The grade will be determined based on the following components:

- 1) Attendance, Class Participation, and Quizzes (20%)
- 2) Homework Assignments/Project, and
- 3) Examinations

Each problem in the exams and homework assignments/projects will carry equal weight, contributing to 80% of the overall course grade. (Problems in the exams, assignments, or projects will be assigned the same point value or percentage.)

**Grading Scale for the Course**

The following grade scale will be applied: A [100-90], B (90-80), C (80-65), D (65-50), and F (50-0)]. Note that Plus-minus grading will not be used.

**Attendance and Participation (20% of overall grade)**

### **Attendance policy**

Class attendance is mandatory unless there is a valid reason to miss a class. Students are expected to attend all lecture sessions. If a class must be missed, please notify the instructor, Peter Ng, via email before the meeting.

Poor attendance may result in a reduction of your final grade, as Attendance and Participation account for 20% of the total grade. Missing 30% or more of classes without an excused absence will result in the forfeiture of all participation points from your final grade.

### **What constitutes participation?**

Participation in this class will be evaluated based on the following components:

- **Weekly Endcap Quizzes** – Quizzes may be given in class and will be graded on a participation basis.
- **Attendance** – Attendance is mandatory. Missing classes will negatively affect your participation score and, consequently, your final grade.
- **In-Class Participation** – Actively engaging through answering questions, asking questions, and contributing to discussions is encouraged. Being present and attentive in class is crucial for your success in the course.
- **Class Focus** – Bring your laptop if you have one, but avoid working on other course assignments during class. Focus on the class activities to maximize your learning experience.

### **Exams**

There are possibly three or up to six exams. If an exam is scheduled during Final Exams Week, it will be treated as a regular exam covering only the material presented since the last exam. **Make-up exams will not be offered unless prior approval has been granted or if there is a valid emergency.** If an emergency arises, contact the instructor immediately to discuss potential accommodations.

### **Assignments, Projects, and Quizzes**

Assignments must be submitted at the beginning of class on the announced due date. Quizzes must be completed in class following the given instructions.

**Late assignments or projects will not be accepted.** A 10% penalty will be applied for each day they are late, up to five days. After five days, no late submission will be accepted, and a grade of zero will be assigned.

All assignments and projects must be computer-printed; handwritten submissions will not be accepted.

The instructor reserves the right to adjust the number of assignments, projects, quizzes, exams, and weights throughout the semester.

Unannounced quizzes will be given at any time during the semester, based on material from lectures and lecture notes. No make-up quizzes will be provided, and a missed quiz will result in a grade of zero.

**Incomplete grade (for information only)**

<http://catalog.pfw.edu/content.php?catoid=49&navoid=1457#grades>

A grade of I may be granted to students (1) who are unable to complete specific course requirements for clearly unavoidable, nonacademic reasons (such as extended illness or relocation) and (2) whose work has been of passing quality up to that time. A student must have completed the majority of the required coursework (as determined by the instructor) before the instructor is permitted to assign an incomplete grade. A grade of I will not be considered an alternative to an anticipated low grade in a course.

**Course Policies****End-of-semester exam policies:**

<http://catalog.pfw.edu/content.php?catoid=49&navoid=1457#finalexaminations>

**Next-to-last week.**

No instructor may schedule an examination-comprehensive or non-comprehensive-except for laboratory and practicum courses during the week preceding the last week of a fall or spring semester.

**Final Exam Policies and Procedures.**

All classes are scheduled for a two-hour meeting during final exam week. Exams will be in the regular meeting classroom at the times specified in the schedule shown (for daytime classes) or the schedule shown (for evening classes). Weekend College final exams are on the last day of class. Each instructor may use this period for a final examination, a last, non-comprehensive examination, or a regular class meeting. No exams may be scheduled during the week prior to final exam week except in laboratory courses. Final grades are due at noon on the Monday following final exam week.

All students are governed by the following regulation regarding final examination conflict:

A student who is scheduled to take more than two examinations in one day, who has a conflict of exams, or who is scheduled to take a state, national, or professional licensing examination may contact the instructor(s) involved, prior to the last week of regularly scheduled classes, to obtain appropriate rescheduling.

Note that the link to the Spring Semester Final Exam Schedule has been updated and is now available.

You can access the schedule at the following link: <https://www.pfw.edu/registrar/employee-resources/schedule-production-resources>.

**Attendance:**

Attendance is a university requirement, and students are generally expected to attend. Attendance will be recorded and may be graded, as detailed in the participation section. Regular attendance is correlated with better performance. Students are responsible for obtaining any course-related information or materials from classes they miss.

**Communication:**

Students are encouraged to actively contribute to the class by asking questions, offering suggestions, and seeking help when needed. Suggestions for improving course delivery are welcome, as your feedback can enhance the course's content and quality. Outside the classroom, the instructor will respond to

emails and be available during office hours. **Please address any difficulties or concerns early in the semester rather than waiting until the end.**

### **Academic Honesty:**

Students are expected to do their work and write their solutions. While collaboration in troubleshooting and problem-solving is encouraged, all assignments must be completed individually. Copying or sharing your work with other students is prohibited. Students must not copy any materials from websites, open sources, and so on and then paste and present them as their work. **If caught cheating or plagiarizing, the student will receive a zero for the assignment and will automatically fail the course if caught a second time.**

### **Plagiarism/academic misconduct:**

<http://catalog.pfw.edu/content.php?catoid=49&navoid=1457#misconduct>

This includes definitions of academic misconduct and the procedures faculty must follow if such student behavior is identified.

### **Research and Reading Course-related Materials:**

Students are expected to engage in independent learning by researching and reading course-related materials.

### **Lap-Top Computer in Classes:**

Students are welcome to use laptops to take notes during class. However, if the laptop is used for activities unrelated to the course, the privilege will be revoked, and the laptop will no longer be allowed in class.

### **Tutors:**

Seek help from your instructor, Teaching Assistants, or tutors early if needed. However, do not expect them to provide solutions— their role is to guide and assist in the learning process.

### **Note to Students with Disabilities:**

If you have a disability and need assistance, special arrangements can be made to accommodate most needs. Contact the Disability Access Center at [dac@pfw.edu](mailto:dac@pfw.edu) or 260-481-6657. (Visit the center located at Walb Union, Room 113) as soon as possible to work out the details. The DAC office will provide you with a Disability Accommodation Verification Card attesting to your needs for modification that you need to bring to me. For more information, please visit the website for <https://www.pfw.edu/disabilities/>.

### **Note for Free Personal Counseling Services:**

PFW and the Department of Computer Science recognize that personal problems can sometimes interfere with a student's ability to progress in his/her academic program. To help students address such problems, PFW makes free personal counseling services

available in Walb 210. To schedule an appointment with a PFW/PARKVIEW Student Assistance Program (SAP) counselor, call 373-8060.

### **Stay Connection:**

Use PFW's Brightspace to access lecture notes, assignments, exams, and any other course-related information throughout the semester.

You can reach me via email at [ngp@pfw.edu](mailto:ngp@pfw.edu). When contacting me, whether through your PFW email account or personal email (such as Yahoo, Hotmail, or Gmail), please ensure that the subject line is specified as: **Subject: CS 48600**.

### **PFW Dates to Know**

|                 |   |
|-----------------|---|
| January 13 – 19 | Late Registration                                   |
| January 17      | Census Day & Regular Credit-to-Audit Deadline       |
| January 19      | Last Day for Full Refund                            |
| February 10     | Pass/Not Pass Deadline                              |
| February 21     | Audit-to-Credit Deadline                            |
| March 10 – 16   | Spring Break  |
| March 14        | Last Day to Request Withdrawal (Full-Term Classes)  |
| May 5 - 11      | Final Exams Week/Last Week of Classes               |
| May 5           | <b>Final Exam for CS 48600-01 1:00 pm – 3:00 pm</b> |
| May 12          | Final Grades Due at Noon                            |

Please consult the university/academic calendar for accurate information.

### **Course Evaluation**

Course evaluation is an important component of the Computer Science Department's assessment plan. Data gathered from assessment surveys helps us to evaluate and improve course content and delivery. To ensure that these data reflect the experiences of all students, your participation is required in both the Student Evaluation of Instruction and the Course Learning Outcomes Assessment surveys. These surveys are distributed online via the Purdue Qualtrics system and take 2-5 minutes to complete. Approximately two weeks before the end of the semester, you will receive a link to each survey via your PFW email account. These surveys are anonymous, and no results will be released to the instructor until after the end of the semester. The CS Department expects you to complete both surveys before the final exam date. If you have difficulty accessing a survey, you should immediately notify the instructor or the CS Department Administrative Assistance (Ms. Merri Peabody, [mrpeabod@pfw.edu](mailto:mrpeabod@pfw.edu), 260-481-6803).

### **ABET CS Program Student Outcomes**

The following learning outcomes are defined by ABET, our accrediting agency, for computer science programs. According to **ABET CS Program's Criterion 3. Student Outcomes**, graduates of the program will have the ability to:

1. Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions.

2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
3. Communicate effectively in a variety of professional contexts.
4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
6. Apply computer science theory and software development fundamentals to produce computing-based solutions. [CS]

## *Resources for to tell students about*

**Math and Science Tutoring** – help with math and science courses or math/science-related assignments in any course. Call 260-481-5740 or stop by Kettler Hall G19 if you do not find an available tutor on [TutorTrac](#).

**PFW Writing Center** - is to help writers learn to use language more effectively, produce clear writing appropriate to their purposes and audiences, and develop positive attitudes about writing and themselves as writers. Located on the Second Floor of the Library.

**Tutoring Center** – also located on the second floor of the library offering tutoring in other subjects.

**Foreign Language Lab** – located in LA 258 to help students in any foreign language course.

**Dean of Students** (<https://www.pfw.edu/offices/dean/faculty-and-staff-resources/>)  
Responsible for implementing the PFW Code of Student Rights, Responsibilities, and Conduct (<http://catalog.pfw.edu/content.php?catoid=49&navoid=1457#code>). The staff advises students about the student complaint process, grade appeals, and other concerns they may have about the university. The Dean of Students office oversees many resources for our students as part of our student wellness program: <https://www.pfw.edu/offices/dean/student-wellness/>

**Walter E. Helmke Library**

**Helmke Library** <https://library.pfw.edu>

**Ask-a-Librarian** <https://guides.library.pfw.edu/askalibrarian>

**Topic Guides to get you started on your research** <https://guides.library.pfw.edu/home>

## **Important Information for Students**

**Balancing life and school** is not always easy. At Purdue University Fort Wayne, every student matters. We are your Mastodon family, and we CARE. If you are feeling sad or depressed, have trouble sleeping, concentrating, or finishing tasks, feel anxious or fearful, or have any concerns, academic or otherwise, it can be helpful to talk with someone. Asking for help can be hard but it is an important first step.

There are several campus and community resources created to help you navigate a wide variety of challenges.

**First is the CARE team.** They help students create a plan to confront difficulties while providing support and the resources needed to keep them safe and successful. Any faculty or staff can help you get to the CARE Team. They can be found at <https://www.pfw.edu/offices/dean-of-students/about/care-team> or call the Dean of Students office at 260-481-6601 or [dos@pfw.edu](mailto:dos@pfw.edu)

**The Student Assistance Program** for counseling is staffed by The Bowen Center and is located on the second floor of Walb in the Health Center. The 24-hour Counseling Hotline is 800-342-5653. For more information, go to <https://pfw.edu/get-support>

**The PFW Police Department** is trained to respond to mental health/psychological emergencies; the Fort Wayne Police Department also has crisis intervention officers available 24/7. In case of emergency, call 911 (from a campus phone 9-911).

**Project COMPASS.** For more information or other resources, contact Project COMPASS (COMMunity Partners Against Student Suicide) at [compass@pfw.edu](mailto:compass@pfw.edu)

**COVID-19.** And for COVID-19 student-specific information: <https://www.pfw.edu/microsites/coronavirus/students/resources>

## Disability Access Center

Please read the following message from the Director of Disability Access Center, dated 1/3/2025:

### Welcome Back from the Disability Access Center (DAC)!

We hope you had a wonderful break and we look forward to collaborating with you this semester. The DAC is here to support you in creating accessible learning environments for all students. Below, you'll find essential information and resources to help you provide accommodations and ensure accessibility in your courses.

### Key Points

#### Syllabus Statement

- Ensure your course syllabus includes an updated Disability Statement.
- Direct students to this statement at the start of the semester.
- Sample statements are available on the [DAC Website](#).

#### AIM Instructor Portal

- Access your [AIM Instructor Portal](#) to manage student accommodations.
- View approved accommodations and facilitate alternative testing.
- Bookmark the portal for easy access and log in with your PFW credentials.
- Tutorials are available under the instructor tab on the DAC website for navigation guidance.

#### Course Accessibility Letters (CAL)

- Students will notify you of their accommodations through the AIM Student Portal.
- CALs will be sent to your email and can be viewed in your AIM Instructor Portal.
- Refer to the [Course Accessibility Letters Information and Procedures](#) for details.

### **DAC Testing Center**

- Use the DAC Testing Center for assistance with facilitating testing accommodations.
- Complete the Testing Instruction Form if you plan to use this resource.
- For further information, visit the [DAC Testing Center Information and Procedures](#).

### **Modified Attendance and Deadline Accommodations**

- Review the DAC's Modified Attendance and Deadline Policies when receiving a CAL.
- Utilize the Modified Attendance and Deadline Agreements to clarify how these accommodations fit with your course structure.
- These resources are available under the instructor tab on the DAC website.

### **Additional Resources**

- [Designing Accessible Courses](#)
- [Academic Resources Handout](#) for time management, note-taking, and test-taking strategies.
- [Read & Write Gold: Text-to-Speech Software](#).

For any questions or concerns, please contact us at 260-481-6657, [dac@pfw.edu](mailto:dac@pfw.edu), or visit us at Walb Student Union, Room 113. We're here to help you create accessible and inclusive learning environments.

Disability Access Center  
Purdue University Fort Wayne  
Walb Student Union, Room 113  
2101 E. Coliseum Blvd, Fort Wayne, IN 46805  
O:260-481-6657 | F: 260-481-6018 | E: [dac@pfw.edu](mailto:dac@pfw.edu)