Computing for Medicine
Quiz - 2

Date -   30th October 2025   **Time - 60 minutes**

Max. Marks -   100   **Name:**

Multiple Choice Questions (MCQs)   **4*15 = 60**

1. What is the primary purpose of HL7 standards in healthcare?
   a)To enable structured exchange of healthcare information between systems
   b)To develop proprietary hospital software
   c) To store all patient data in a centralized repository
   d) To focus solely on data security

2. In HL7 v2 messages, which character is used as the primary field separator?
   a) Comma ,
   b) Semicolon ;
   c) Pipe |
   d) Colon :

3. What is the relationship between FHIR and ABDM?
   a) FHIR is a software developed by ABDM
   b) FHIR acts as the technical backbone of ABDM for standardized data exchange
   c) ABDM replaces FHIR for interoperability
   d) FHIR only handles patient authentication

4. A hospital wants to send a patient's hemoglobin test result to a national health registry. Which FHIR resource is most appropriate for representing this lab test?
   a) Encounter
   b) Observation
   c) DiagnosticReport
   d) MedicationRequest

5. Which ABDM component uniquely identifies every patient in India?
   a. Health Information Exchange
   b. Consent Manager
   c. Health ID
   d. Electronic Medical Record

6. In FHIR, resources are exchanged between systems via:
   a. File transfer protocol
   b. RESTful APIs using standard JSON or XML formats
   c. Encrypted ZIP files
   d.Proprietary message queues

7. The benefit of using FHIR in multi-vendor healthcare environments is:
   a. It forces all vendors to use the same database
   b.It replaces EHR systems completely
   c.It enables data interoperability without changing internal vendor systems
   d. It increases data storage capacity

8. In SMART on FHIR, authentication and authorization are achieved using:
   a.SQL credentials
   b.FTP certificates
   c.Custom hospital logins
   d. OAuth 2.0 and OpenID Connect protocols

9. Storyboarding in healthcare software design helps teams to:
   a. Visualize and understand user workflows before actual implementation
   b. Write backend code
   c.Encrypt data
   d. Develop database schemas

10. In ABDM, patient consent is:
   a. Mandatory and digitally verifiable via the Consent Manager
   b. Managed manually by doctors
   c.Given once for lifetime access
   d. Optional for hospitals

11. Which of the following ensures data privacy while enabling interoperability?
   a. Restricting all external access
   b. Storing data in proprietary formats
   c. Using tokenized, consent-based, encrypted data exchange
   d.Manual data entry

12. In ABDM's data exchange model, how is data consistency maintained even when hospitals use different vendors software?
   a.By exporting data in spreadsheets
   b. Through common hospital management systems
   c. By enforcing uniform data structure and semantics via standardized FHIR resources and APIs
   d.By using one central government database

13. The main difference between **HL7 v2** and **FHIR** is that:
   a.   HL7 v2 is used only in the U.S., while FHIR is used only in India
   b.   HL7 v2 is message-based, while FHIR is resource-based and API-driven
   c.   HL7 v2 supports mobile apps, while FHIR does not
   d.   HL7 v2 uses XML, while FHIR uses PDFs

14. A patient revokes consent for a digital health app to access their records. What must happen immediately according to ABDM's framework?
   a.   The Consent Manager notifies the data source to terminate further access
   b.   The app archives the data for later review
   c.   The app continues access for emergency cases

d. The app retains previous data indefinitely

15. A telehealth application wants to show a dashboard combining blood sugar readings, blood pressure, and cholesterol for a diabetic patient. Which FHIR resource would the app most likely use to retrieve these values?
   a. MedicationRequest
   b. ServiceRequest
   c. Observation
   d. Encounter

Short- Answer Questions   **10*4 = 40**

1. Mr. Verma visits two different hospitals in Delhi for diabetes management. Hospital A uses an EHR system from Vendor X, while Hospital B uses a system from Vendor Y. Mr. Verma wants his lab results, medication history, and allergy information from Hospital A to be accessible to his endocrinologist at Hospital B. Both hospitals are integrated with the Ayushman Bharat Digital Mission (ABDM) using FHIR standards.
   a. Explain how FHIR enables Mr. Verma's clinical data to be shared securely and consistently between two different EHR systems
   b. Discuss how patient consent is managed in this scenario to ensure data sovereignty
   c. Evaluate the benefits of using FHIR in such multi-vendor healthcare environments for both patients and providers.

Ans. **FHIR-based secure data exchange:**
   ● FHIR (Fast Healthcare Interoperability Resources) provides a standardized data structure for healthcare entities such as Observation (lab results), MedicationStatement (drug history), and AllergyIntolerance (allergies).

   ● Both Hospital A (Vendor X) and Hospital B (Vendor Y) expose RESTful FHIR APIs that exchange data in JSON or XML formats.

   ● Because both systems follow FHIR specifications and terminologies (e.g., LOINC, SNOMED CT), the data remains semantically consistent across vendors.

2**. Patient consent management:**

   ● Under ABDM, data sharing happens only after patient consent via the Consent Manager.

   ● Mr. Verma uses his ABHA ID to authenticate and give digital, purpose-specific, time-bound consent.

   ● The Consent Manager issues a tokenized consent artifact, ensuring that only authorized systems can fetch specific records securely.

   ● Consent can be revoked anytime, ensuring full data sovereignty.

3. Benefits of using FHIR:

- For patients: Seamless continuity of care and reduced redundancy in tests.

- For providers: Quicker, standardized access to medical records for better decision-making.

- For systems: Vendor-neutral interoperability and secure integration with ABDM infrastructure.

2. A telemedicine startup wants to develop an app that monitors patient vitals and schedules appointments. The app needs access to patients' EHRs through ABDM.
    a. Describe how SMART on FHIR enables secure app authentication and data access without altering the underlying EHR.
    b. Explain how ABHA health IDs ensure accurate patient identification in the app.

Ans. (a) **SMART on FHIR – Secure authentication and access**:

- SMART (Substitutable Medical Applications, Reusable Technologies) on FHIR allows third-party apps to connect securely to EHRs.

- It uses OAuth 2.0 and OpenID Connect protocols for user authentication and authorization.

- The app receives a secure access token defining what data (e.g., vitals, appointments) it can access, without modifying or directly integrating into the EHR backend.

- This ensures modularity, privacy, and auditability.

(b) **ABHA (Ayushman Bharat Health Account) IDs – Patient identification:**

- Every patient has a unique 14-digit ABHA ID, ensuring consistent identification across hospitals and apps.

- When patients log into the telemedicine app, their ABHA ID links to their health records via ABDM's Health Information Exchange.

- This prevents duplication or mismatch of records and enables accurate retrieval of patient history.

3. A multi-specialty hospital is designing a new module to manage patient referrals between cardiology and radiology departments. A hospital wants to design a software system to manage requests or tasks between different departments. Explain how storyboarding can help understand and visualize the workflow before implementation. Suggest a few standard data objects or resources that could represent the main entities in this workflow.

Ans **1. Role of storyboarding:**

- Storyboarding is a **visual planning tool** used to depict the end-to-end workflow — e.g., how a cardiologist creates a referral, how the radiology department receives and fulfills it, and how reports are returned.

- It helps multidisciplinary teams (clinicians, designers, developers) **understand user needs**, sequence of actions, and pain points before actual coding.

- Reduces errors, improves user experience, and ensures clinical relevance.

2. Key FHIR resources in the workflow:

- ServiceRequest → Represents referral or diagnostic orders.

- Patient → Identifies the individual.

- Practitioner and Organization → Represent doctors and departments.

- Encounter → Captures details of each patient visit.

- DiagnosticReport and ImagingStudy → Represent results and radiology findings.

4. India's ABDM allows linkage of EHR data between private and government hospitals. Explain how FHIR APIs make this technically feasible without requiring all hospitals to use the same vendor system.
Ans

- ABDM uses **FHIR APIs** to standardize how healthcare data is structured and exchanged, regardless of the vendor.

- Each hospital retains its own EHR system but exposes data through **FHIR-compliant endpoints** (e.g., /Observation, /Patient, /MedicationRequest).

- When a patient gives consent, the **ABDM gateway** orchestrates the data flow securely between hospitals using **tokenized, encrypted channels**.

- This avoids the need for a **central database** or uniform vendor software while ensuring **real-time, secure interoperability**.

- Thus, hospitals with different systems can still share records accurately and efficiently.

5. Explain how combining storyboarding, FHIR modeling, and SMART app development ensures that a digital health system is both clinically useful and technically interoperable.

- **Storyboarding**: Aligns technical teams with **clinical workflows** — defines what users (doctors, nurses, patients) actually need.

- **FHIR modeling**: Provides a **standardized data backbone**, ensuring all clinical entities (like vitals, labs, medications) are represented consistently.

- **SMART app development**: Adds **secure, modular functionality** (via OAuth 2.0) that can plug into any FHIR-compliant EHR.

- Together:

  - Ensures the system is **clinically relevant** (real workflow-based).

  - Guarantees **technical interoperability** (using FHIR standards).

  - Enables **secure, flexible app integration** (via SMART).

- The result is a **patient-centered, interoperable, and scalable** digital health ecosystem.

6. In modern healthcare, exchanging patient data between different hospitals, clinics, and digital health apps is essential for better patient care. However, interoperability is not just about technology. It also requires strong governance to ensure data is shared securely, consistently and ethically. Explain why governance is as important as technology for healthcare interoperability. Illustrate your answer with examples from the Ayushman Bharat Digital Mission (ABDM) and SMART on FHIR, focusing on aspects such as patient consent, data privacy, standardization, and secure access.

- **Interoperability isn't just technical** — governance ensures data is shared **ethically, securely, and with accountability**.

- **Technology layer:** FHIR, SMART on FHIR, encryption, APIs enable data exchange.

- **Governance layer (ABDM):**

  - **Consent Manager:** Patients control who accesses their data and for how long.

  - **Data privacy:** Enforced through encryption and tokenization.

  - **Standardization:** Mandatory FHIR-based formats ensure semantic consistency.

  - **Auditability:** All accesses are logged and monitored.

- Example:

  - A digital health app must obtain **explicit, verifiable consent** from the patient via ABDM before accessing any record.

  - If consent is revoked, access is immediately terminated — ensuring **data sovereignty**.

- Thus, **governance builds trust**, ensuring interoperability supports patient rights, not just data flow.