NCO-Style · Original Practice Content

Class 10 | Cyber Olympiad

40 Questions · With Answer Key
Syllabax Olympiad Series
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Instructions: Each question has one correct answer. Choose the best option (A/B/C/D). Answer key is provided at the end. This paper is for practice only — not an official exam paper. Recommended time: **45 minutes**.

Q1. What does the 'no free lunch theorem' state in machine learning?

A. all algorithms perform equally poorly on all problems

B. no single algorithm outperforms all others across all problems — there is no universally superior learning algorithm

C. deep learning always outperforms shallow learning

D. ensemble methods are always optimal

Q2. What is 'isochronous execution' in real-time systems?

A. executing tasks at varying speeds

B. executing tasks at precisely timed, regular intervals with bounded latency

C. scheduling tasks based on priority only

D. parallel execution with synchronisation barriers

Q3. In type theory, what is the 'Calculus of Constructions' (CoC)?

A. a type system for object-oriented languages

B. a higher-order typed lambda calculus serving as the basis for proof assistants like Coq

C. a calculus for computing object sizes

D. a type system for hardware description

Q4. What is 'algebraic effects' in programming language theory?

A. algebraic operations on numeric types

B. a structured way to represent and handle computational effects (e.g. I/O, exceptions) as first-class values, enabling modular effect handling

C. side effects in algebraic data types

D. function composition with monadic effects only

Q5. What is 'separating conjunction' * in separation logic used for?

A. separating logical clauses with 'and'

B. asserting that two predicates hold for disjoint portions of the heap simultaneously

C. separating program statements

D. a type of pointer arithmetic

Q6. In distributed systems, the 'FLP impossibility result' states:

A. distributed consensus is always achievable with 3+ nodes

B. in an asynchronous distributed system with even one faulty process, deterministic consensus is impossible

C. network partitions can always be resolved

D. Byzantine failures are impossible in practice

Q7. What is 'semantic versioning' (semver)?

A. versioning software by date

B. versioning using MAJOR.MINOR.PATCH — MAJOR for breaking changes, MINOR for backward-compatible features, PATCH for fixes

C. versioning by the number of commits

D. versioning based on feature count

Q8. What is 'information-theoretic security'?

A. security based on computational hardness assumptions

B. security that cannot be broken even with unlimited computational power, because there is not enough information

C. security using information theory metrics

D. security through obscurity

Q9. What is 'NUMA-aware scheduling' in operating systems?

A. scheduling tasks alphabetically

B. scheduling tasks to prefer CPUs close to their memory, reducing latency on NUMA architectures

C. scheduling by CPU priority only

D. avoiding NUMA nodes for performance

Q10. In Haskell, what is the 'State monad'?

A. a monad for I/O operations

B. a monad that threads an implicit mutable state through computations in a purely functional way

C. a monad for error handling

D. a monad for list operations

Q11. What is 'abstract interpretation' at its core?

A. interpreting programs without running them

B. a theory of sound approximation of program semantics using Galois connections between concrete and abstract domains

C. analysing source code structure

D. profiling program memory

Q12. In machine learning, 'normalising flows' are used for:

A. normalising input data only

B. learning complex distributions by applying a sequence of invertible transformations to a simple base distribution

C. flow-based network routing optimisation

D. optimising gradient flow in deep networks

Q13. What is 'Kruskal's algorithm' used for?

A. shortest path in a directed graph

B. finding the minimum spanning tree of a graph by sorting edges by weight and adding them greedily

C. topological sorting

D. maximum flow in a network

Q14. In operating systems, what is 'seL4'?

A. a Linux kernel variant

B. a formally verified microkernel with mathematical proofs of correctness and security

C. a real-time OS for embedded systems

D. a container runtime

Q15. What is 'symbolic regression'?

A. regression using symbolic variables

B. regression using symbolic computation libraries

C. automatically discovering mathematical expressions that best fit data

D. linear regression with symbolic coefficients

Q16. In Python, what is 'PyPy'?

A. a subset of Python syntax

B. an alternative Python implementation using JIT compilation for significantly faster execution than CPython

C. a package manager for Python

D. a Python testing framework

Q17. What is 'non-interference' in computer security?

A. a network protocol avoiding packet collisions

B. a security property stating that high-security inputs cannot affect low-security outputs (preventing information leakage)

C. preventing interrupts in real-time systems

D. ensuring programs do not affect each other's execution time

Q18. What is 'coherence protocol' in multi-core CPUs?

A. a protocol ensuring instructions execute in order

B. a protocol ensuring all CPU cores see a consistent view of shared memory by managing cache line states (e.g. MESI)

C. a protocol synchronising CPU clocks

D. a protocol for inter-core communication

Q19. What is 'quantum supremacy' (or quantum advantage)?

A. quantum computers being faster at all tasks

B. the demonstration that a quantum computer can solve a specific problem faster than any classical computer

C. quantum encryption being unbreakable

D. quantum computers replacing classical computers

Q20. In compilers, what is 'loop unrolling'?

A. converting a recursive function to a loop

B. replicating the loop body multiple times per iteration to reduce loop control overhead and enable more optimisations

C. removing unnecessary loops

D. parallelising loops automatically

Q21. What is 'session types' in type theory?

A. types for user session tokens

B. a type discipline for communication protocols, statically verifying that all parties follow the correct sequence of sends and receives

C. types for HTTP session data

D. a type system for transaction isolation

Q22. In deep learning, what is the 'lottery ticket hypothesis'?

A. training success depends on initialisation luck

B. large networks contain small subnetworks (winning tickets) that, when trained from initialisation, match the full network's performance

C. random neurons are the most useful

D. smaller networks always generalise better

Q23. What is 'Hindley-Milner type inference'?

A. a runtime type checking system

B. an algorithm that automatically infers the most general type of an expression without explicit type annotations

C. a type system requiring all types to be explicitly declared

D. a type system for object-oriented languages

Q24. In security, what is 'transient execution attack'?

A. an attack during transient network conditions

B. an attack exploiting CPU speculative/out-of-order execution to leak data via side channels (e.g. Spectre, Meltdown)

C. an attack exploiting transient memory access patterns

D. a timing attack on SSL handshakes

Q25. What is 'coinduction' in programming language theory?

A. a method for proving properties of finite data structures

B. a principle for reasoning about infinite data structures and processes (e.g. streams, bisimulation)

C. a type of loop invariant

D. induction applied to concurrent programs

Q26. In high-performance computing, what is 'strong scaling' vs 'weak scaling'?

A. strong: problem size stays fixed while adding processors; weak: problem size and processors grow together

B. strong: performance improves with more data; weak: performance stays constant

C. strong: single-node performance; weak: multi-node performance

D. they are identical concepts

Q27. What is 'self-supervised learning' in machine learning?

A. a model that supervises itself using reinforcement

B. learning representations from unlabelled data by constructing supervised signals from the data itself (e.g. masking tokens)

C. unsupervised clustering

D. a student model supervising a teacher model

Q28. In Python, what does 'sys.setrecursionlimit' do, and what is the default?

A. sets the maximum list size; default 1000

B. sets the maximum call stack depth; default 1000

C. sets the GIL timeout; default 1000 ms

D. sets the memory limit; default 1000 MB

Q29. What is 'oblivious computation' in secure computing?

A. computation without knowing the algorithm

B. computation where the access pattern does not depend on the data, preventing side-channel leakage

C. computation in an encrypted cloud

D. computation with no output

Q30. In computer graphics, what is 'signed distance field' (SDF) font rendering?

A. rendering fonts with distance from pixels

B. representing glyph shapes as signed distance functions enabling high-quality rendering at any scale from a low-resolution texture

C. a physics-based font rendering method

D. a vector font format

Q31. What is 'hyperthreading' (SMT) in Intel CPUs?

A. running two different programs on two physical cores

B. a technique allowing one physical core to appear as two logical processors by sharing execution resources

C. overclocking a CPU to double speed

D. a type of branch prediction

Q32. In security, what is 'control flow integrity' (CFI)?

A. ensuring programs never crash

B. a security mechanism ensuring that program execution follows only valid control flow paths, preventing code-reuse attacks

C. encrypting function pointers

D. a type of stack canary

Q33. In probabilistic programming, 'inference' refers to:

A. making deterministic predictions

B. computing the posterior distribution over latent variables given observed data

C. compiling probabilistic code to deterministic code

D. sampling from a prior distribution

Q34. What is 'unikernel'?

A. a Linux kernel running in user space

B. a specialised, minimal OS library kernel compiled directly with the application for a single purpose, deployable as a VM

C. a kernel with exactly one process

D. a single-core operating system

Q35. In quantum computing, 'quantum teleportation' transfers:

A. physical particles instantaneously

B. quantum state from one qubit to another using entanglement and classical communication

C. data faster than light

D. qubits through optical fibre

Q36. What is 'differential dataflow' in distributed computing?

A. computing differences between database versions

B. an incremental computation model processing only changes to inputs efficiently

C. differentiating continuous data streams

D. a consensus protocol for streaming data

Q37. In Python, the 'descriptor protocol' defines:

A. how Python loads modules

B. how attribute access, assignment, and deletion are customised via __get__, __set__, __delete__

C. how class inheritance is resolved

D. how metaclasses create classes

Q38. What is 'Byzantine Generals Problem' and its relevance to distributed systems?

A. a military strategy problem unrelated to computing

B. a thought experiment illustrating the challenge of reaching consensus in a distributed system where some nodes may send conflicting messages

C. a problem about network routing

D. a load-balancing challenge

Q39. In deep learning, 'residual connections' (ResNet) help by:

A. reducing the number of parameters

B. allowing gradients to flow directly through skip connections, enabling training of very deep networks

C. adding noise to prevent overfitting

D. sharing weights across layers

Q40. What is 'proof-carrying code' (PCC)?

A. code that documents its own proofs in comments

B. a technique where code is accompanied by a formal proof of its properties (e.g. safety), verified by the recipient before execution

C. code that generates proofs at runtime

D. automated theorem proving embedded in a compiler

Answer Key

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Q1: B    Q2: B    Q3: B    Q4: B    Q5: B    Q6: B    Q7: B    Q8: B    Q9: B    Q10: B
Q11: B   Q12: B   Q13: B   Q14: B   Q15: C   Q16: B   Q17: B   Q18: B   Q19: B
Q20: B   Q21: B   Q22: B   Q23: B   Q24: B   Q25: B   Q26: A   Q27: B   Q28: B
Q29: B   Q30: B   Q31: B   Q32: B   Q33: B   Q34: B   Q35: B   Q36: B   Q37: B
Q38: B   Q39: B   Q40: B
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