

Class 6 | Cyber Olympiad

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 CAP theorem's 'partition tolerance' guarantee?

A. the system always returns the most recent data

B. the system remains available under all conditions

C. the system continues operating despite network partitions between nodes

D. the system can scale infinitely

Q2. In the context of Byzantine Fault Tolerance, what is a Byzantine failure?

A. a node that simply crashes and stops responding

B. a node that behaves arbitrarily or maliciously, sending conflicting information

C. a network partition isolating one node

D. a hardware failure of the CPU

Q3. What is 'amortised analysis' in algorithms?

A. measuring the worst-case performance of an individual operation

B. averaging the cost of a sequence of operations over the total number of operations

C. measuring the best-case performance

D. computing space complexity only

Q4. In Python, what does '`__slots__`' do in a class?

A. allows unlimited attributes

B. restricts attributes to those defined in `__slots__`, saving memory by avoiding `__dict__`

C. defines class methods

D. creates immutable instances

Q5. What is the P vs NP problem?

A. whether all polynomial algorithms can be converted to non-polynomial

B. whether every problem whose solution can be verified quickly (NP) can also be solved quickly (P)

C. whether neural networks can solve any problem

D. the comparison of procedural and object-oriented languages

Q6. In cryptography, 'perfect forward secrecy' ensures:

A. all past sessions remain secure even if long-term private keys are compromised later

B. the same key is used for all sessions

C. decryption requires two people

D. the encryption key is stored permanently

Q7. What is 'consistent hashing' used for in distributed systems?

A. ensuring all servers store the same data

B. minimising rehashing when nodes are added or removed from a distributed hash table

C. encrypting distributed data

D. guaranteeing transaction consistency

Q8. In Python, what does 'functools.lru_cache' do?

A. limits function call frequency

B. logs function calls

C. parallelises function execution

D. caches function return values to avoid redundant computation (memoisation)

Q9. What is 'eventual consistency' in distributed databases?

A. data is always consistent immediately

B. the database will never become consistent

C. given no new updates, all replicas will eventually converge to the same value

D. data is consistent only if all nodes agree simultaneously

Q10. In the context of operating systems, what is 'copy-on-write' (COW)?

A. copying files automatically to a backup

B. a memory optimisation where shared pages are only physically copied when one process modifies them

C. writing data twice for reliability

D. a file system journaling technique

Q11. What is 'tail call optimisation' (TCO)?

A. optimising the last element in a list

B. replacing a recursive call in tail position with a jump, avoiding stack growth

C. removing the final iteration of a loop

D. caching the result of the last function call

Q12. In machine learning, what is 'regularisation' used for?

A. normalising input data

B. reducing overfitting by penalising model complexity

C. increasing model complexity

D. speeding up gradient descent

Q13. What is a 'Bloom filter'?

A. a data structure for sorting

B. a probability-based filter for UI elements

C. a space-efficient probabilistic data structure used to test if an element is possibly in a set (with false positives possible)

D. a hash map variant

Q14. In operating systems, the 'page replacement algorithm' LRU stands for:

A. Last Recently Used

B. Least Recently Used

C. Locally Referenced Unit

D. Low Resource Utilisation

Q15. What is 'backpropagation' in neural networks?

A. passing data backward through layers

B. undoing a bad training step

C. the algorithm computing gradients of the loss with respect to weights by applying the chain rule

D. removing neurons that do not fire

Q16. In Python, what is the MRO (Method Resolution Order)?

A. the order of methods alphabetically

B. the order Python searches base classes for methods in multiple inheritance (C3 linearisation)

C. the order in which methods are defined

D. the order of function calls in a recursive stack

Q17. What does 'sharding' mean in databases?

A. encrypting data at rest

B. splitting a large database into smaller, distributed pieces across multiple servers

C. creating database backups

D. merging multiple databases into one

Q18. In Kubernetes, a 'pod' is:

A. a physical server

B. a network router in the cluster

C. the smallest deployable unit, containing one or more containers sharing network and storage

D. a type of load balancer

Q19. What is 'ACID' in database transactions?

A. Asynchronous, Consistent, Isolated, Durable

B. Atomicity, Consistency, Isolation, Durability

C. Atomicity, Concurrency, Integrity, Dependency

D. Availability, Consistency, Integrity, Durability

Q20. In Python, the 'asyncio' library is used for:

A. running code on multiple CPUs in parallel

B. writing synchronous blocking code faster

C. writing asynchronous, event-driven concurrent code using `async/await`

D. automatic memory management

Q21. What is 'reentrancy' in function design?

A. a function that calls itself

B. a function that can be safely interrupted and called again before the first call completes

C. a function that is called multiple times with the same result

D. a function that never returns

Q22. What is the 'travelling salesman problem' (TSP)?

A. finding the shortest path in a graph

B. finding the minimum spanning tree

C. finding the shortest possible route visiting all cities exactly once and returning to the start (NP-hard)

D. sorting cities by population

Q23. In Python, what is 'monkey patching'?

A. testing code with random inputs

B. dynamically modifying or extending a class or module at runtime

C. creating a sub-class

D. generating stub code

Q24. What is 'homomorphic encryption'?

A. encryption using identical keys

B. encryption allowing computations on ciphertext that, when decrypted, give the same result as operating on plaintext

C. double encryption for extra security

D. one-way encryption with no decryption

Q25. In computer architecture, 'out-of-order execution' allows:

A. CPUs to execute instructions in program order only

B. CPUs to execute instructions in an order different from the program order to improve utilisation

C. memory to be read before it is written

D. multiple CPUs to share one cache

Q26. What is 'SIMD' (Single Instruction, Multiple Data)?

A. a CPU executing one instruction on one data element at a time

B. a parallelism approach applying one instruction simultaneously to multiple data elements

C. a type of CPU cache

D. a network transmission protocol

Q27. In Python's CPython implementation, what causes the 'thundering herd' problem?

A. too many imports at startup

B. multiple threads/processes waking up simultaneously to handle a single event, causing resource contention

C. excessive recursion

D. large lists causing cache misses

Q28. What is 'speculative execution' in modern CPUs?

A. running code based on guesses about future instructions to keep the pipeline full

B. executing code only when safe to do so

C. predicting user inputs

D. running code in a sandboxed virtual environment

Q29. In distributed systems, the 'Paxos' protocol is used for:

A. encrypting distributed data

B. achieving consensus among distributed nodes

C. load balancing

D. database replication

Q30. What does 'zero-knowledge proof' allow?

A. proving a statement is false without evidence

B. proving knowledge of a secret without revealing the secret itself

C. encryption with zero computational cost

D. authentication with no password

Q31. In Python, what is the difference between 'deepcopy' and 'copy' (shallow copy)?

A. deepcopy is faster

B. shallow copy duplicates object references; deepcopy recursively duplicates all nested objects

C. copy creates a new object; deepcopy modifies the original

D. there is no difference

Q32. What is 'A*' search algorithm'?

A. a brute-force graph search

B. an informed search using a heuristic to find the shortest path efficiently

C. a sorting algorithm

D. a compression algorithm

Q33. In cryptography, a 'nonce' is:

A. a password that never changes

B. an arbitrary number used only once to prevent replay attacks

C. a type of hash function

D. a symmetric encryption key

Q34. What is 'differential privacy'?

A. encrypting the difference between two datasets

B. a technique ensuring that adding or removing one individual's data from a dataset does not significantly affect the output of a query

C. comparing two encrypted datasets

D. a type of secure multi-party computation

Q35. In compiler design, what is 'abstract syntax tree' (AST)?

A. a tree of memory addresses

B. a visual diagram of a class hierarchy

C. a tree representation of the grammatical structure of source code

D. an optimised binary representation of bytecode

Q36. What is 'memory-mapped I/O'?

A. mapping RAM directly to CPU registers

B. a technique where I/O device registers are mapped to CPU address space, allowing normal memory instructions to control devices

C. using virtual memory for I/O buffering

D. compressing I/O data in memory

Q37. In formal language theory, a 'context-free grammar' (CFG) generates:

A. regular languages only

B. all recursively enumerable languages

C. context-free languages (a superset of regular languages, including nested structures like balanced brackets)

D. only finite languages

Q38. What is 'RAFT' consensus algorithm?

A. a distributed file system

B. a simpler, more understandable consensus algorithm than Paxos, using leader election and log replication

C. a routing protocol

D. an encryption scheme

Q39. In machine learning, 'attention mechanism' in transformers:

A. focuses the model on the first token only

B. allows the model to weight the importance of different positions in the input when computing representations

C. removes unimportant neurons

D. speeds up backpropagation

Q40. What is 'Kolmogorov complexity'?

A. the number of operations a program performs

B. the length of the shortest program that produces a given output

C. the number of recursive calls in an algorithm

D. a measure of data compression ratio

Answer Key

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

Free practice paper from syllabax.com · Take the free live challenge at syllabax.com/olympiad/class/6 · Not affiliated with SOF or any official olympiad body.