AP Computer Science Principles

Revision Sheet · 考前速记

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

Creative Development

Development is iterative: investigate, design, prototype, test, refine. Collaboration widens perspective and reduces bias.

Program: purpose, inputs, outputs, and the behaviour between them. Say all four when you describe one.

Error types: syntax (will not run), runtime (crashes), logic (runs but is wrong), overflow (number too large).

Debug by testing with a range of inputs, hand-tracing, and adding display statements. Test the BOUNDARIES.

Data

n bits $\Rightarrow 2^n$ values 1 byte = 8 bits = 256 values; this powers most multiple-choice data questions

n 位可表示的数量

Binary to decimal: sum the place values $(128, 64, 32, 16, 8, 4, 2, 1)$.

Analog is continuous; digital is discrete. Sampling converts analog to digital: a higher sampling rate is a closer approximation.

Lossless compression restores the original exactly (PNG, ZIP). Lossy discards data permanently for a smaller file (JPEG, MP3).

Overflow: too big for the bits. Round-off: a real number cannot be stored exactly.

Metadata is data about data. Data can be filtered, cleaned and combined to reveal patterns, but correlation is not causation.

Bias in data comes from HOW it was collected. More data does not remove bias.

Algorithms and Programming

Three constructs are enough for any algorithm: sequencing, selection, iteration.

Variables, lists, and procedures. A procedure with parameters and a return value is the unit of abstraction.

Procedural abstraction 过程抽象: name a block of code and use it without knowing the inside; it manages complexity and enables reuse

Boolean: AND needs both, OR needs one, NOT flips. De Morgan: NOT(a AND b) equals NOT a OR NOT b.

List traversal visits every element. Off-by-one and empty lists are the classic bugs.

Linear search checks each item; binary search halves a SORTED list each step and is far faster.

Reasonable time means polynomial (n, n^2). Unreasonable means exponential or factorial (2^n, $n!$).

A heuristic gives a good-enough answer when the exact one is too slow. Undecidable problems have no algorithm for all inputs.

Sequential runs one step at a time; parallel runs at once; distributed spreads across machines. Speedup = sequential time / parallel time.

Simulations are cheap, safe and repeatable, but they simplify reality and inherit their designer's assumptions.

Computer Systems and Networks

The internet is a network of networks using open PROTOCOLS. Packets are routed independently and reassembled at the destination.

IP addresses and route; TCP guarantees delivery and order; UDP is faster but unreliable. HTTP carries the web; DNS maps names to IPs.

Fault tolerance 容错: redundant paths mean the network keeps working when a route fails; that redundancy is why the internet is robust

Bandwidth is bits per second; latency is delay. Scalability is coping with growth.

Impact of Computing

Digital divide 数字鸿沟: unequal access to computing by income, geography or demographics; it both reflects and widens existing inequality

Computing bias can be built in by the designers or learned from biased data. Both are the developer's responsibility.

Crowdsourcing and citizen science gather effort at scale. Open source and Creative Commons license reuse.

PII is personally identifiable information. Protect with strong passwords, multi-factor authentication, and encryption.

Symmetric encryption uses ONE key; public-key uses a public key to encrypt and a private key to decrypt.

Threats: phishing (deception), keylogging, malware, rogue access points. Most attacks target the PERSON, not the machine.

Create Performance Task

Your program must show: input, a list (or collection) used meaningfully, a STUDENT-DEVELOPED procedure with a parameter that affects the result, selection AND iteration inside it, plus output.

The procedure must be yours and must actually be called. A parameter that changes nothing scores zero.

Written response: explain the purpose, describe how the list manages complexity, and give TWO calls with different arguments and their different results.

Exam technique

Multiple choice: eliminate the two obviously wrong answers first, then check the boundary case.

Reading code: trace with a variable table. For a list, write the index next to each value.

Use the vocabulary by name (abstraction, redundancy, heuristic, lossy). The term IS the mark.