AP Computer Science A

Revision Sheet · 考前速记

Learn these by heart before the exam. 考试前把这些内容背熟。

Primitives, objects, and operators

Primitives: int, double, boolean, char. Everything else is a reference type (String, arrays, ArrayList, your own classes).

`int / int` ⇒ `int` 7/2 is 3, not 3.5. Cast first: (*double*) 7/2 gives 3.5 整数除法

`%` $x\%2 == 0$ tests even; $x\%10$ takes the last digit; $x/10$ removes it 取余

Operator precedence: unary, then $*$ */* *%, then* $+$ $-$*, then relational, then &&, then ||, then assignment.*

Compare objects with .equals(), NEVER with ==. On Strings == compares references and silently fails.

Integer overflow wraps around. Division by zero throws for int but gives Infinity for double.

Selection and Iteration

Short-circuit: a&&b skips b if a is false. Use it to guard: if (arr != null && arr.length > 0).

De Morgan: !(a && b) equals !a || !b; !(a || b) equals !a && !b.

for (int i = 0; i < n; i++) runs n times. Off-by-one is the commonest exam error: check the first and last iteration by hand.

Enhanced for (for (int x : arr)) reads only. You cannot use it to WRITE into the array.

while runs zero or more times; do-while runs at least once.

$O(n^2)$ a loop inside a loop over the same n; state this when asked to count statements 嵌套循环

Class Creation

Encapsulation: private fields, public methods. Accessor (getter) returns; mutator (setter) changes.

Constructor has the class name and NO return type. this.field = field disambiguates a shadowed parameter.

Static belongs to the CLASS (one copy, shared); instance belongs to the OBJECT. A static method cannot touch instance fields.

Inheritance: extends. super() calls the parent constructor and MUST be the first statement.

Overriding replaces a parent method with the same signature. Overloading is the same name with DIFFERENT parameters.

Polymorphism: the declared type decides what compiles; the ACTUAL object decides which override runs at runtime.

toString() is called automatically by System.out.println. Override equals() to compare by value.

Data Collections

`arr.length` vs `str.length()` vs `list.size()` array is a FIELD (no brackets), String is a method, ArrayList uses size(). A classic trap 三种长度写法

Array is fixed length; ArrayList grows. ArrayList holds objects only, so use Integer, not int (autoboxing does it for you).

ArrayList: add(x), add(i,x), get(i), set(i,x), remove(i), size(). remove SHIFTS everything left.

Removing while looping forward SKIPS elements. Loop BACKWARDS, or do not increment after a removal.

2-D array: arr[row][col]. arr.length is the number of ROWS; arr[0].length the number of columns.

String: substring(a,b) excludes b; indexOf returns -1 if absent; compareTo is negative/zero/positive. Strings are IMMUTABLE.

Traversals: sequential search is $O(n)$*; binary search is* $O(\log n)$ *but needs a SORTED array.*

Selection and insertion sort are $O(n^2)$*; merge sort is* $O(n \log n)$ *and recursive.*

Recursion

Every recursion needs a BASE CASE and progress toward it. Without a base case: StackOverflowError.

Trace by hand: write each call and its return value on a separate line, then unwind from the base case.

$T(n) = T(n-1) + O(1)$ merge sort splits in half each time, hence $O(n \log n)$ 线性递归

Common exceptions

NullPointerException: calling a method on null. ArrayIndexOutOfBounds: index < 0 *or* $\geq$ *length.*

StringIndexOutOfBounds from substring with bad bounds. ArithmeticException from integer division by zero.

ClassCastException from casting to the wrong type. Check with instanceof first.

Exam technique

Free-response: write real, compilable Java. No pseudocode, no comments instead of code. Use the exact method names given.

You may call methods from earlier parts even if you did not write them. Assume they work.

Do not change the given signature and do not add parameters. Read the preconditions: they tell you what you need not check.

Trace questions: keep a running table of every variable. Guessing the output loses more marks than slow tracing.

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