COMPUTER SCIENCE COMPETITION - JAVA TOPIC LIST 2014-2015

IMPORTANT NOTES: Java is the official programming language for UIL Computer Science. Contest content for 2014-2015 will conform to the Java Platform Standard Edition, Version 7 *(not version 8)*. This list is intended as a guideline and is not all-inclusive. Knowledge of basic Java concepts is assumed. Visit the UIL web site at uiltexas.org/academics/computer-science for a list of Java resources and other important contest information.

Base Conversions and Arithmetic
User-Defined Classes (constructors, methods, instance variables, private vs. public, overloading, overriding, `final` local variables, `static final` class variables, `static` methods, `static` non-`final` variables)
Constructors and initialization of static variables, default initialization of instance variables
Concepts of inheritance, abstract classes, interfaces and polymorphism
`null, this, super, super.method(args), super(args), this.var, this.method(args), this(args), instanceof`
Conversion to supertypes and (`Subtype`) casts
Comparison of reference types (`equals(), ==, !=, Comparable.compareTo()`)
Primitive types (`int, double, boolean, short, long, byte, char, float`), casting of primitives
Arrays, including arrays of arrays and initialization of named arrays
Arithmetic operators (`+, -, *, /, %, ++, --`) and string concatenation
Using the values of `++, --` expressions in other expressions
Assignment operators (`=, +=, -=, *=, /=, %=`)
Boolean expressions and operators (`==, !=, <, <=, >, >=, &&, ||, !, &, |, ^`) including short-circuit evaluation
Bitwise operators (`<<, >>, &, ~, |, ^, >>=, <<=, !=, &=, |=, ^=`)
Branching (`if, if/else, ?:, switch, break`)
Looping (`while, for,` enhanced `for, return, do/while, break, continue`)
`System.out.print(),println(),printf(), %f, %d, %s, escape sequences \n, \\, \"`
Parsing (`String.split(), Integer.parseInt(), Double.parseDouble()`)
Pattern class, Regex (`. + * \d \D \s \S \w \W [abc] [^abc] [a-zA-Z]`) , matches
Java Standard Library (`String, Integer, Double, Character, Math, Object, Comparable, Scanner, Random, Arrays`) See supplemental class reference list.
Generic collections (`Collection, List, Set, Map, Stack, Queue, PriorityQueue, ArrayList, LinkedList, HashSet, TreeSet, HashMap, TreeMap`) See supplemental class reference list.
`Arrays.sort()` and `Collections.sort()`
Recursion
Stacks, Queues, Binary Trees, Linked Lists, Heaps, Hash Tables, Priority Queues, Graphs
Sorts (Selection, Insertion, Mergesort, Quicksort) and Searches (Sequential, Binary) – same canonicals as AP
Analysis of algorithms: informal comparison of running times, exact calculation of statement execution counts, Big-O notation, best case / worst case / average case time and space analysis
Digital Electronics – symbolic representation of Boolean expressions using logic gates NOT, AND, XOR, OR, NAND, NOR, NXOR
Two's complement binary representation of negative 8-bit integers – conversion both ways between base 10 and base 2
Polish notation – representation, analysis, and conversion of simple infix, prefix, and postfix expressions
Boolean simplification using generic notation (A*B, A+B, A⊕B, $\overline{A}$, $\overline{A * B}$, $\overline{A + B}$, $\overline{A \oplus B}$ – using truth tables and Boolean Identities to analyze and simplify Boolean expressions (see list of identities on UIL CS website)

UIL Computer Science Topic List 2014-2015

Written Test First 15 Questions

1. **Number base concepts**, arithmetic, conversion
2. **Simple literal math expression** with mixed operations
3. **Simple output** involving print, println, printf (%d, %f, %s, \", \\, \n)
4. **String class methods**
5. **Simple Boolean logic** (AND, OR, XOR, NOT) - Java based
6. **Math class methods** (no advanced topics like trig - save that for later in the test)
7. **Simple variable expression** with mixed operations
8. **Conditionals** (if, if/else, switch - not ternary)
9. **Simple output loop**
10. **1D primitive array**, basic concepts
11. **Input concepts –** use of Scanner and File classes
12. **Accumulation loop** – summation, product accumulation, etc.
13. **Order of operations** (beyond just the math expressions - testing knowledge of the full Java spectrum of order of precedence)
14. **Java specific data type concepts**, memory size, max and min limits, wrap around, complements (~)
15. **ArrayList –** generics only

Topics for last 5 written test questions (40 question test)

(three multiple choice, two free response, one discrete answer each)

- **Boolean algebra concepts** – truth table analysis, use of Boolean identities for simplifying expressions.
- **Digital Electronics** - interpretation of symbols, sketching DE circuits from expressions
- **Polish notation -** representation, analysis, and conversion of simple infix, prefix, and postfix expressions
- **2s complement binary negative representation** (limit 8 bits)
- **Graph theory** - simple paths, cycles, analysis
- **Data structure theory** - stacks, queues, priority queues, binary trees (heaps, search, expression, generic)