Problem Solving and Programming CSC 5050 Syllabus, Winter 2017

Title: Algorithms and Data Structures
Credits: 4

WSU Catalog Description:
Prereq: Knowledge of C or C++ programming through arrays and pointers. You should have completed the programming class with a C grade or above.
Introduction to problem solving methods and algorithm development, data abstraction for structures such as stack, queues, linked lists, trees, and graphs, searching and sorting algorithms and their analysis.

Instructor: Brady King, Senior Research Assistant at Children’s Hospital of Michigan
Office Hours: T/Th 6:00 – 7:00
Office: 3330 Engineering
Phone: 248-217-4130
Email: bwking@wayne.edu
Course Meeting Time: T/Th 7:30 – 9:10
Course Meeting Location: STAT 0129

Course Website: We will use Blackboard (You are responsible for all announcements on the course homepage).

Goals: To introduce the students to problem solving methods and algorithm development and data abstraction that serve as the basis of complex algorithms and applications.

Learning Objectives: Upon successful completion of this course the student will be able to

- use data structures and algorithms in C++ programs
- recognize multiple methods for implementing a solution to a problem and designate one as the most efficient
- define a fundamental abstract data type and discuss its various implementations
- analyze algorithms
- implement generic data structures using templates
- implement fundamental algorithms (e.g. searching, sorting, hashing, traversal algorithms, etc.)
- use UML class diagram notation to describe the interface of classes
- apply theoretical knowledge about algorithms to solve engineering problems using a computer
**Textbooks:** There is no official textbook for this course. However, good references include the following:

- Data Abstraction and Problem Solving with C++, Frank Carrano, 2005, 6th Edition
- C++ How to Program, Harvey Deitel and Paul Deitel, 9th Edition

**Prerequisites by Topic:** Knowledge of C or C++ programming through arrays and pointers. You should have completed the programming class with a C grade or above.

**Corequisites by Topic:** None

**Topics:**

- A thorough review of C/C++ programming, including stream I/O, loops, functions, structs, arrays, pointers, and dynamic memory allocation
- Object-oriented design including encapsulation and information-hiding, separation of behavior and implementation, inheritance, operator overloading, templates, polymorphism, exception, and UML class notation
- Data abstraction using object-oriented programming techniques
- Algorithms and problem-solving: problem-solving strategies, the role of algorithms in the problem-solving process, implementation strategies for algorithms, debugging strategies, the concept and properties of algorithms
- Basic searching and sorting algorithms
  - Sorting: selection, insertion, bubble, heap, radix, quick and merge sorting techniques
  - Searching: linear search, binary search and basic searching structures
- Recursion and recursive algorithms
- Implementation of the fundamental abstract data types using pointers, arrays and templates:
  - Linear data structures such as lists, stacks, queues, and sets
  - Hierarchical data structures such as binary trees and ordered oriented (or general) trees
  - Search structures such as hash tables, binary search trees, balanced trees, priority queue implementations
  - Algorithms that make use of these data structures
- Basic algorithm analysis

**Course Structure:** The class meets for two lectures a week (T/Th 7:30 – 9:20) in STAT 0129

**Computer Resources:** Each student should have access to a computer for programming assignments

**Course Resources:** None

**Distribution of Points:**

<table>
<thead>
<tr>
<th>Exam</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Midterm Exam</td>
<td>20%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>30%</td>
</tr>
</tbody>
</table>
Programming Assignments 40%
Attendance and Participation 10%

Grading Scale:

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<tr>
<th>Percentage</th>
<th>Grade</th>
<th>Honor Point Value</th>
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<tr>
<td>90-92</td>
<td>A-</td>
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<tr>
<td>87-89</td>
<td>B+</td>
<td>3.33</td>
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<tr>
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<td>80-82</td>
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Attendance: Every student is expected to attend all lectures

Exams:

- The midterm exam will be scheduled based on the class progress and will be announced at least one week in advance
- The final exam is schedule for Wednesday April 27th during normal class time. You must let me know during the first week of classes if you have a conflict with another exam or you have exam overload.
- Do NOT assume that you will be able to take a makeup exam. Regardless of your circumstances, approval to take a makeup exam is up to the instructor.
- All exams are closed-book, closed-notes except for only one single-sided 8 ½” x 11” sheet of hand-written notes
- Calculators that store notes are not allowed
- Flagrant cheating on an exam will result in, at minimum, a failing grade for the course

Assignments:

- Assignments will be posted on the course webpage (Blackboard)
- Assignments must represent your original work. You must not look at other solutions or show your solutions to anyone else. At minimum, duplicate or very similar assignments will receive negative grades.
- Save all intermediate work until an assignment has been graded, returned, and recorded. Keep the final source version of your programs. Make frequent backups of your work. Never let anyone else use your account.
• All questions on grading must be brought to my attention within one week of the assignment's return.
• You are welcome to ask any questions with regard to the assignments after class or during office hours. You do not have to have an appointment to come to the office hours.
• You should always start working on the assignments as soon as they are announced, even if they seem to be easy to you. You may run into unexpected problems which you may not be able to solve on your own when it is too late for you to ask for help.

Late-Submission Policy:

• Late assignments will NOT be accepted. The following excuses will NOT be approved for late submissions: computer crashes, disk crashes, accidental file deletions, lab computer unavailability, forgetting to print out the checklist and/or the output, printer problems, and the like.
• You are strongly encouraged to turn in the assignments in the class before the deadline to account for any unpredictable situations. You must always work ahead and make backups to account for unexpected problems.

Cheating Policy and Penalty for Cheating: Cheating is defined by the university as “intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information, or assistance in any academic exercise.” This includes any group efforts on assignments or exams unless specifically approved by the professor for that assignment/exam. Evidence of fabrication or plagiarism, as defined by the university in its brochure Academic Integrity, will also result in downgrading for the course. Students who cheat on any assignment or during any examination will be assigned a failing grade for the course.

Outcome Coverage:

(a) **An ability to apply math, science and engineering knowledge.** The homework and exams require students to solve problems using C++ and data structures techniques.
(b) **An ability to design and conduct experiments, as well as to analyze and interpret data.** The homework and project assignments require the student to analyze, design and implement applications using C++ applications and data structures.
(c) **An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.** The design and implementation of the project must be checked against real world constraints.
(e) **An ability to identify, formulate and solve engineering problems.** Students must be able to design and develop C++ applications and predict their performance under practical limits.
(f) **An understanding of professional and ethical responsibility.** Students will learn how not to misuse or abuse their knowledge in programming.
(g) **An ability to communicate effectively.** Students are required to write documentation on their project.
The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. The course details the design of engineering solutions to meet global, economic, environmental, and societal needs.

A knowledge of contemporary issues. The students will learn about contemporary issues with C++ programs and how these issues are being addressed.

An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. Students taking the course will learn how to use software tools such as Visual Studio .NET and the UNIX operating system along with the C++ programming language to build applications.

Religious Holidays:
Because of the extraordinary variety of religious affiliations of the University student body and staff, the Academic Calendar makes no provisions for religious holidays. However, it is University policy to respect the faith and religious obligations of the individual. Students with classes or examinations that conflict with their religious observances are expected to notify their instructors well in advance so that mutually agreeable alternatives may be worked out.

Student Disabilities Services:
- If you have a documented disability that requires accommodations, you will need to register with Student Disability Services for coordination of your academic accommodations. The Student Disability Services (SDS) office is located in the Adamany Undergraduate Library. The SDS telephone number is 313-577-1851 or 313-202-4216 (Videophone use only). Once your accommodation is in place, someone can meet with you privately to discuss your special needs. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.
- Students who are registered with Student Disability Services and who are eligible for alternate testing accommodations such as extended test time and/or a distraction-reduced environment should present the required test permit to the professor at least one week in advance of the exam. Federal law requires that a student registered with SDS is entitled to the reasonable accommodations specified in the student’s accommodation letter, which might include allowing the student to take the final exam on a day different than the rest of the class.

Academic Dishonesty - Plagiarism and Cheating:
Academic misbehavior means any activity that tends to compromise the academic integrity of the institution or subvert the education process. All forms of academic misbehavior are prohibited at Wayne State University, as outlined in the Student Code of Conduct (http://www.doso.wayne.edu/student-conduct-services.html). Students who commit or assist in committing dishonest acts are subject to downgrading (to a failing grade for the test, paper, or other course-related activity in question, or for the entire course) and/or additional sanctions as described in the Student Code of Conduct.
- Cheating: Intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information or assistance in any academic exercise. Examples include: (a) copying from another student’s test paper; (b) allowing another student to copy from a test paper; (c) using unauthorized material such as a "cheat sheet" during an exam.
• **Fabrication**: Intentional and unauthorized falsification of any information or citation. Examples include: (a) citation of information not taken from the source indicated; (b) listing sources in a bibliography not used in a research paper.

• **Plagiarism**: To take and use another’s words or ideas as one’s own. Examples include: (a) failure to use appropriate referencing when using the words or ideas of other persons; (b) altering the language, paraphrasing, omitting, rearranging, or forming new combinations of words in an attempt to make the thoughts of another appear as your own.

• **Other** forms of academic misbehavior include, but are not limited to: (a) unauthorized use of resources, or any attempt to limit another student’s access to educational resources, or any attempt to alter equipment so as to lead to an incorrect answer for subsequent users; (b) enlisting the assistance of a substitute in the taking of examinations; (c) violating course rules as defined in the course syllabus or other written information provided to the student; (d) selling, buying or stealing all or part of an un-administered test or answers to the test; (e) changing or altering a grade on a test or other academic grade records.

**Course Drops and Withdrawals:**
In the first two weeks of the (full) term, students can drop this class and receive 100% tuition and course fee cancellation. After the end of the second week there is no tuition or fee cancellation. Students who wish to withdraw from the class can initiate a withdrawal request on Pipeline. You will receive a transcript notation of WP (passing), WF (failing), or WN (no graded work) at the time of withdrawal. No withdrawals can be initiated after the end of the tenth week. Students enrolled in the 10th week and beyond will receive a grade. Because withdrawing from courses may have negative academic and financial consequences, students considering course withdrawal should make sure they fully understand all the consequences before taking this step. More information on this can be found at: [http://reg.wayne.edu/pdf-policies/students.pdf](http://reg.wayne.edu/pdf-policies/students.pdf)

**Student services:**
- The Academic Success Center (1600 Undergraduate Library) assists students with content in select courses and in strengthening study skills. Visit [www.success.wayne.edu](http://www.success.wayne.edu) for schedules and information on study skills workshops, tutoring and supplemental instruction (primarily in 1000 and 2000 level courses).
- The Writing Center is located on the 2nd floor of the Undergraduate Library and provides individual tutoring consultations free of charge. Visit [http://clasweb.clas.wayne.edu/](http://clasweb.clas.wayne.edu/) writing to obtain information on tutors, appointments, and the type of help they can provide.

**Class recordings:**
Students need prior written permission from the instructor before recording any portion of this class. If permission is granted, the audio and/or video recording is to be used only for the student’s personal instructional use. Such recordings are not intended for a wider public audience, such as postings to the internet or sharing with others. Students registered with Student Disabilities Services (SDS) who wish to record class materials must present their specific accommodation to the instructor, who will subsequently comply with the request unless there is some specific reason why s/he cannot, such as discussion of confidential or protected information.