Software and Data Engineering
Quiz 2

1. If a system prioritizes security with multiple layers of encryption and authentication, what architectural trade-off is most likely?

   A) Faster system response times
   B) Increased system availability
   C) Reduced system performance
   D) Simplified system complexity

   Answer: C

2. A company with a $20M annual budget is designing an e-learning platform. Which factors should the architect consider as constraints rather than quality attributes?

   A) System scalability for thousands of users
   B) Maximum student capacity per classroom
   C) Project budget cap
   D) Secure login for students

   Answer: B, C

3. To increase availability to 4-nines (~99.99%) for a service, which tactics from the notes are appropriate?

   A) Replication across regions
   B) Single powerful server with good hardware
   C) Health checks + automated failover
   D) Increasing encryption layers for security

   Answer: A, C

4. Which of the following design principles help in reducing *tight coupling*?

   A) Interface Segregation
   B) Dependency Inversion
   C) Liskov Substitution
   D) High Cohesion

   Answer: A, B

5. You must design a notification system for mobile devices where IPs frequently change. Based on the notes, which approach most realistically simulates "push"?

A) Pure server-initiated TCP connections to every device IP.
B) Device-side background client polling notification server.
C) Broadcasting messages to device subnet.
D) Relying on DNS to reach mobile clients.

Answer: B

6. In a layered architecture, what prevents ripple effects of changes across the system?

   A) Isolation of logic within layers
   B) Cyclic dependencies between layers
   C) One-way communication between layers
   D) Use of brokers for all communication

   Answer: A, C

7. Which scenario best highlights the difference between functional and quality attributes?

   A) Secure login vs User login
   B) Budget limit vs Memory limit
   C) Authentication vs Data storage
   D) Encryption vs Backup

   Answer: A

8. A system shows unpredictable latency under load spikes. Which architectural measurement or change aligns best with lecture guidance?

   A) Add more complex encryption to secure the channel
   B) Measure layer-specific latency and horizontally scale the slowest layer
   C) Merge all layers to reduce hops
   D) Move everything to a single powerful server

   Answer: B

9. If Google used a *smart broker* that cancels extra server responses, what problem would likely occur at scale?

   A) Reduced broker overhead
   B) Broker becomes a bottleneck

C) More parallelism is achieved
D) Simpler server design

Answer: B

10. Why might WhatsApp architecture scale better than IRCTC's?

A) Sequence of messages doesn't matter in WhatsApp
B) WhatsApp uses a broker for message delivery
C) IRCTC requires strict sequence for ticket bookings
D) WhatsApp uses microservices for payment systems

Answer: A, B, C

11. A team implements microservices where each service has its own database. What is the main benefit?

A) Easier centralization of data
B) Independent scaling of services
C) Reduced security needs
D) Single point of failure eliminated

Answer: B

12. When comparing SOA and Microservices, which statements are true?

A) SOA services handle end-to-end business functionality
B) Microservices focus on smaller, isolated services
C) SOA requires fixed sequence like layered pattern
D) Microservices can be combined to fulfill complete use cases

Answer: A, B, D

13. Why is the OSI model an ideal example of layered architecture?

A) Every layer can directly access all others
B) Layers only communicate unidirectionally
C) No processing overhead exists between layers
D) Each layer shares the same responsibilities

Answer: B

14. What makes Pipes & Filters pattern ideal for data processing?

    A) Filters are reusable in different workflows
    B) Data flows in a predictable sequential manner
    C) Each filter tightly couples with the next filter
    D) Pipes handle format conversions between filters

    Answer: A, B, D

15. In a client-server model, what is the biggest risk if the central server crashes?

    A) Clients automatically take over server responsibilities
    B) All client requests fail until recovery
    C) Only half of clients lose connectivity
    D) Data replication across clients prevents failure

    Answer: B

16. Why is P2P better suited for file sharing (e.g., torrents)?

    A) Eliminates central server cost
    B) Supports parallel downloads from multiple peers
    C) Provides stronger consistency guarantees
    D) Avoids single point of failure

    Answer: A, B, D

17. If multiple applications use a shared database, what issue becomes critical?

    A) Synchronization and consistency across transactions
    B) Requirement for multiple brokers
    C) Increased file system size
    D) Simplified update process

    Answer: A

18. Which patterns or tactics help build an architecture that favors maintainability in a large multi-team project?

    A) High cohesion modules
    B) Two-pizza microservice teams with own DBs

C) Massive shared monolithic codebase with no modules
D) Clear common interfaces and documentation (diagrams)

Answer: A, B, D

19. Which anti-pattern risk arises when a broker performs too much logic?

A) Reduced fault tolerance
B) Broker bottleneck limiting scalability
C) Clients lose ability to request servers
D) Simplified architecture but higher speed

Answer: B

20. Which are examples of runtime parameters in a software system?

A) Android app permissions at startup
B) Page size defined during kernel compilation
C) User preferences changed during execution
D) Database connection string at initialization

Answer: C, D

21. Why is layered architecture considered more maintainable?

A) Cyclic dependencies ensure robustness
B) Internal logic changes in one layer don't affect others
C) Every layer shares data with all others
D) It eliminates all communication overhead

Answer: B

22. For a Pub-Sub system serving millions of subscribers, which design decisions improve scalability?

A) Make Pub-Sub layer stateless and scalable
B) Push every message synchronously to all subscribers without batching
C) Partition topics and use selective subscription channels
D) Integrate load balancing for hot publishers

Answer: A, C, D

23. If a broker becomes “smart” and starts cancelling duplicate server work to save resources, what hidden cost is most likely to negate gains at global scale?

    A) Extra network round-trips and coordination overhead
    B) Reduced CPU usage on servers
    C) Simpler client implementations
    D) Lower memory on broker

    Answer: A

24. Which property best distinguishes microservices from modular architecture?

    A) Microservices always use the same database.
    B) Microservices are end-to-end units often with independent DBs and deployment.
    C) Modular architecture implies independent deployment units with separate DBs by default.
    D) Microservices remove the need for APIs.

    Answer: B

25. Which is a valid architectural reason to separate payment verification into its own layer/service?

    A) To increase cyclic inter-layer dependencies
    B) To isolate sensitive security concerns and apply stricter quality attributes like audit and compliance
    C) To eliminate all latencies
    D) To force every request through the UI layer only

    Answer: B

26. Which characteristics differentiate Pub-Sub from Load Balancer?

    A) Publishers provide unique curated content
    B) Load balancers distribute identical services
    C) Subscribers choose publishers based on interest
    D) Both deliver the same message to all subscribers

    Answer: A, B, C

27. Which is the most faithful description of SOA vs Microservices?

A) SOA: smaller focused services; Microservices: entire business use cases
B) SOA: services often represent business use cases end-to-end; Microservices: typically smaller focused services that together form business flows
C) They are identical with no distinguishing traits
D) Microservices require monolithic DBs always

Answer: B

28. In MVC, what advantages does two-way communication enable?

A) Real-time updates between Model and View
B) Simpler implementation compared to layered
C) More flexible data flow
D) Reduced complexity in all cases

Answer: A, C

29. Why are microservices often developed by “two-pizza teams”?

A) Small team sizes encourage focused ownership
B) Easier to implement SOA principles
C) Prevents dependency on shared databases
D) Avoids scalability concerns

Answer: A

30. In Pipes & Filters, what challenges occur without pipes?

A) Filters become tightly coupled
B) Each filter must know others’ interface requirements
C) Filters lose ability to transform data
D) Reusability of filters decreases

Answer: A, B, D

31. Which pattern is closest to a “dumb load balancer”?

A) Broker Pattern
B) Master-Slave
C) MVC Pattern
D) Layered Architecture

Answer: A

32. Why is multi-factor authentication a good candidate for layered architecture?

A) Sequential checks at each layer
B) Independence between verification steps
C) Each layer can bypass security for efficiency
D) Separation of concerns across layers

Answer: A, B, D

33. Which deployment strategy aligns most with microservices?

A) Deploying as a single file
B) Independent deployment of services via APIs
C) Running all modules on one machine
D) Using shared memory communication

Answer: B

34. When comparing Shared Data vs Pub-Sub, which are valid observations?

A) Shared Data allows active updates and edits
B) Pub-Sub provides read-only copies
C) Shared Data read-only mode resembles Pub-Sub
D) Pub-Sub allows subscribers to modify publisher's content

Answer: A, B, C

35. Why is modular architecture preferable in large systems?

A) It increases cyclic dependencies
B) It isolates complexity into manageable units
C) It eliminates need for interfaces
D) It reduces number of components drastically

Answer: B

36. What makes architectural diagrams valuable?

A) Reasoning about performance before implementation
B) Predicting system behavior without execution
C) Simplifying communication with stakeholders
D) Eliminating need for testing

Answer: A, B, C

37. Which quality attribute directly impacts why iOS is often preferred over Android?

A) Flexibility
B) User experience consistency
C) Availability
D) Security

Answer: B

38. What problems does the broker pattern solve in distributed systems?

A) Server dependency by hiding server details from clients
B) Scalability by registering new servers at the broker
C) Simplifying client logic with single broker address
D) Eliminating all performance overhead

Answer: A, B, C

39. In P2P networks, why is pure decentralization rarely achieved in practice?

A) Because peers always remain online forever
B) Due to the need for peer discovery and trackers (some centralized elements) and dynamic addressing issues
C) P2P works flawlessly without any centralized components
D) P2P is faster for transactional banking systems by design

Answer: B

40. Why is software architecture critical for reducing project failures?

A) Enables reasoning before coding
B) Helps manage system-level complexity
C) Provides patterns for recurring problems
D) Guarantees project success regardless of execution

Answer: A, B, C