COMP 2150 CS 2: Object-Oriented Programming and Data Structures – Fall 2017
Mr. Kriangsiri (“Top”) Malasri

Contact Information:

<table>
<thead>
<tr>
<th>Office: Dunn Hall 396</th>
<th>Department Office: Dunn Hall 375</th>
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</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>Email: <a href="mailto:kmalasri@memphis.edu">kmalasri@memphis.edu</a></td>
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</tr>
</tbody>
</table>

TAs/Graders: Rong Qi, rqi@memphis.edu; Lasang Tamang, ljtamang@memphis.edu

The best way to get in touch with me is through email – I will almost always respond within 24 hours.

Office Hours:
No formal hours, but I’m usually around in the afternoon. Stop by anytime – you may want to call or set up an appointment in advance to ensure I’m there.

Lecture Meeting Times/Locations:
MW 5:30-7:25 pm FCB 131

Catalog Description:
COMP 2150 – CS 2: Object-Oriented Programming and Data Structures (4) Principles of object-oriented programming and software development; problem solving with recursion and abstract data types, including linked lists, stacks, queues, binary search trees, hash tables; basic GUIs. PREREQUISITE: MATH 1910 or MATH 1421 (or MATH 1830 for COMP minors) and COMP 1900. COREQUISITE: COMP 2700.

Student Learning Outcomes:
This course focuses on the following ABET student outcomes and performance indicators:

(b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
(Performance indicator: Demonstrate an ability to break down a problem into smaller components.)

(j) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
(Performance indicator: Demonstrate an ability to evaluate the benefits and tradeoffs of different data structures.)

Course Website:
Lecture notes, code that we write in class, assignments, and grades will be posted to the eCourseware system: https://elearn.memphis.edu

Required Text:
Y. Daniel Liang, Introduction to Java Programming and Data Structures, Comprehensive Version, Pearson, 11th ed. ISBN-13: 978-0-13-467094-2. Note that this is the same book that was used for COMP 1900. The older 10th edition is also fine.

Evaluation:

<table>
<thead>
<tr>
<th>Attendance/Participation</th>
<th>25 pts.</th>
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<tbody>
<tr>
<td>Homework</td>
<td>200 pts.</td>
</tr>
<tr>
<td>Programming Projects</td>
<td>225 pts. (3 @ 75 pts. each)</td>
</tr>
<tr>
<td>Quizzes</td>
<td>100 pts. (2 @ 50 pts. each)</td>
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<tr>
<td>Midterm Exam</td>
<td>200 pts.</td>
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<tr>
<td>Final Exam (Comprehensive)</td>
<td>300 pts.</td>
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</table>

Final grade: add up your point total and divide by 1000. Note that the highest possible percentage grade is 105% since the points add up to 1050. This gives you some built-in buffer in case your second cousin’s ex-wife’s brother-in-law has a funeral that forces you to miss an assignment, or a temporary zombie apocalypse happens to just your neighborhood, or whatever. This also means I’ll be strict about enforcing assignment deadlines. Please don’t beg me for points for late assignments.
Grading Scale:  Letter grades will be determined as follows:

- **A+**: 96-100%; **A**: 90-95%
- **B+**: 87-89%; **B**: 81-86%; **B-**: 79-80%
- **C+**: 77-78%; **C**: 71-76%; **C-**: 69-70%
- **D+**: 67-68%; **D**: 60-66%
- **F**: Below 60%

Attendance and Participation:
I will use the TopHat platform to take attendance and for short in-class participation activities. If you are taking both COMP 2150 and COMP 2700, you need to purchase the software only once. Let me know if you did not receive an email invite to create a TopHat account.

Homework and Programming Projects:
Although COMP 2150 does not have a dedicated lab time like COMP 1900, homework will be given most weeks to reinforce the concepts covered in lecture. In addition to the homework, there will be three larger programming projects throughout the semester. For both homework and programming assignments, it is **MANDATORY** that your submission successfully compiles and runs. A submission that does not compile/run will receive zero credit. Altogether, assignments make up almost half of your grade for this course. You cannot pass unless you complete them!

Late/Makeup Policy:
All assignments are expected to be completed and turned in on schedule. Due dates will be clearly indicated for each assignment. Late assignments are **NOT** accepted except in extreme circumstances. Likewise, makeup quizzes and exams will be given only under extreme circumstances. If you feel that your circumstances warrant a late work submission or a makeup quiz/exam, get in touch with me as soon as possible. Be prepared to show some kind of documented proof of your situation.

eCourseware Dropbox Policy:
All code submissions should be made through the dropbox on eCourseware unless specifically indicated otherwise. The dropbox will automatically cut off submissions precisely at the deadline. It is your responsibility to submit your work with time to spare, and to double check that your submission made it into the dropbox. “I accidentally submitted the wrong file,” “The dropbox was having technical issues at the last minute,” “I submitted the file but somehow it never made it to the dropbox,” “The dropbox wouldn’t accept my submission because it was 3 seconds late,” and similar statements are **NOT** valid excuses.

Email:
Please check your [University of Memphis email account](mailto:University of Memphis email account) at least once a day, as that is my primary means of communicating with you outside of class.

Plagiarism/Cheating Policy:
An essential part of learning any skill is getting plenty of practice with it yourself. That being said, it’s often helpful if you bounce ideas off other people. I don’t mind if you discuss general solution approaches with other students. However, the work that you hand in should always be your own. Handing in work that’s identical to another student’s except minor changes like variable names does **NOT** count as your own work.

If I determine that you have copied something directly from a book, the Internet, or some other source, you will receive a failing grade on the assignment and (at my discretion) a failing grade in the course. If I determine that you have copied another student’s assignment, this will happen to both you and the person from whom you copied. The incident may also be forwarded to the University Judicial Affairs Office for further disciplinary action. Please don’t put me in this situation.

Getting Help:
I encourage you to come talk to me if you need help! I’m very willing to sit down and try to provide hints without giving away the solution. The Computer Science Learning Center ([http://www.memphis.edu/cs/current_students/cslc.php](http://www.memphis.edu/cs/current_students/cslc.php)) in Dunn Hall 208 will also be open throughout the semester if you’d like to get help from upper-level undergraduate students.

Student Disabilities:
If you have a disability that may require assistance or accommodations, or if you have any questions related to any accommodation for testing, note taking, reading, etc., please speak with me as soon as possible. You must contact Disability Resources for Students ([http://www.memphis.edu/drs](http://www.memphis.edu/drs)) to officially request such accommodations / services.
**Tentative Course Schedule:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture Material</th>
<th>Text</th>
<th>Quizzes</th>
<th>Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/28</td>
<td>Course introduction / review of COMP 1900</td>
<td>Notes</td>
<td></td>
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<tr>
<td>8/30</td>
<td>Java API / Using the <strong>String</strong> class</td>
<td>Ch. 4</td>
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<tr>
<td>9/04</td>
<td><strong>NO CLASS – Labor Day</strong></td>
<td>Ch. 9-10</td>
<td></td>
<td>HW 1: Built-in classes (Rong)</td>
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<tr>
<td>9/06</td>
<td>Writing custom classes</td>
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<td>Quiz 1 (9/20)</td>
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<tr>
<td>9/11</td>
<td>Writing custom classes, cont’d.</td>
<td>Ch. 9-10</td>
<td></td>
<td>HW 2: Writing custom classes (Lasang) Project 1 (Lasang)</td>
</tr>
<tr>
<td>9/18</td>
<td>Inheritance</td>
<td>Ch. 11</td>
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<td>HW 3: Inheritance (Rong)</td>
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<td>9/20</td>
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<tr>
<td>9/25</td>
<td>Interfaces and polymorphism</td>
<td>Ch. 13</td>
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<td>HW 4: Polymorphism (Lasang)</td>
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<td>9/27</td>
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<tr>
<td>10/02</td>
<td>Exception handling and file I/O</td>
<td>Ch. 12</td>
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<td>HW 5: File I/O (Rong)</td>
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<tr>
<td>10/04</td>
<td>Introduction to Big-O</td>
<td>Ch. 22</td>
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<tr>
<td>10/09</td>
<td>Array lists / Review for midterm</td>
<td>Ch. 20, 24</td>
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<td>Project 2 (Rong)</td>
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<td>10/11</td>
<td><strong>MIDTERM EXAM</strong></td>
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<tr>
<td>10/16</td>
<td><strong>NO CLASS – Fall Break</strong></td>
<td>Ch. 20, 24</td>
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<tr>
<td>10/18</td>
<td>Linked lists</td>
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<tr>
<td>10/23</td>
<td>Linked lists and iterators</td>
<td>Ch. 20, 24</td>
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<td>HW 6: Array lists and linked lists (Lasang)</td>
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<tr>
<td>10/25</td>
<td>Stacks and applications</td>
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<tr>
<td>11/01</td>
<td>Recursion</td>
<td>Ch. 20, 24</td>
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<td>HW 7: Stacks and queues (Rong)</td>
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<tr>
<td>11/06</td>
<td>Recursion, cont’d.</td>
<td>Ch. 18</td>
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<td>HW 8: Recursion (Lasang)</td>
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<td>11/08</td>
<td>Introduction to GUIs</td>
<td>Notes</td>
<td>Quiz 2 (11/06)</td>
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<tr>
<td>11/13</td>
<td>Binary search trees</td>
<td>Ch. 25</td>
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<td>HW 9: BSTs (Rong) Project 3 (Lasang)</td>
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<td>11/15</td>
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<tr>
<td>11/20</td>
<td>Sets and maps</td>
<td>Ch. 21</td>
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<td>11/22</td>
<td><strong>NO CLASS – Thanksgiving</strong></td>
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<tr>
<td>11/27</td>
<td>Hash tables</td>
<td>Ch. 27</td>
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<td>HW 10: Hash tables (Rong)</td>
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<td>11/29</td>
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<tr>
<td>12/04</td>
<td>Heaps and priority queues / Review for final</td>
<td>Ch. 20, 24</td>
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<tr>
<td>12/06</td>
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**FINAL EXAM: Wednesday, Dec. 13, 5:30-7:30 pm**  
(same classroom as lecture)

**Tentative Quiz and Exam Topics:**

- Quiz 1: String manipulation, classes and objects
- Midterm Exam: Object-oriented programming concepts
- Quiz 2: Linear data structures (lists, stacks, queues)
- Final Exam: Everything!
This page summarizes what was covered in COMP 1900.

- Installing the Java Development Kit (JDK) and an IDE of your choice (I’ll be using BlueJ/Eclipse in class) onto your computer
- Structure of a basic Java program
  - Always starts with the class (program) name, followed by a `main` method that contains all the steps that you want the program to perform. You can have other methods besides `main` too, but whatever’s inside `main` is what will be executed when the program runs.
  - Standard Java conventions for `ClassNames, variableAndMethodNames, CONSTANT_NAMES`
  - Single and multi-line comments (`//`, `/* */`)
- Java expressions and how they’re evaluated
  - Order of operations in numerical expressions (parentheses, multiplication/division/modulo, addition/subtraction)
  - Order of operations in Boolean expressions (parentheses, ‘!, &&, ||)
  - Constructing Boolean expressions using `relational operators` (`<, >, <=, >=, ==, !=`)
  - Integer division and modulo
  - How expressions work when different data types are mixed (such as `int` and `double`, or `String` and anything else)
- Variables
  - Java’s `primitive data types` (`byte, short, int, long, float, double, boolean, char`) and what each can hold
  - Declaring a variable
  - Assigning a value to a variable
  - Declaring and working with constants
  - Shorthand notations for changing variable values (`+=, -=, *=, /=, %=, ++, --`)
  - Implicit and explicit casting
  - Variable scope: a variable exists and is usable only within the block where it’s declared. Examples: a variable declared within a method body exists only within that method; a variable declared within a loop exists only within that loop.
- Program input/output
  - Using a `Scanner` object to read information from the user as your program is running
  - Remember that before you can use `Scanner`, you need to 1) include the `import` statement at the top of your program, and 2) create a `Scanner` object within the method where you want to read information
  - Displaying stuff on the screen using `System.out.println` and its variants
- Conditionals
  - `if`: execute a segment of code if a condition is true
  - `if-else`: execute one of two possible branches depending on whether a condition is true
  - `if-else if`: execute one of multiple possible branches depending on a set of conditions. At most one branch can execute. An optional `else` may be added to the end to provide code to execute if none of the provided conditions are true.
  - `switch`: allows you to test the value of an expression and execute code based on different case values. Case values must be integers. Remember that more than one case may execute if you don't have a `break` statement. An optional `default` case may be added to the end to provide code to execute if none of the provided cases apply.
- Loops
  - `while`: repeatedly execute a segment of code as long as the provided condition is true. Condition is checked at the beginning of the loop, so the body of a `while` loop may not execute at all if the condition is initially false.
  - `do-while`: repeatedly execute a segment of code as long as the provided condition is true. Condition is checked at the end of the loop, so the body of a `do-while` loop is guaranteed to execute at least once.
  - `for`: consists of initialization, termination, and increment parts. Remember that this is really just a concise way of writing a `while` loop – you can rewrite one type as the other very easily! You usually use `for` loops when working with arrays, and in other situations where you know exactly how many iterations the loop needs to go through.
  - Infinite loops
- Methods – a `method` is a block of code that performs some specific task. Useful for organizing a complex program into more manageable “chunks.” Once you define a method, you can use (a.k.a. `call, invoke`) it as many times as you want!
  - Terminology: `parameters/arguments` (method inputs), `return value` (method output)
  - Parameter passing: Java uses `pass-by-value`. Basically this means that the parameters specified in the method header (`formal parameters`) and the actual values you use when you call the method (`arguments or actual parameters`) are stored in two different memory locations. When you call a method, the values of the actual parameters are `copied` over to the formal parameters, and the method performs its actions using the formal parameters. Hence, the actual parameters themselves can never be altered by a method!
  - Using built-in `Math` methods such as `Math.random, Math.sqrt, Math.pow`
  - Writing and calling your own methods to perform specific actions
  - Method overloading – defining two or more methods with the same name. The methods MUST differ in the number and/or type of parameters. (Why can’t they differ only in return type?)
Recursive methods – these are methods that call themselves. Get evaluated by means of your computer’s call stack. Simple problems that lend themselves well to recursive solutions: computing the factorial of a number, computing powers, finding Fibonacci numbers.

- Arrays – an array is just a collection of data of the same type. Each element in an array is associated with a numerical index. Indices start counting from 0 and go up to 1 less than the total number of elements in the array. In other words, an array of length $n$ has indices from 0 to $n - 1$, inclusive.
  - Declaring and instantiating an array
  - Using .length to get an array’s length (number of elements)
  - Remember that array variables are references, which are fundamentally different from primitive variables. Primitive variables store information directly. References store memory addresses where information is kept (you can think of this as “pointing to” a memory address). For you C/C++ folks – a Java reference is more or less the same idea as a C/C++ pointer.
    - Using = and == with array variables – what do they mean?
  - Doing things to individual array elements – this usually involves a loop that performs the same action(s) at each array index
  - How arrays work with methods – arrays as parameters, arrays as return values. Remember that what gets passed to/from methods are actually references to the arrays and not the array elements themselves.
  - Working with 2-D arrays – these are really just arrays of arrays (or more precisely, arrays of references to arrays)
  - Basic array algorithms: linear search, binary search, insertion sort

- Fundamentals of object-oriented programming (OOP)
  - In OOP, software is developed as a collection of software objects that interact with one another, as opposed to a single step-by-step sequence of instructions
  - Every object is created from a description called a class. A single class can be used to create as many objects as desired. Objects created from a class are known as instances of that class, and creating an object from a class is known as instantiating the class.
  - A class consists of attributes (a.k.a. instance variables), which are characteristics or qualities of the object, and methods, which are actions or behaviors. Different objects created from the same class can (and often do) have different values for their instance variables, but they all share access to the same methods.
  - Syntax for creating an instance of a class, and calling methods using that instance (think about how you use the Scanner class)