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Certificate in Accounting and Finance Stage Examination

Data, Systems and Risks

9 March 2026
100 marks
3 hours and 15 minutes (including 15 minutes' reading time)

Instructions to examinees:
(i) Answer all **SEVEN** questions.
(ii) Answer in **black** pen only.
(iii) Use the first page of the answer script to answer the Multiple-Choice Questions.

SECTION A

QUESTION 1

Select the most appropriate answer from the options provided for each of the following Multiple-Choice Questions (MCQs). Each MCQ carries **ONE** mark.

(i) After purchasing a product, every customer of Rectangle Rings (RR) completes a survey to rate RR's customer service quality in one of four categories: Excellent, Good, Average, or Poor. At the end of each month, RR's manager calculates the percentage of customer responses in each category.

The original survey responses provided by the customers would be classified as:

(a) Nominal data
(b) Discrete data
(c) Ordinal data
(d) Continuous data

(ii) Which of the following best describes the activities undertaken at the tactical level of data governance?

(a) Implementing data standards, establishing governance frameworks, and monitoring progress
(b) Implementing data standards, developing implementation plans, and monitoring progress
(c) Managing data quality, managing metadata, and defining vision and goals
(d) Developing data governance policies, securing executive sponsorship, and managing metadata

(iii) Shahzad Ali, the Finance Manager of Arrow Associates, has prepared a dashboard that reports monthly sales for February 2026, analyses the decline in sales compared to February 2025, and recommends increasing discounts to 20% of the retail price for March 2026.

The recommendation provided by Shahzad Ali in the above dashboard reflects:

(a) Descriptive analytics
(b) Diagnostic analytics
(c) Predictive analytics
(d) Prescriptive analytics

(iv) Which of the following statements regarding the implications of data analytics is **NOT** correct?

(a) Data analytics provides valuable insights that enable organizations to make informed decisions
(b) Data analytics helps organizations identify inefficiencies and optimize performance
(c) Data analytics guarantees reliable insights regardless of the quality of the underlying data
(d) Data analytics helps companies gain a competitive advantage by enabling them to respond more quickly to market changes

(v) Cylinder Airline (Private) Limited (CAPL) streams real-time sensor data from various aircraft engines to detect potential faults during flights and initiate immediate corrective actions. However, despite heavy investment in technology, CAPL's system fails to process the collected data in real time.

CAPL's inability to process data in real time directly affects which characteristic of Big Data?

(a) Velocity (b) Veracity (c) Variety (d) Value

(vi) Nonagon Foods Limited (NFL) recently collected a large volume of data from online transactions, customer surveys, and sensors. Before performing detailed analysis, NFL's manager is resolving inconsistencies, handling missing values, and correcting data entry errors.

Which stage of the Data Analytics Cycle is being performed by NFL's manager?

(a) Data Collection
(b) Data Exploration
(c) Data Modeling
(d) Data Cleaning

(vii) Octagon Innovations (OI), a rapidly growing startup, does not want to invest in physical servers. Instead, OI has engaged a cloud provider to manage the data center and physical hardware. OI rents virtual machines, installs its own operating systems, and configures applications according to its business needs. The cloud service model being utilized by OI is:

(a) Software as a Service (SaaS)
(b) Platform as a Service (PaaS)
(c) Infrastructure as a Service (IaaS)
(d) Heroku

(viii) Sphere Hospital and Clinics (SHC) stores patient records in a dedicated cloud environment that is not shared with any other organization. The infrastructure is customized to meet SHC's specific regulatory and data privacy requirements.

Which of the following cloud deployment models is being utilized by SHC?

(a) Public Cloud
(b) Private Cloud
(c) Community Cloud
(d) Hybrid Cloud

(ix) Rhombus Creative Designers (RCD), a global marketing firm, uses a cloud-based collaborative platform to manage its international campaigns. Team members residing in London, Tokyo, and Beijing work on the same project files in real time. Employees access the cloud environment using company laptops and personal smartphones over various public and private network connections.

Which key cloud characteristic is most clearly demonstrated by RCD's setup?

(a) Broad network access
(b) Rapid elasticity
(c) Resource pooling
(d) Measured service

(x) Which of the following is the key components of a Blockchain?

(a) Blocks, Hashing, Consensus Mechanisms, Nodes, Cryptocurrencies
(b) Blocks, Hashing, Smart Contracts, Nodes, Hashgraph
(c) Blocks, Chain Propagation, Smart Contracts, Nodes, Holochain
(d) Blocks, Hashing, Consensus Mechanisms, Nodes

(xi) Which of the following types of Distributed Ledger Technology uses a non-linear, graph-like structure that eliminates the need for mining and enables faster and more scalable transactions?

(a) Blockchain
(b) Directed Acyclic Graph
(c) Holochain
(d) Hashgraph

(xii) A digital audit of a financial system is being conducted to evaluate the effectiveness of its IT General Controls (ITGCs). The audit team is assessing the purpose, scope, and organizational impact of ITGCs. Which of the following statements about ITGCs is **NOT** correct?

(a) ITGCs are essential for maintaining the confidentiality, integrity, and availability of systems and data
(b) ITGCs are designed to ensure data integrity and privacy; however, ITGCs are not able to provide any protection against external cyber threats
(c) ITGCs enhance stakeholder confidence by safeguarding sensitive data / information and supporting data privacy
(d) ITGCs aim to ensure data integrity and compliance with regulatory and legal requirements

(xiii) Square Automotive Limited (SAL) is in the process of migrating its legacy inventory system to a cloud-based platform. During the transition, the IT manager came to know that, to meet project timelines, the software development team implemented code changes directly to the production environment without prior testing in a separate test environment and without formal authorization.

Which of the following IT General Controls has been violated by SAL's software development team?

(a) IT operations controls
(b) Privileged access controls
(c) Program development controls
(d) Change management controls

(xiv) Which of the following is the examples of IT Operations Controls?

(a) User authentication and incident management
(b) Code reviews and role-based access control
(c) Incident management and system monitoring
(d) Environment controls and system monitoring

(xv) How do automated risk scanners primarily assist an organization in its risk management process?

(a) They simulate attacks on IT infrastructure to uncover security flaws
(b) They use predictive modeling techniques to anticipate future risks
(c) They detect unusual login attempts or unauthorized access attempts
(d) They monitor network traffic and send real-time alerts to security teams

QUESTION 2

(a) Trapezoid Airways (TA), after providing domestic travel services within Pakistan for one year, has recently commenced international flight operations to Middle Eastern countries.

The Database Management System (DBMS) of TA follows the standard three-level ANSI/SPARC architecture, which consists of three schema levels. However, employees of TA have reported several issues regarding the DBMS, which are summarized as follows:

- Two different passengers were able to book the same seat on Flight TA102. The system accepted both entries without generating an error message, resulting in duplicate seat allocation.
- A recently inducted junior flight attendant was able to view a screen in the crew portal displaying hourly pay rates of senior pilots, although access to such information was restricted to authorized senior management personnel only.
- Following the commencement of international operations, booking staff observed that there is no designated field available to store passengers' meal preferences.
- Passenger data is stored in an unencrypted form, which is non-compliance with the regulatory requirements.

Required:

(i) To resolve each of the reported issues, identify the appropriate level of the DBMS architecture at which the database administrator should implement changes. Also, suggest an appropriate corrective action. **(06 marks)**

(ii) Briefly explain each level of DBMS architecture identified in part (i) above. Also, provide any **two** characteristics of each identified level. **(06 marks)**

(b) TA's management has observed that, despite the availability of large volumes of data generated from online bookings, mobile applications, international check-ins, flight sensors, and customer service interactions, TA is facing several challenges in utilising this data effectively.

Management has noted that some records contain inconsistent information, while other data arrives in different formats from multiple systems. The IT department has reported increasing difficulties in storing and processing this growing volume of data efficiently, particularly during peak travel seasons during which system slowdown is common. Furthermore, the legal department has raised increasing concerns regarding the protection of sensitive passenger information.

Required:

Identify and briefly explain the Big Data challenges faced by TA and recommend a suitable solution to address each challenge. **(06 marks)**

QUESTION 3

(a) Pyramid Traders (Private) Limited (PTL) is a medium-sized trading company that stores all its inventory, sales, and customer data in a single large table maintained across multiple spreadsheets. Over time, different departments have added new data fields to meet their specific requirements. This has resulted in data duplication, update anomalies, and inconsistencies in reporting.

Due to the increasing volume of data and structural inefficiencies, PTL has been advised by a database consultant to implement database normalization to restructure its data.

Required:
Explain the concept of database normalization and discuss its importance for PTL. Also, describe the rules and prerequisites (if any) of the **three** most commonly used normal forms. **(06 marks)**

(b) Data security involves protecting data from unauthorized access, disclosure, alteration, and destruction. Organizations often use a multi-layered approach to safeguard their data assets.

Required:
Briefly explain any **five** data security practices that organizations can adopt to address emerging threats to data security. **(05 marks)**

(c) The expansion of data-driven decision making has significantly increased both the scope and complexity of data collection practices.

Required:
Briefly explain any **two** key considerations involved in data collection. Also, briefly discuss any **two** key ethical principles that govern data collection practices. **(04 marks)**

SECTION B

QUESTION 4

Ellipse Lifeline Hospital (ELH) operates a network of 65 hospitals across the country. The hospital group uses 'Spiral', which is an integrated application developed by a local software vendor, to manage ELH's operations, reporting and data processing. The application and database servers run on the Linux operating system and are hosted at ELH's head office data centre.

ELH has continued to use the older version of the Spiral despite the release of three newer versions over the past five years. Due to the tightly integrated (monolithic) architecture of the older version currently in use, incorporating changes or upgrades is complex and often leads to unexpected system issues. The latest version of Spiral adopts a modular system architecture and requires significantly upgraded hardware infrastructure.

A backup server for disaster recovery purposes has been installed in another city located approximately 1,250 km from the head office. Data is transferred to this backup server at the end of each month; however, restoration of the backup requires manual intervention by highly skilled technical staff. Last year, ELH experienced a major service disruption when the customer-facing reporting module of the Spiral remained unavailable for two days due to a hardware failure in the primary server. The prolong downtime was attributed to the lack of trained technical staff capable of executing the switchover to the backup system.

Required:

(a) Identify the system software and application software used by ELH and explain their respective roles within ELH's IT environment. **(04 marks)**

(b) Explain the concept of modular system design with reference to the latest version of the Spiral. Also, state any **two** advantages of modular system design. **(04 marks)**

(c) With reference to the service disruption experienced by ELH, explain why the mere presence of a backup server proved to be insufficient to ensure system availability. Also, briefly discuss how a properly designed redundancy and failover mechanism could have minimized the downtime. **(05 marks)**

QUESTION 5

Diamond Corporation (DC) is a rapidly growing multinational firm currently restructuring its digital footprint. To remain competitive, DC is preparing a 'Three-Pillar Modernization Plan', which includes the following initiatives:

(i) Evaluating infrastructure options for its Enterprise Resource Planning (ERP) system.
(ii) Transforming specialised staff training and enhancing customer experience through Virtual Reality (VR).
(iii) Implementing intelligent data processing systems to automate complex decision-making, preferably using neural networks, a core component of artificial intelligence modelled loosely on the structure and functioning of the human brain.

Required:

(a) Briefly explain any **two** distinct features of On-Premise ERP, Cloud ERP, and Hybrid ERP. **(06 marks)**

(b) Explain any **two** benefits and **two** challenges of VR. **(04 marks)**

(c) Explain how neural networks learn. Also, identify any **four** types of neural networks. **(05 marks)**

QUESTION 6

Cube Bank Limited (CBL) operates 800+ branches nationwide and serves 7 million customers through internet banking, a mobile banking application, and ATM networks. CBL processes over 5 million transactions daily, including fund transfers, bill payments, and remittances.

The following matters related to CBL have been brought to your attention:

(a) Recently, the following security incidents were reported to senior management:

(i) Multiple customers received fraudulent text messages and emails impersonating CBL officials, requesting them to click malicious links to verify account details. Similar emails were also sent to employees requesting their login credentials for CBL's official systems.

(ii) The IT security team discovered that three employees in the loan processing department had intentionally shared their login credentials with unauthorised persons, granting them access to sensitive customer financial data and credit histories of approximately 50,000 customers.

(iii) In February 2026, CBL's website experienced two separate incidents in which an unusually large volume of traffic from multiple unknown sources overwhelmed the system's capacity. As a result, internet banking services became unavailable for approximately four hours during peak banking periods, affecting customer transactions and causing reputational damage.

(iv) A laptop containing sensitive customer financial data was stolen from the branch premises. This was the second such incident reported within the same month.

Required:

For each incident described above, identify and explain the type of risk involved (digital risk, human risk, or physical risk). Also, recommend an appropriate mitigation strategy for each incident. **(07 marks)**

(b) During CBL's risk management committee meeting, the Chairman emphasised the need to implement a layered security model supported by proactive security defenses.

Required:

Briefly describe the layered security approach and explain any **two** security layers that CBL can implement as part of a robust cybersecurity strategy. Also, identify and briefly explain any **three** proactive security defenses that can help to prevent cybersecurity incidents in future. **(07 marks)**

(c) Recognizing the increasing cyber risk exposure, CBL attempted to recruit experienced cybersecurity professionals, including cybersecurity analysts and incident response specialists. However, despite multiple recruitment campaigns and attractive compensation packages, CBL has been unable to fill these critical roles due to a shortage of suitably skilled candidates.

Required:

Briefly explain any **five** practical measures that CBL can adopt to address its cybersecurity workforce challenge. **(05 marks)**

QUESTION 7

You have been engaged by Circle Textiles (CT), a manufacturer and retailer of high-quality fabrics, to review its IT environment.

During your review, you observed the following:

(i) CT is using an in-house information system that was originally developed ten years ago.

(ii) The information system has been modified several times; however, changes have not been properly documented.

(iii) Of the three original developers, two have left the organization. The remaining developer now leads the software development and maintenance team, which consists primarily of junior staff members.

(iv) The current head of IT department joined three years ago and has strong expertise in network security but limited experience in software development and IT governance.

(v) Although certain information security controls are in place, CT does not have a documented risk management process and does not follow any formal IT governance framework.

(vi) IT procurement decisions are made annually at the discretion of the IT Head. Recently, high-capacity servers were purchased that appear excessive for business requirements.

(vii) A recent data breach resulted in customers' names and phone numbers being leaked on social media. This incident damaged CT's reputation and led to regulatory penalties.

Required:
With reference to the issues identified in the scenario, explain **three** best practices which CT should adopt to ensure effective IT governance and management. Support your answer by clearly linking their benefits to specific weaknesses observed at CT. **(05 marks)**

(THE END)

DATA, SYSTEMS AND RISKS
Suggested Answer
Certificate in Accounting and Finance – Spring 2026

ANSWER 1

(i) **(c)**	(ii) **(b)**	(iii) **(d)**
(iv) **(c)**	(v) **(a)**	(vi) **(d)**
(vii) **(c)**	(viii) **(b)**	(ix) **(a)**
(x) **(d)**	(xi) **(b)**	(xii) **(b)**
(xiii) **(d)**	(xiv) **(c)**	(xv) **(a)**

ANSWER 2

(a) (i)

S.No.	Level of the DBMS architecture	Corrective action
(1)	Conceptual level	Add a unique constraint on combination of flight number and seat number to prevent duplicate seat bookings.
(2)	External level	Restrict user views and access privileges so that salary information is accessible only to authorized personnel.
(3)	Conceptual level	Add a new attribute (meal preference) to the passenger or booking entity in the database conceptual schema.
(4)	Internal level	Implement encryption at the storage level without affecting application functionality to ensure passenger data is securely stored.

(ii) An explanation of the three levels of DBMS architecture of TA requiring changes, along with their respective characteristics, is detailed as follows:

(1) External level

This is the highest level of abstraction in the DBMS architecture. It describes how data is perceived by individual users or groups of users. This level allows each user to have a customized view of the database tailored to their specific needs.

Characteristics of the external level (*any two*)

- **Customized views:** Different users can have different views of the same data, depending on their roles and access privileges.
- **Security:** Views can restrict access to sensitive data.
- **Simplification:** Users see data in a simplified format without needing to know the complexity of the underlying database structure.

(2) Conceptual level

The conceptual level defines the overall logical structure of the entire database. This level is responsible for defining the database schema, including entities, relationships, and constraints.

Characteristics of the conceptual level (*any two*)

- **Entity-relationship model:** At this level, data is modeled using entities, attributes, and relationships.
- **Data integrity and constraints:** This level defines data validation rules that ensure the accuracy and consistency of the data.
- **Independence from physical storage:** This level hides the physical details from users, so the users don't need to know how the data is stored or indexed.

(3) Internal level

This is the lowest level of the DBMS architecture, which deals with the physical storage of the database on disk or other storage devices. It describes how the data is physically stored, including the use of file structures, indexes, data blocks, and storage allocation strategies.

Characteristics of the internal level (*any two*)

- **Data storage techniques:** This level defines how data is stored on storage devices, such as the organization of data into blocks or pages.
- **Indexing:** Indexes are created to speed up the retrieval of data, allowing the DBMS to locate specific records quickly without scanning the entire database.
- **Data compression:** Data may be compressed at this level to save disk space and optimize storage usage.
- **Physical data access:** Includes low-level file access techniques, storage allocation, and buffer management.

(b) Challenges of Big Data faced by TA

(i) An issue relating to data quality has been identified since records contain inconsistent information, while other data arrives in different formats from multiple systems.

Challenge: Given the volume, velocity, and variety of Big Data, ensuring data quality is a major challenge for TA. Inaccurate, incomplete, or inconsistent data can lead to flawed insights and poor decision-making.

Recommendation: TA must implement rigorous data validation processes and cleansing techniques to ensure data quality. Furthermore, data standardization protocols should be applied to ensure uniformity, accuracy, and reliability of data across all sources.

(ii) An issue related to storage and processing has been identified since the IT department has reported difficulties in storing and processing this growing volume of data efficiently.

Challenge: Traditional databases at TA are inadequate for handling Big Data, as evidenced by system slowdowns during peak usage times. Storing and processing vast amounts of data requires specialized infrastructure.

Recommendation: TA should consider cloud storage and distributed computing platforms that are designed to handle Big Data workloads efficiently.

(iii) An issue related to data privacy and security has been identified on account of concerns raised regarding the protection of sensitive passenger information.

Challenge: With the growing use of Big Data, ensuring the privacy and security of sensitive information is critical. TA would be required to comply with data protection regulations while also safeguarding against cyber threats.

Recommendation: TA needs to implement strong encryption, access controls, and monitoring systems to protect sensitive data.

ANSWER 3

(a) Database normalization

Database normalization is a systematic process of organizing data in a relational database to minimize redundancy and ensure data integrity. By breaking down large tables into smaller, logically related ones and defining clear relationships between them, normalization reduces the risk of data anomalies during insertions, updates, or deletions.

Importance of database normalization for PTL

- Reduction of data redundancy by eliminating duplicate information.
- Elimination of data anomalies such as update, insertion, and deletion anomalies.
- Improved data consistency across reports and transactions.
- Enhanced data integrity by maintaining accurate and reliable records.
- Better performance and scalability as the volume of data grows.

Below are the rules, and prerequisites (where applicable) for the first three normal forms:

First Normal Form (1NF)

Rules	▪ All data in a column must be of the same type. ▪ No repeating groups or arrays in a single column. ▪ Each row must be uniquely identifiable (typically with a primary key).

Second Normal Form (2NF)

Rule	No attribute should depend on only part of a composite primary key.
Prerequisite	The table must already be in 1NF.

Third Normal Form (3NF)

Rule	All attributes must depend directly on the primary key, not indirectly through another attribute.
Prerequisite	The table must be in 2NF.

(b) The data security practices that organization can adopt to address emerging threats to data security are as follows:

S.No.	Practice *(any five)*	Explanation
(1)	**Encryption**	Using algorithms to encode data, ensuring it can only be accessed with the correct key.
(2)	**Multi-factor authentication**	Requiring multiple forms of verification to authenticate users, i.e., logging in with a password, an SMS code, and biometrics.
(3)	**Firewalls and intrusion detection systems (IDS)**	Monitoring and filtering network traffic to detect and block malicious activity and prevent unauthorized access. This includes a network firewall blocking suspicious IP addresses or an IDS alerting administrators of intrusion attempts.
(4)	**Endpoint Security**	Securing devices (employee laptops) that access organizational data through antivirus software and device encryption.
(5)	**Data loss prevention (DLP)**	Implementing DLP tools to monitor and prevent unauthorized data exfiltration. This can be done by blocking employees from emailing confidential and sensitive data outside the organization.
(6)	**Zero trust architecture**	Adopting a 'never trust, always verify' approach, where access is granted only after continuous verification of identity and context. Requiring identity verification every time a user accesses sensitive systems, even within the corporate network.
(7)	**Employee awareness**	Educating employees about data security policies, phishing attacks, social engineering techniques, and safe handling of sensitive information reduces the risk of human error.
(8)	**Regular data backup**	Performing daily automated backups and storing them in a secure cloud environment to ensure that data can be restored in case of cyberattacks, hardware failure, or accidental deletion.

(c) Key considerations for data collection include the following ***(any two)***:

Relevance	Ensuring that the data collected aligns with the organization's objectives.
Accuracy	Gathering data from reliable and valid sources.
Timeliness	Using data that reflects the current state of affairs to make informed decisions.
Security	Appropriate technical and organizational measures must be implemented to protect data from unauthorized use.
Integration	Data collected from different sources should be compatible and be able to be easily integrated for analysis.

Key ethical principles that govern data collection practices include the following ***(any two)***:

Privacy	Respecting individuals' rights to control their personal data.
Transparency	Ensuring that data collection practices are clear to individuals.
Security	Protecting collected data from unauthorized access or misuse.
Fairness	Avoiding bias in data collection that could lead to discrimination or unethical outcomes.

ANSWER 4

(a) The system software used by ELH is Linux, which is an operating system that manages the hardware resources of ELH and provides a platform for application software.

Role: The operating system acts as an interface between hardware and application software. It manages resources like processor usage, memory, storage, and input/output devices, ensures security and access control, and provides a stable environment for applications like Spiral to run efficiently. Without an operating system, application software cannot function.

Spiral is the application software used by ELH to manage hospital operations, reporting, and data processing.

Role: Application software is a program designed to help users perform business functions, analyse data, and interact with the system.

(b) Modular design involves breaking down the IT system into smaller, independent components, each responsible for a specific function. In modular design, each component operates independently of others, which enhances flexibility, ease of updates, and scalability. Changes to one module do not affect the others, making it easier to maintain and update systems without causing downtime or disruptions.

Advantages of modular systems *(any two)*:

(i) **Ease of maintenance and upgrades:** Troubleshooting and maintaining smaller, independent modules is simpler compared to monolithic systems. Changes can be made to one module without affecting the entire system, reducing risk of system-wide failures.

(ii) **Improved scalability and greater flexibility:** Individual modules can be upgraded or scaled independently to meet changing business or technological requirements without impacting the entire system.

(iii) **Better fault isolation:** Failure in one module does not bring down the whole system, and the failure is contained within that module, which improves the overall system reliability and availability.

(iv) **Faster development and testing:** Since modules are independent, development teams can work on different modules simultaneously. Each module can be tested separately before being integrated into the system, reducing errors and speeding up deployment.

(c) The mere presence of a backup server proved to be insufficient due to the following:

- Without an automated failover mechanism, the switch to a backup required human intervention. At ELH, the reliance on manual intervention by skilled technical staff led to a two-day outage because those resources were unavailable.
- The backup server did not have current data as the data transfer occurred at the month-end. If the system is not configured for real-time synchronization, the data on the backup may be outdated, leading to data loss or system inconsistencies upon recovery.

A properly designed redundancy and failover mechanism could have significantly reduced ELH's downtime by having redundant components, using which the business services can remain online even if part of the infrastructure fails.

Redundancy ensures that essential services remain operational during outages, thereby ensuring business continuity. Building redundancy into IT systems ensures that critical components have backups available in case of failure.

A failover mechanism is an automated process that switches to a backup system or component when the primary system fails. This approach minimizes downtime and ensures the continuous availability of services, which is essential for mission-critical applications.

ANSWER 5

(a) (i) Key features of an on-premise ERP ***(any two)***

- **Complete control over data:** The organization has full ownership and control of its data, ensuring it can manage it according to internal protocols.
- **Customizable:** On-premise ERP systems offer a high degree of customization, allowing businesses to tailor the system to meet specific operational needs.
- **Higher upfront costs:** The initial investment is higher due to the need for purchasing hardware, software licenses, and IT infrastructure.
- **IT resource intensive:** Requires in-house IT teams to manage, update, and maintain the system, including hardware maintenance, security updates, and backups.

(ii) Key features of cloud ERP ***(any two)***

- **Scalable:** These are highly scalable, allowing businesses to add or reduce users and resources as needed without the need for additional hardware investments.
- **Lower upfront costs:** These typically have lower upfront costs, as organizations don't need to invest in hardware or pay for extensive IT infrastructure.
- **Automatic updates:** Cloud ERP vendors handle system updates and security patches, ensuring the software stays current without requiring in-house IT intervention.
- **Accessibility:** Employees can access the system from anywhere with an internet connection, enabling remote work and multi-location collaboration.

(iii) Key features of hybrid ERP ***(any two)***

- **Flexible deployment:** Businesses can choose which modules or data to host on-premise and which to move to the cloud, depending on security, performance, and compliance needs.
- **Gradual migration to cloud:** This allows organizations with existing on-premise systems to gradually move to cloud systems, minimizing disruption to their operations.
- **Optimized costs:** By balancing on-premise and cloud solutions, businesses can optimize their IT budgets by keeping mission-critical systems on-premises while leveraging the cost advantages of cloud services for non-core functions.

(b) Benefits of virtual reality (VR) ***(any two)***

- **Enhanced user experience:** VR provides highly immersive and interactive experiences to engage the users in innovative ways, similar to a gaming environment.
- **Cost-effective training:** VR offers safe and cost-effective solutions for training in hazardous environments.
- **Remote interaction:** VR allows for virtual meetings reducing the need for physical presence.

Challenges of virtual reality (VR) ***(any two)***

- **Hardware requirements:** VR often requires specialized and expensive hardware like headsets and sensors, which can limit accessibility.
- **Content development:** Creating high-quality VR content requires advanced technology and expertise, which can be costly and time-consuming.
- **User discomfort:** Extended use of VR can cause discomfort such as motion sickness or eye strain in some users.

(c) Neural networks learn through a process called backpropagation, which involves:

Forward pass	Input data flows through the network to generate predictions.
Loss calculation	The error/loss between predicted and actual values is measured.
Backward pass	The network adjusts its internal weights to minimize this loss using algorithms like gradient descent.

The above process is repeated over multiple epochs until the network achieves acceptable performance.

Types of neural networks ***(any four):***

- Feedforward Neural Networks (FNN)
- Convolutional Neural Networks (CNN)
- Recurrent Neural Networks (RNN)
- Deep Neural Networks (DNN)
- Generative Adversarial Networks (GANs)

ANSWER 6

(a) (i) **Digital risk:** Phishing attacks consist of fraudulent communications that trick users into revealing credentials or clicking malicious links.

Mitigation strategy: Conduct regular training on recognizing phishing attempts and social engineering tactics. Use simulated phishing exercises to test employee readiness. Create customer awareness through recorded messages, text, or email.

(ii) **Human risk:** Malicious insiders i.e., CBL employees who intentionally misuse their access to steal data, sabotage systems, or facilitate external attacks.

Mitigation strategy: Behavioral monitoring by deploying user and entity behavior analytics to detect unusual activities, such as excessive data downloads or unauthorized access attempts. Establish clear security policies, including password requirements, data handling protocols, and incident reporting procedures.

(iii) **Digital risk:** Distributed denial of service attacks are made by overwhelming a system with traffic to disrupt its availability, often targeting websites or online services.

Mitigation strategy: Enhance cybersecurity defenses by deploying firewalls, intrusion detection and prevention systems to block malicious activities. Regularly update software with security patches to address known vulnerabilities.

(iv) **Physical risk:** Theft risk where unauthorized individuals steal hardware.

Mitigation strategy: Implement robust security controls such as biometric access systems, surveillance cameras, and on-site security personnel to prevent theft. Use secure storage for portable devices like laptops.

(b) Layered security

A layered security approach, also known as defense in depth, involves implementing multiple layers of protection to reduce the risk of breaches. Each layer works independently to address different aspects of cybersecurity, ensuring that even if one layer is compromised, others will still protect critical assets.

CBL can consider to implement following security layers ***(any two)***:

- Encryption ensures that sensitive data is converted into a secure format, unreadable by unauthorized individuals. Strong encryption protocol should be used for both data at rest and data in transit.
- Firewalls create a barrier between an internal network and external entities, filtering traffic based on security rules. Next-generation firewalls come equipped with advanced features enhancing their ability to detect and block threats beyond basic network traffic filtering.
- Security monitoring tools like Security Information and Event Management (SIEM) systems track and log all activity across the network to detect abnormal patterns. SIEM tools incorporate artificial intelligence and machine learning to detect anomalies faster.

Proactive security defenses that can help to prevent cybersecurity incidents are as follows:

- **Threat intelligence:** Advanced threat intelligence platforms gather and analyze data on the latest cyber threats, providing organizations with actionable insights to enhance their security posture. By anticipating new attack vectors and adopting threat intelligence feeds, organizations can proactively adjust their defenses.
- **Real-time monitoring:** Tools, such as SIEM systems, continuously scan the network for anomalies. These tools detect suspicious activities, log events, and alert cybersecurity teams when threats arise, allowing for quick responses.
- **Frequent risk assessments:** Conducting regular risk assessments ensures that organizations remain aware of potential vulnerabilities in their systems. Risk assessments should evaluate the organization's current cybersecurity posture, identify gaps, and recommend improvements.

(c) CBL can address the cybersecurity talent gap in the following manner ***(any five)***:

- Invest in training programs and certifications to develop cybersecurity expertise among existing IT and audit personnel.
- Outsource security operations to specialized firms would allow access to skilled professionals without hiring in-house human resources.
- Deploy tools that use artificial intelligence for threat detection, anomaly detection, and response automation to reduce manual workload and improve response times.
- Collaborate with governments and industry bodies to create cybersecurity boot camps, scholarships, and fast-track certification programs to grow the talent pool.
- Broaden recruitment by hiring from diverse backgrounds and offering flexible work arrangements to attract underrepresented groups in technology sector.
- Create internship opportunities, initiate fresh graduate hiring or specified skillset hiring, and train them as per requirement.

ANSWER 7

The best practices which CT should adopt to ensure an effective IT governance and management are as follows **(*any three*):**

(i) **Establish a clear IT governance structure for accountability:** Define roles, responsibilities, and decision-making authority within IT teams and between IT and business units. This ensures accountability and alignment between IT and business objectives.

The lack of documentation, dependence on one key developer, and discretionary procurement indicate weak governance structures. A formal framework defines roles, responsibilities, and decision-making authority.

(ii) **Alignment of IT with business strategy:** IT investments should directly support CT's overall strategy. An IT governance framework ensures that all IT projects are aligned with long-term goals and provide measurable benefits to the business.

Currently, IT-related procurement is done without a structured framework. The purchase of high-end servers beyond required capacity indicates misalignment between IT investments and business needs.

(iii) **Implement risk management processes:** Continuously assess IT risks and implement appropriate controls to mitigate them. This includes cybersecurity risks, data privacy concerns, and operational risks related to IT service availability.

CT does not have a documented risk management process. The recent data breach demonstrates inadequate risk identification and mitigation. An IT governance framework provides structured risk assessment and continuous monitoring to reduce cybersecurity and operational risks.

(iv) **Performance optimization and continuous improvement:** Use Key Performance Indicators (KPIs) to measure the success of IT initiatives. Regularly review and update IT processes to adapt to changing business needs and technological advancements.

Repeated system modifications without documentation may lead to inefficiencies and system vulnerabilities. Governance frameworks encourage performance measurement and continuous improvement. Use KPIs to measure the success of IT initiatives.

(v) **Ensure compliance with regulatory requirements to ensure data security:** Adhere to relevant regulations and industry standards for data privacy and payment security. Regular audits and assessments should be conducted to ensure compliance.

The data breach would result in regulatory penalties. IT governance frameworks ensure compliance with applicable laws and regulations, to avoid fines and reputational damage.

(vi) **Implement formal change management and documentation procedures:** CT should implement formal change management practices, including proper documentation, testing, and approval of system changes. This would ensure knowledge retention, improve system maintainability, and reduce reliance on a single employee.

CT's in-house system has been modified multiple times without proper documentation, and two of the original developers have left the organization. This creates significant operational risk and dependency on the remaining developer.

(THE END)

Certificate in Accounting and Finance Stage Examination

Data, Systems and Risks

9 March 2026
100 marks
3 hours and 15 minutes (including 15 minutes' reading time)

Instructions to examinees:
(i) Answer all **SEVEN** questions.
(ii) Answer in **black** pen only.
(iii) Use the first page of the answer script to answer the Multiple-Choice Questions.

SECTION A

QUESTION 1

Select the most appropriate answer from the options provided for each of the following Multiple-Choice Questions (MCQs). Each MCQ carries **ONE** mark.

(i) After purchasing a product, every customer of Rectangle Rings (RR) completes a survey to rate RR's customer service quality in one of four categories: Excellent, Good, Average, or Poor. At the end of each month, RR's manager calculates the percentage of customer responses in each category.

The original survey responses provided by the customers would be classified as:

(a) Nominal data
(b) Discrete data
(c) Ordinal data
(d) Continuous data

(ii) Which of the following best describes the activities undertaken at the tactical level of data governance?

(a) Implementing data standards, establishing governance frameworks, and monitoring progress
(b) Implementing data standards, developing implementation plans, and monitoring progress
(c) Managing data quality, managing metadata, and defining vision and goals
(d) Developing data governance policies, securing executive sponsorship, and managing metadata

(iii) Shahzad Ali, the Finance Manager of Arrow Associates, has prepared a dashboard that reports monthly sales for February 2026, analyses the decline in sales compared to February 2025, and recommends increasing discounts to 20% of the retail price for March 2026.

The recommendation provided by Shahzad Ali in the above dashboard reflects:

(a) Descriptive analytics
(b) Diagnostic analytics
(c) Predictive analytics
(d) Prescriptive analytics

(iv) Which of the following statements regarding the implications of data analytics is **NOT** correct?

(a) Data analytics provides valuable insights that enable organizations to make informed decisions
(b) Data analytics helps organizations identify inefficiencies and optimize performance
(c) Data analytics guarantees reliable insights regardless of the quality of the underlying data
(d) Data analytics helps companies gain a competitive advantage by enabling them to respond more quickly to market changes

(v) Cylinder Airline (Private) Limited (CAPL) streams real-time sensor data from various aircraft engines to detect potential faults during flights and initiate immediate corrective actions. However, despite heavy investment in technology, CAPL's system fails to process the collected data in real time.

CAPL's inability to process data in real time directly affects which characteristic of Big Data?

(a) Velocity (b) Veracity (c) Variety (d) Value

(vi) Nonagon Foods Limited (NFL) recently collected a large volume of data from online transactions, customer surveys, and sensors. Before performing detailed analysis, NFL's manager is resolving inconsistencies, handling missing values, and correcting data entry errors.

Which stage of the Data Analytics Cycle is being performed by NFL's manager?

(a) Data Collection
(b) Data Exploration
(c) Data Modeling
(d) Data Cleaning

(vii) Octagon Innovations (OI), a rapidly growing startup, does not want to invest in physical servers. Instead, OI has engaged a cloud provider to manage the data center and physical hardware. OI rents virtual machines, installs its own operating systems, and configures applications according to its business needs. The cloud service model being utilized by OI is:

(a) Software as a Service (SaaS)
(b) Platform as a Service (PaaS)
(c) Infrastructure as a Service (IaaS)
(d) Heroku

(viii) Sphere Hospital and Clinics (SHC) stores patient records in a dedicated cloud environment that is not shared with any other organization. The infrastructure is customized to meet SHC's specific regulatory and data privacy requirements.

Which of the following cloud deployment models is being utilized by SHC?

(a) Public Cloud
(b) Private Cloud
(c) Community Cloud
(d) Hybrid Cloud

(ix) Rhombus Creative Designers (RCD), a global marketing firm, uses a cloud-based collaborative platform to manage its international campaigns. Team members residing in London, Tokyo, and Beijing work on the same project files in real time. Employees access the cloud environment using company laptops and personal smartphones over various public and private network connections.

Which key cloud characteristic is most clearly demonstrated by RCD's setup?

(a) Broad network access
(b) Rapid elasticity
(c) Resource pooling
(d) Measured service

(x) Which of the following is the key components of a Blockchain?

(a) Blocks, Hashing, Consensus Mechanisms, Nodes, Cryptocurrencies
(b) Blocks, Hashing, Smart Contracts, Nodes, Hashgraph
(c) Blocks, Chain Propagation, Smart Contracts, Nodes, Holochain
(d) Blocks, Hashing, Consensus Mechanisms, Nodes

(xi) Which of the following types of Distributed Ledger Technology uses a non-linear, graph-like structure that eliminates the need for mining and enables faster and more scalable transactions?

(a) Blockchain
(b) Directed Acyclic Graph
(c) Holochain
(d) Hashgraph

(xii) A digital audit of a financial system is being conducted to evaluate the effectiveness of its IT General Controls (ITGCs). The audit team is assessing the purpose, scope, and organizational impact of ITGCs. Which of the following statements about ITGCs is **NOT** correct?

(a) ITGCs are essential for maintaining the confidentiality, integrity, and availability of systems and data
(b) ITGCs are designed to ensure data integrity and privacy; however, ITGCs are not able to provide any protection against external cyber threats
(c) ITGCs enhance stakeholder confidence by safeguarding sensitive data / information and supporting data privacy
(d) ITGCs aim to ensure data integrity and compliance with regulatory and legal requirements

(xiii) Square Automotive Limited (SAL) is in the process of migrating its legacy inventory system to a cloud-based platform. During the transition, the IT manager came to know that, to meet project timelines, the software development team implemented code changes directly to the production environment without prior testing in a separate test environment and without formal authorization.

Which of the following IT General Controls has been violated by SAL's software development team?

(a) IT operations controls
(b) Privileged access controls
(c) Program development controls
(d) Change management controls

(xiv) Which of the following is the examples of IT Operations Controls?

(a) User authentication and incident management
(b) Code reviews and role-based access control
(c) Incident management and system monitoring
(d) Environment controls and system monitoring

(xv) How do automated risk scanners primarily assist an organization in its risk management process?

(a) They simulate attacks on IT infrastructure to uncover security flaws
(b) They use predictive modeling techniques to anticipate future risks
(c) They detect unusual login attempts or unauthorized access attempts
(d) They monitor network traffic and send real-time alerts to security teams

QUESTION 2

(a) Trapezoid Airways (TA), after providing domestic travel services within Pakistan for one year, has recently commenced international flight operations to Middle Eastern countries.

The Database Management System (DBMS) of TA follows the standard three-level ANSI/SPARC architecture, which consists of three schema levels. However, employees of TA have reported several issues regarding the DBMS, which are summarized as follows:

- Two different passengers were able to book the same seat on Flight TA102. The system accepted both entries without generating an error message, resulting in duplicate seat allocation.
- A recently inducted junior flight attendant was able to view a screen in the crew portal displaying hourly pay rates of senior pilots, although access to such information was restricted to authorized senior management personnel only.
- Following the commencement of international operations, booking staff observed that there is no designated field available to store passengers' meal preferences.
- Passenger data is stored in an unencrypted form, which is non-compliance with the regulatory requirements.

Required:

(i) To resolve each of the reported issues, identify the appropriate level of the DBMS architecture at which the database administrator should implement changes. Also, suggest an appropriate corrective action. **(06 marks)**

(ii) Briefly explain each level of DBMS architecture identified in part (i) above. Also, provide any **two** characteristics of each identified level. **(06 marks)**

(b) TA's management has observed that, despite the availability of large volumes of data generated from online bookings, mobile applications, international check-ins, flight sensors, and customer service interactions, TA is facing several challenges in utilising this data effectively.

Management has noted that some records contain inconsistent information, while other data arrives in different formats from multiple systems. The IT department has reported increasing difficulties in storing and processing this growing volume of data efficiently, particularly during peak travel seasons during which system slowdown is common. Furthermore, the legal department has raised increasing concerns regarding the protection of sensitive passenger information.

Required:

Identify and briefly explain the Big Data challenges faced by TA and recommend a suitable solution to address each challenge. **(06 marks)**

QUESTION 3

(a) Pyramid Traders (Private) Limited (PTL) is a medium-sized trading company that stores all its inventory, sales, and customer data in a single large table maintained across multiple spreadsheets. Over time, different departments have added new data fields to meet their specific requirements. This has resulted in data duplication, update anomalies, and inconsistencies in reporting.

Due to the increasing volume of data and structural inefficiencies, PTL has been advised by a database consultant to implement database normalization to restructure its data.

Required:
Explain the concept of database normalization and discuss its importance for PTL. Also, describe the rules and prerequisites (if any) of the **three** most commonly used normal forms. **(06 marks)**

(b) Data security involves protecting data from unauthorized access, disclosure, alteration, and destruction. Organizations often use a multi-layered approach to safeguard their data assets.

Required:
Briefly explain any **five** data security practices that organizations can adopt to address emerging threats to data security. **(05 marks)**

(c) The expansion of data-driven decision making has significantly increased both the scope and complexity of data collection practices.

Required:
Briefly explain any **two** key considerations involved in data collection. Also, briefly discuss any **two** key ethical principles that govern data collection practices. **(04 marks)**

SECTION B

QUESTION 4

Ellipse Lifeline Hospital (ELH) operates a network of 65 hospitals across the country. The hospital group uses 'Spiral', which is an integrated application developed by a local software vendor, to manage ELH's operations, reporting and data processing. The application and database servers run on the Linux operating system and are hosted at ELH's head office data centre.

ELH has continued to use the older version of the Spiral despite the release of three newer versions over the past five years. Due to the tightly integrated (monolithic) architecture of the older version currently in use, incorporating changes or upgrades is complex and often leads to unexpected system issues. The latest version of Spiral adopts a modular system architecture and requires significantly upgraded hardware infrastructure.

A backup server for disaster recovery purposes has been installed in another city located approximately 1,250 km from the head office. Data is transferred to this backup server at the end of each month; however, restoration of the backup requires manual intervention by highly skilled technical staff. Last year, ELH experienced a major service disruption when the customer-facing reporting module of the Spiral remained unavailable for two days due to a hardware failure in the primary server. The prolong downtime was attributed to the lack of trained technical staff capable of executing the switchover to the backup system.

Required:

(a) Identify the system software and application software used by ELH and explain their respective roles within ELH's IT environment. **(04 marks)**

(b) Explain the concept of modular system design with reference to the latest version of the Spiral. Also, state any **two** advantages of modular system design. **(04 marks)**

(c) With reference to the service disruption experienced by ELH, explain why the mere presence of a backup server proved to be insufficient to ensure system availability. Also, briefly discuss how a properly designed redundancy and failover mechanism could have minimized the downtime. **(05 marks)**

QUESTION 5

Diamond Corporation (DC) is a rapidly growing multinational firm currently restructuring its digital footprint. To remain competitive, DC is preparing a 'Three-Pillar Modernization Plan', which includes the following initiatives:

(i) Evaluating infrastructure options for its Enterprise Resource Planning (ERP) system.
(ii) Transforming specialised staff training and enhancing customer experience through Virtual Reality (VR).
(iii) Implementing intelligent data processing systems to automate complex decision-making, preferably using neural networks, a core component of artificial intelligence modelled loosely on the structure and functioning of the human brain.

Required:

(a) Briefly explain any **two** distinct features of On-Premise ERP, Cloud ERP, and Hybrid ERP. **(06 marks)**

(b) Explain any **two** benefits and **two** challenges of VR. **(04 marks)**

(c) Explain how neural networks learn. Also, identify any **four** types of neural networks. **(05 marks)**

QUESTION 6

Cube Bank Limited (CBL) operates 800+ branches nationwide and serves 7 million customers through internet banking, a mobile banking application, and ATM networks. CBL processes over 5 million transactions daily, including fund transfers, bill payments, and remittances.

The following matters related to CBL have been brought to your attention:

(a) Recently, the following security incidents were reported to senior management:

(i) Multiple customers received fraudulent text messages and emails impersonating CBL officials, requesting them to click malicious links to verify account details. Similar emails were also sent to employees requesting their login credentials for CBL's official systems.

(ii) The IT security team discovered that three employees in the loan processing department had intentionally shared their login credentials with unauthorised persons, granting them access to sensitive customer financial data and credit histories of approximately 50,000 customers.

(iii) In February 2026, CBL's website experienced two separate incidents in which an unusually large volume of traffic from multiple unknown sources overwhelmed the system's capacity. As a result, internet banking services became unavailable for approximately four hours during peak banking periods, affecting customer transactions and causing reputational damage.

(iv) A laptop containing sensitive customer financial data was stolen from the branch premises. This was the second such incident reported within the same month.

Required:

For each incident described above, identify and explain the type of risk involved (digital risk, human risk, or physical risk). Also, recommend an appropriate mitigation strategy for each incident. **(07 marks)**

(b) During CBL's risk management committee meeting, the Chairman emphasised the need to implement a layered security model supported by proactive security defenses.

Required:

Briefly describe the layered security approach and explain any **two** security layers that CBL can implement as part of a robust cybersecurity strategy. Also, identify and briefly explain any **three** proactive security defenses that can help to prevent cybersecurity incidents in future. **(07 marks)**

(c) Recognizing the increasing cyber risk exposure, CBL attempted to recruit experienced cybersecurity professionals, including cybersecurity analysts and incident response specialists. However, despite multiple recruitment campaigns and attractive compensation packages, CBL has been unable to fill these critical roles due to a shortage of suitably skilled candidates.

Required:

Briefly explain any **five** practical measures that CBL can adopt to address its cybersecurity workforce challenge. **(05 marks)**

QUESTION 7

You have been engaged by Circle Textiles (CT), a manufacturer and retailer of high-quality fabrics, to review its IT environment.

During your review, you observed the following:

(i) CT is using an in-house information system that was originally developed ten years ago.

(ii) The information system has been modified several times; however, changes have not been properly documented.

(iii) Of the three original developers, two have left the organization. The remaining developer now leads the software development and maintenance team, which consists primarily of junior staff members.

(iv) The current head of IT department joined three years ago and has strong expertise in network security but limited experience in software development and IT governance.

(v) Although certain information security controls are in place, CT does not have a documented risk management process and does not follow any formal IT governance framework.

(vi) IT procurement decisions are made annually at the discretion of the IT Head. Recently, high-capacity servers were purchased that appear excessive for business requirements.

(vii) A recent data breach resulted in customers' names and phone numbers being leaked on social media. This incident damaged CT's reputation and led to regulatory penalties.

Required:
With reference to the issues identified in the scenario, explain **three** best practices which CT should adopt to ensure effective IT governance and management. Support your answer by clearly linking their benefits to specific weaknesses observed at CT. **(05 marks)**

(THE END)