NCO-Style · Original Practice Content

Class 7 | 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 is the 'Church-Turing thesis'?

A. any algorithm can be implemented in any programming language

B. any effectively calculable function can be computed by a Turing machine

C. all problems can be solved in polynomial time

D. neural networks can compute any function

Q2. In Python, what is 'metaclass'?

A. a class that inherits from multiple parents

B. a class whose instances are classes themselves — it controls class creation

C. a class decorator

D. a class with no instance variables

Q3. The NP-complete problem 3-SAT asks whether a Boolean formula in 3-CNF is:

A. always satisfiable

B. satisfiable (there exists a truth assignment making the formula true)

C. equivalent to another formula

D. minimisable

Q4. In compilers, 'SSA form' (Static Single Assignment) ensures:

A. each variable is assigned exactly once

B. each function is called once

C. all loops are unrolled

D. memory is statically allocated

Q5. What is 'software transactional memory' (STM)?

A. a method for storing software in RAM

B. a concurrency control mechanism using transactions for memory operations, avoiding explicit locks

C. a type of virtual memory

D. a cache invalidation protocol

Q6. In type theory, 'parametric polymorphism' allows:

A. functions to behave differently for each type at runtime

B. a single function to operate on values of any type uniformly, without type-specific code

C. classes to inherit from multiple typed parents

D. dynamic typing at compile time

Q7. What is the 'Nyquist-Shannon sampling theorem'?

A. a signal must be sampled at exactly twice the highest frequency to reconstruct it perfectly

B. a signal must be sampled at least twice the highest frequency (at Nyquist rate) to reconstruct it without aliasing

C. any sampling rate is sufficient for digital signals

D. sampling at half the frequency is sufficient

Q8. In distributed systems, 'vector clocks' are used to:

A. synchronise physical clocks

B. capture causal relationships and partial ordering of events without a global clock

C. measure network latency

D. encrypt messages

Q9. What is 'JIT compilation'?

A. compiling code ahead of time into native machine code

B. compiling code at program startup only

C. compiling frequently executed code segments at runtime for performance

D. interpreting code without compilation

Q10. In formal verification, 'model checking' verifies:

A. whether a source code is well-formatted

B. whether a system model satisfies a given specification (e.g. temporal logic formula)

C. whether a model matches training data

D. whether a network protocol is efficient

Q11. What is 'dependent typing' in programming language theory?

A. types that depend on other types

B. types that depend on values (e.g. a vector type parameterised by its length)

C. dynamic typing with runtime checks

D. types that inherit from parent types

Q12. In machine learning, 'batch normalisation' helps by:

A. normalising the input dataset

B. normalising the activations of each layer to stabilise and accelerate training

C. selecting a random batch of data

D. preventing overfitting by adding noise

Q13. What is the 'Curry-Howard correspondence'?

A. a duality between object-oriented and functional programming

B. a correspondence between types and propositions, and programs and proofs

C. the equivalence of recursive and iterative programs

D. the relationship between syntax and semantics

Q14. In operating systems, 'demand paging' means:

A. all pages are loaded into memory at program start

B. pages are loaded into memory only when they are needed

C. the OS demands all memory from the user

D. pages are written to disk immediately after use

Q15. What does 'Amdahl's Law' state about parallel computing?

A. parallel computing always doubles performance

B. the speedup is limited by the sequential fraction of the program

C. adding more processors always improves performance

D. parallel programs are always more efficient

Q16. In Python, what does 'abc.ABCMeta' provide?

A. a way to create abstract base classes with abstract methods that subclasses must implement

B. an alphabet-based class structure

C. a metaclass for sorting

D. automatic base class creation

Q17. What is 'approximate nearest neighbour' (ANN) search used for?

A. exact database lookups

B. finding the closest vectors in high-dimensional spaces efficiently, accepting small errors for speed

C. sorting vectors by magnitude

D. classifying images exactly

Q18. In network security, what is 'BGP hijacking'?

A. breaking into a router physically

B. manipulating BGP routing tables to redirect Internet traffic through attacker-controlled networks

C. blocking DNS resolution

D. intercepting Wi-Fi packets

Q19. What is 'continuation-passing style' (CPS) in programming?

A. a style where all functions return normally

B. a style where control flow is passed explicitly via continuations (callbacks)

C. a recursive programming style

D. an imperative programming style

Q20. In TensorFlow/PyTorch, what is an 'autograd' system?

A. automatic code generation

B. automatic computation of gradients by tracking operations on tensors

C. GPU scheduling

D. automatic model architecture selection

Q21. What is 'phantom read' in database transactions?

A. reading data that has been physically deleted

B. a phenomenon where a transaction re-executes a query and finds new rows due to another committed transaction

C. reading uncommitted data from another transaction

D. reading the same row twice and getting different values

Q22. In computer vision, what does a convolutional neural network's 'receptive field' refer to?

A. the output size of the network

B. the number of classes the network can predict

C. the region of the input image that influences a particular neuron's activation

D. the size of the convolution kernel

Q23. What is 'NUMA' (Non-Uniform Memory Access)?

A. a memory type that does not use addresses

B. a system architecture where memory access time depends on the memory's location relative to the processor

C. a uniform cache system

D. a method for virtual memory management

Q24. In formal language theory, the 'pumping lemma' for regular languages is used to:

A. prove that a language is regular

B. construct a DFA for any language

C. prove that a language is NOT regular

D. minimise a finite automaton

Q25. What is 'space complexity' of Fibonacci computed with dynamic programming (bottom-up)?

A. $O(n)$

B. $O(n^2)$

C. $O(\log n)$

D. $O(1)$ if only the last two values are kept

Q26. In the Ethereum blockchain, 'gas' is used to:

A. mine new blocks

B. store smart contract code

C. measure and limit computational effort for executing transactions and contracts

D. encrypt transaction data

Q27. What is 'federated learning' in machine learning?

A. learning from centralised data

B. training models across multiple decentralised devices without sharing raw data

C. combining predictions from multiple models

D. training models on federated databases

Q28. In Python, what does 'itertools.groupby' do?

A. groups elements by occurrence count

B. groups consecutive elements that share the same key

C. groups all elements with the same value anywhere in the iterable

D. creates groups of fixed size

Q29. What is 'row-level security' in PostgreSQL?

A. encrypting individual rows

B. policies restricting which rows a user can see or modify

C. indexing individual rows for faster access

D. compressing rows to save space

Q30. What is 'superscalar execution' in CPUs?

A. executing instructions at speeds beyond the clock rate

B. fetching and executing multiple instructions simultaneously in the same clock cycle using multiple execution units

C. using multiple CPU cores

D. executing code in parallel on a GPU

Q31. In information theory, Shannon entropy $H(X) = -\Sigma\, p(x) \log p(x)$ measures:

A. the total energy in a signal

B. the average uncertainty or information content of a random variable

C. the maximum frequency in a signal

D. the compression ratio

Q32. In Python, what is 'structural pattern matching' (match/case, PEP 634)?

A. a new loop syntax

B. a way to match regular expressions

C. a feature to match values against patterns, enabling destructuring and branching

D. a type-checking decorator

Q33. What is 'capability-based security'?

A. granting permissions based on user roles

B. an access control model where subjects hold unforgeable tokens (capabilities) granting specific rights

C. encrypting capabilities

D. a biometric authentication system

Q34. In distributed systems, 'two-phase commit' (2PC) ensures:

A. data is written to two servers

B. atomic commitment of a distributed transaction across all participating nodes

C. data is encrypted in two phases

D. consensus through two rounds of voting

Q35. What is the 'Lempel-Ziv-Welch' (LZW) algorithm?

A. a sorting algorithm

B. a lossy image compression algorithm

C. a lossless data compression algorithm using a dynamically built dictionary

D. a network routing algorithm

Q36. In quantum computing, a 'qubit' differs from a classical bit because it can be:

A. either 0 or 1 only

B. in a superposition of 0 and 1 simultaneously

C. faster than a classical bit

D. stored at lower temperatures

Q37. What is 'eventual consistency' vs 'strong consistency' in databases?

A. eventual: always correct; strong: sometimes wrong

B. strong: all reads see the most recent write; eventual: replicas converge over time but may return stale data momentarily

C. they are identical concepts

D. strong: faster; eventual: more accurate

Q38. In Python's CPython, the 'reference counting' garbage collection mechanism fails for:

A. large integers

B. strings with Unicode characters

C. circular references (objects pointing to each other)

D. class instances with many attributes

Q39. What is 'Spectre' vulnerability?

A. a buffer overflow in web servers

B. a ransomware targeting Windows

C. a side-channel attack exploiting speculative execution to read arbitrary memory

D. a SQL injection variant

Q40. In linear algebra (used in ML), the eigenvectors of matrix A satisfy:

A. $Av = 0$

B. $Av = \lambda v$ (where λ is the eigenvalue)

C. $Av = v$

D. $Av = A$

Answer Key

Q1: B Q2: B Q3: B Q4: A Q5: B Q6: B Q7: B Q8: B Q9: C Q10: B

Q11: B Q12: B Q13: B Q14: B Q15: B Q16: A Q17: B Q18: B Q19: B

Q20: B Q21: B Q22: C Q23: B Q24: C Q25: D Q26: C Q27: B Q28: B

Q29: B Q30: B Q31: B Q32: C Q33: B Q34: B Q35: C Q36: B Q37: B

Q38: C Q39: C Q40: B