

Mathematics 2170 : Computer Science I

Topics for Exam 3

General comments

The exam will be **comprehensive**. You are responsible for all assigned reading and topics covered in lecture, slides, and labs for weeks 1 through 13. The topics for our third exam are taken primarily from Chapters 6 and 8, although it is impossible to have an exam exclusively on the most recent topics, since this class builds on prior knowledge and skills. However, to the extent possible, the **emphasis** will be on material covered since the last exam.

The format will be similar to the first two exams. Many questions will be short-answer that ask about concepts, require understanding of brief snippets of Java code, or ask you to supply Java statements to solve some portion of a problem. Other problems will require a larger amount of Java code, such as providing a complete method or class.

Important textbook material

- Conceptual understanding of pseudo-random number generators
- Section 6.1: Creating and using a `RandomGenerator` class object, the random seed
- Section 6.3: Defining your own classes
 - Structure of a `class` definition
 - Visibility: `public` versus `private`
 - Encapsulation: combining data values
- Section 6.4: the `Student` class, Section 6.5: the `Rational` class
- Section 6.6: the `FilledRect` class
 - The idea of inheritance
 - The use of the keywords `extends`, `super`, and `this`
- The `GSquare`, `GSmartSquare`, and `GMovingSquare` classes
- The `GCircle`, `GSmartCircle`, `GMovingCircle`, and `GParticle` classes
- The `Temperature` and `ArrayList` classes
- Defining, implementing and using derived classes
- Constructors
- Implementing and using member functions and member data
- Implementing class methods
- Method header, arguments, reference vs value parameters (class objects are references vs primitive data types which are copied and thus are called value parameters)
- Section 8.1: The underlying representations of all data are integers (bits)
- Section 8.2: Characters
 - The data type `char`
 - The concept of character codes (e.g., Unicode)
 - Using the single quote to specify character constants — e.g., `'A'`
 - Use of escape sequences, such as `\n` and `\"`
 - Character arithmetic
 - Static methods of the `Character` class
 - Control statements involving characters

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- Section 8.3: Strings as an abstract idea: finite sequences
- Section 8.4: Various methods in the `String` class — all of which produce new strings and do not change the original string
 - Selecting characters from a string with `charAt()`
 - String concatenation with `+` and `+=`
 - Substrings with the `substring()` method
 - Comparing strings with the `equals()` and `equalsIgnoreCase()` methods
 - Searching within a string with the `indexOf()` method
 - Case conversion with `toUpperCase()` and `toLowerCase()`
- The valid range of `String` indices
- The two string idioms presented in lecture — processing a `String` object one character at a time, and creating a `String` object one character at a time.

Lab Exercises

- Lab 8: Bullseye using `createFilledCircle()`, finding primes, numerical palindrome, the Julia Set
- Lab 9: Chaos game, Calculating Pi (tossing darts), Sine and Cosine Graphs
- Lab 10: Squares, circles, sparks, emitter, pool game, fireworks
- Lab 11: Extra credit
- Lab 12: String palindromes, Temperature class
- Lab 13: `ArrayListStats`, `TemperatureStats` (`ArrayList`)

Allowed materials

You will be allowed to use a single page of notes and the following summaries provided for your use during the exam:

- Table of `Color` names (page 43)
- Summary of selected methods from `acm.graphics` (page 45)
- Summary of selected methods from the `Math` class (page 137)
- Summary of selected methods from the `RandomGenerator` class (page 180)
- Summary of selected `static` methods from the `Character` class (page 262)
- Summary of selected methods from the `String` class (page 266)