CERTIFIED PUBLIC ACCOUNTANT

FOUNDATION LEVEL 2 EXAMINATIONS

F2.3: INFORMATION SYSTEMS

DATE: TUESDAY,30 NOVEMBER 2021

MODEL ANSWER AND MARKING GUIDE

QUESTION ONE:

Qn	Description	Marks
a	Six primary strategic business objectives of investing in information systems: Should be briefly explained 6 objectives * 1 mark = 6 max marks Simply listed objectives score 0.5 marks (Consider different explanations offered by candidates)	6
b		2
	Digital Economy: The description should cite key aspects such as digital computing technologies, digital and internet usage by economies 2 maximum marks awarded (Award 1 mark for a poor or overly simple/short description	
	Digital Firm: The description should cite key aspects such as usage of digital networks and information systems by firms 2 maximum marks awarded (Award 1 mark for a poor or overly simple/short description)	2
c	Enterprise Resource Planning (ERP) Systems 2 maximum marks awarded (Award 1 mark for a poor or overly simple/short description)	2
	Supply Chain Management (SCM) Systems 2 maximum marks awarded (Award 1 mark for overly simple/short description)	2
	Customer Relationship Management (CRM) Systems 2 maximum marks awarded (Award 1 mark for a poor or overly simple/short description)	2
	Knowledge Management Systems (KMS) 2 maximum marks awarded (Award 1 mark for a poor or overly simple/short description)	2
	Decision-Support Systems (DSSs) 2 maximum marks awarded (Award 1 mark for a poor or overly simple/short description)	2
	Total	**20**

Detailed Answer

a) Advise Ms Kampeta on SIX primary strategic business objectives of investing in information systems.

Business firms invest in information systems to accomplish six primary strategic business objectives:

- Operational excellence: Efficiency, productivity and improved changes in business practice and management behavior
- New products, services, and business models: A business model describes how a company produces, delivers and sells a product or service to generate profit. Information systems and technologies create opportunities for products, services, and new ways to engage in business.
- Customer and supplier intimacy: Improved communication and enhanced services to customers will help raise revenues. Closer relationships with suppliers will lead to lower costs of supplies.
- Improved decision making: Accurate and timely information is essential if business managers are to make the best possible decisions.
- Competitive advantage: Implementing effective and efficient information systems can allow a company to charge less than competitors for quality products, leading to higher sales and profits.
- Survival: Information systems can also be a necessity of doing business. A necessity may be driven by industry-level changes, such as the widespread adoption by many airlines of online booking of flights and check-in. A necessity may also be driven by governmental regulations, such as one requiring a business to retain data and report specific information for a period of time.
- Low-cost leadership: Information systems help companies cut down on costs and outcompete others as a result.

b) Differentiate a Digital Economy from a Digital Firm.

A Digital economy Digital economy refers to an economy that is based on digital computing technologies, although we increasingly perceive this as conducting business through markets based on the internet and the World Wide Web. Increasingly, the digital economy is intertwined with the traditional economy, making a clear delineation harder. It results from billions of everyday online connections among people, businesses, devices, data, and processes. It is based on the interconnectedness of people, organizations, and machines that results from the Internet, mobile technology and the internet of things (IoT).

Digital economy is underpinned by the spread of Information and Communication Technologies (ICT) across all business sectors to enhance its productivity. Digital transformation of the economy is undermining conventional notions about how businesses are structured, how consumers obtain services, information, and goods and how countries need to adapt to these new regulatory challenges.

WHEREAS

A **Digital firm** is a term used to describe a company that has enabled its key business relationships with customers, suppliers, employees, and business partners using digital networks and information systems. Information technology is also used widely throughout the organisation to support key functions and to manage internal processes. These information systems include Enterprise Resource Planning (ERP) Systems, Supply Chain Management (SCM) Systems, Customer Relationship Management (CRM) Systems, and Knowledge Management Systems. The aim of the digital firm is to integrate functions and systems to enable the seamless exchange of information between internal employees and externally with suppliers, business partners and customers.

c) Briefly describe the following enterprise applications and information systems:.

i. **Enterprise Resource Planning (ERP) systems**: ERP systems model and automate many business processes, for instance filling an order or scheduling a shipment, with the objective of integrating information throughout the company and eradicating complex, costly links between computer systems in different areas of the business. Information that was in the past split between different systems can now effortlessly flow throughout the company, allowing it to be shared by business processes in manufacturing, accounting, human resources and other areas of the organisation. Distinct business processes from sales, production, finance and logistics can be integrated into company-wide business processes that flow across organizational levels and functions.

ii. **Supply Chain Management Systems**: Supply chain management (SCM) systems facilitate businesses with managing relationships with their suppliers. These systems help suppliers, purchasing firms, distributors and logistics companies share information about orders, production, inventory levels, and delivery of products and services so that they can source, produce and deliver goods and services more efficiently.

iii. **Customer relationship management (CRM) systems** focus on coordinating the business processes regarding a firm's interactions with its customers in sales, marketing, and service, to fully optimize profits, customer satisfaction and customer retention. They merge customer data from numerous sources and communication channels to enable firms to identify profitable customers, acquire new customers, improve service and support and target products and services more accurately to particular customers' preferences.

iv. **Knowledge Management Systems (KMS):** KMS enable organisations to better manage processes for capturing and applying knowledge and expertise. These systems collect all relevant knowledge and experience in the firm and make it available wherever and whenever it is needed to improve business processes and management decisions. They also link the firm to external sources of knowledge.

v. **Decision-Support Systems (DSSs)**: Decision support systems (DSS) or business intelligence systems, are systems which assist managers with non-routine decisions that are unique, rapidly changing and not easily specified in advance (semi structured decision-making). DSS are more analytical than Management Information Systems, as they use a

variety of models to analyse internal and external data or compress large quantities of data for analysis. DSS are generally used at the middle management level. Decision-support systems are used for complex "what-if" questions that necessitate internal and external data. Decisions made at this management level are predominantly semi-structured so the information system needs to be able to respond to the unique needs of the managers. A selection of decision-support systems includes sales region analysis, production scheduling, profitability analysis and contract cost analysis.

QUESTION TWO:

Qn	Description	Marks
a	Why computer-based systems tend to be more vulnerable:	
	4 reasons * 1 mark = 4 maximum marks	
	Simply listed answers score 0.5 marks	
	Consider other logical reasons offered by candidates	4
b	Spoofing attacks	
	Consider any explanation that involves hiding of a hacker's identity or redirecting a web link	
	A poor explanation scores 1 mark	2
	Sniffing attacks	
	Consider any explanation that involves eavesdropping program and stealing information	
	A poor explanation scores 1 mark	2
c	SIX principal general information system controls:	
	Should be discussed in detail	
	6 controls * 2 marks = 12 maximum marks	
	Unexplained answers earn 1 mark	
	Consider alternative explanations of the six controls by candidates	12
	Total	**20**

Detailed Answer

a) State why the computer-based systems tend to be more vulnerable to damage, error, and fraud than manual systems.

Computer-based systems tend to be more vulnerable to damage, error, and fraud than manual systems for the following reasons:

- Data are stored in electronic format and are therefore not visible or easily auditable.
- Data are concentrated in electronic files and databases. A disaster such as a hardware or software fault, power failure or fire can be more far-reaching. An organization's entire record-keeping system could be destroyed.
- There may not be a visible trail to indicate what occurred for every computer process so errors entered in data can be very difficult to detect.
- Computer programs are also vulnerable as errors can be accidentally introduced when updates to the programs are installed. It can also be possible for programmers to make unauthorized changes to working systems.
- Many information systems can be accessed through telecommunications, and telecommunications can produce errors in data transmission.
- Data in files or databases can be accessed and manipulated directly in online systems. The data can be stolen, corrupted or damaged by hackers and computer viruses.
- Hardware equipment can be stolen – this is a growing problem because of the growth in mobile computing.

b) Differentiate between spoofing and sniffing attacks.

Spoofing involves hiding of a hacker's identity or email addresses or redirecting a web link to a different web site setup up by the hacker. The aim of spoofing is to trick users to provide information such as login names and passwords and account information to the outsider. For example, if hackers redirect customers to a fake website that looks almost exactly like the true site, they can then collect and process orders, effectively stealing business as well as sensitive customer information from the true site.

A sniffer is an eavesdropping program that monitors network information and can enable hackers to steal information transmitting over the network. The sniffer program searches for passwords or other content in packet of data as they pass through the Internet or other network. When used legitimately, sniffers help identify potential network trouble spots or criminal activity on networks, but when used for criminal purposes, they can be damaging and very difficult to detect. Sniffers enable hackers to steal proprietary information from anywhere on a network, including email messages, company files, and confidential reports.

c) Explain SIX principal general information system controls that companies can establish to strengthen their information technology infrastructure control environment.

General controls govern the design, security, and use of computer programs and the security of data files in general throughout the organization's information technology infrastructure. They include the following:.

- Computer software security can be promoted by program security controls to prevent unauthorized changes to programs in production systems. Software security is also promoted by system software controls that prevent unauthorized access to system software and log all system activities.
- Computer hardware security can be promoted by locating hardware in restricted rooms where only authorized individuals can access it. Special safeguards against fire, high temperature, and electric power disruptions can be implemented.
- Computer operations controls oversee the work of the computer department, ensuring that procedures for storage and processing of data are followed. Computer operations controls include the setup of computer processing jobs, computer operations and computer backup and restore procedures.
- Data security controls prevent unauthorized changes, deletion or access to data while the data is in use or in storage. Data security software can be configured to restrict access to individual files, data fields or groups of records. Data security software often features logs that record users who access or update files. Data storage media can be physically secured to prevent access by unauthorized personnel.
- System implementation controls ensure that the systems development process is properly controlled and managed. A system development audit checks that formal reviews and signoff were done by users and management at the various stages of the development process. The audit should look for the use of controls and quality assurance techniques for program development, conversion and testing and for complete system documentation.
- Administrative controls are formalized standards, rules, procedures and control disciplines to ensure the organizations general and application controls are properly executed and enforced.

QUESTION THREE:

Qn	Description	Marks
a	FOUR advantages and FOUR disadvantages of Cloud Computing: Each of the advantages/disadvantages should be simply outlined. 4 advantages * 1 mark (4 maximum marks) + 4 disadvantages * 1 mark (4 maximum marks) = 8 maximum marks Consider other logical advantages/disadvantages proposed by a candidate	8
b	Virtualization (Consider alternative valid explanations)	2
	Quantum computing (Consider alternative valid explanations)	2
c	FOUR main trends in contemporary software platforms: Should be discussed briefly	

Qn	Description	Marks
	1. Linux and Open-Source Software: A correct mention of Linux and Open-Source Software = 1 mark A correct description = 1 mark	2
	2. Software for the Web: A correct mention of Software for the Web = 1 mark A correct description of any of the software eg java, HTML= 1 mark	2
	3. Software Outsourcing and Cloud Services: A correct mention of Software Outsourcing and Cloud Services or one of them = 1 mark A correct description either Software Outsourcing or Cloud Services or any of their examples i.e software package, Software outsourcing, Cloud-based software = 1 mark	2
	4. Web Services and Service-Oriented Architecture: A correct mention of Web Services and Service-Oriented Architecture or one of them = 1 mark A correct description either Web Services and Service-Oriented Architecture = 1 mark	2
	Total	**20**

Detailed Answer

a) Outline FOUR advantages and FOUR disadvantages of Cloud Computing.

The advantages associated with cloud computing include:

- It is not dependent on physical location of either resources or users.
- Users access computing resources on their own and are not necessarily dependent on IT staff.
- It is based on standard network and internet devices.
- Resources serve multiple users with computing virtually assigned according to need. • Resources are increased or decreased according to demand.
- Charges are based on the amount of resources actually used.
- Large investments in Information Technology (IT) infrastructure are not necessarily needed or investments are significantly reduced.

- Firms can shift additional processing requirements to cloud computing during peak business periods.
- It allows a more flexible IT infrastructure.

The disadvantages associated with cloud computing includes:

- Responsibility for data storage and control is transferred away from the organization to a third party.
- Security risks and chances of data compromises are increased.
- Risk diminishing system reliability.
- Increased dependency on a third party.
- Huge investments in proprietary systems supporting unique business processes may be at risk.

b) Briefly describe the following trendy technologies:.

i. **Virtualization:** Virtualization is the process of presenting a set of computing resources (such as computing power or data storage) so that they can all be accessed in ways that are not restricted by physical configuration or geographic location. Virtualization enables a single physical resource (such as a server or a storage device) to appear to the user as multiple logical resources. For example, a server or mainframe can be configured to run many instances of an operating system (or different operating systems) so that it acts like many different machines.

ii. **Quantum computing**: Quantum computing is a type of computation that harnesses the collective properties of quantum states, such as superposition, interference, and entanglement, to perform calculations. The devices that perform quantum computations are known as quantum computers. They are believed to be able to solve certain computational problems, such as integer factorization (which underlies RSA encryption), substantially faster than classical computers. While conventional computers handle bits of data as either 0 or 1 but not both, quantum computing can process units of data as 0, 1, or both simultaneously.

c) Discuss FOUR main trends in contemporary software platforms.

1. **Linux and Open-Source Software:** Open-source software is computer software for which the source code and certain other rights normally reserved for copyright holders are provided under a software license that meets the Open-Source definition or that is in the public domain. Open-source software is produced and maintained by a global community of programmers and is downloadable for free. Users can use, change, and improve the software, and redistribute it in modified or unmodified forms. It is very often developed in a public, collaborative manner. Popular open source software tools include the Linux operating system, the Apache HTTP web server, the Mozilla Firefox web browser, and the Apache OpenOffice desktop productivity suite.

   Linux is a powerful, resilient open-source operating system that can run on multiple hardware platforms and is used widely to run Web servers. Linux is virtually free, meaning expensive operating licenses are practically eliminated. Support is available through the

open-source Linux community. Other help is increasingly becoming more available as more companies migrate towards this software.

2. **Software for the Web: Java, HTML, and HTML5**: **Java** is a programming language that delivers only the software functionality needed for a particular task. With Java, the programmer writes small programs called applets that can run on another machine on a network. With Java, programmers write programs that can execute on a variety of operating systems and environments. Further, any program could be a series of applets that are distributed over networks as they are needed and as they are upgraded. Java is important because of the dramatic growth of Web applications. Java is an operating system that can run on multiple hardware platforms and is used widely to run Web servers. It provides a standard format for data exchange and for Web page descriptions. **Hypertext Markup Language (HTML)** is a page description language for specifying how text, graphics, video, and sound are placed on a web page and for creating dynamic links to other web pages and objects. Using these links, a user need only point at a highlighted keyword or graphic, click on it, and immediately be transported to another document.
3. **Software Outsourcing and Cloud Services:** Today, many business firms continue to operate legacy systems that continue to meet a business need and that would be extremely costly to replace. But they will purchase or rent most of their new software applications from external sources. There are three external sources for software: software packages from a commercial software vendor (most ERP systems), outsourcing custom application development to an external vendor (which may or may not be offshore), and cloud-based software services and tools (SaaS/PaaS). **A software package** is a prewritten commercially available set of software programs that eliminates the need for a firm to write its own software programs for certain functions, such as payroll processing or order handling. **Software outsourcing** enables a firm to contract custom software development or maintenance of existing legacy programs to outside firms, which often operate offshore in low-wage areas of the world. **Cloud-based software** and the data it uses are hosted on powerful servers in data centers and can be accessed with an Internet connection and standard web browser. A leading example of software as a service (SaaS) is Salesforce.com. In order to manage their relationship with an outsourcer or technology service provider, firms need a contract that includes a service level agreement (SLA). .
4. **Web Services and Service-Oriented Architecture**: **Web services** refer to a set of loosely coupled software components that exchange information with each other using standard Web communication standards and languages. They can exchange information between two different systems regardless of the operating systems or programming languages on which the systems are based. The collection of web services that are used to build a firm's software systems constitutes what is known as a service-oriented architecture. A **service-oriented architecture (SOA)** is set of self-contained services that communicate with each other to create a working software application. Business tasks are accomplished by executing a series of these services. Software developers reuse these services in other combinations to assemble other applications as needed.

QUESTION FOUR:

Qn	Description	Marks
a	THREE types of physical transmission media	
	Twisted pair wire (CAT 5): Correct mention of the type i.e Twisted pair	0.5
	Correct description of Twisted pair (consider other logical descriptions)	1
	Correct speed	0.5
	Coaxial cable:Correct mention of the type i.e Coaxial cable	0.5
	Correct description of Coaxial cable (consider other logical descriptions)	1
	Correct speed	0.5
	Fiber-optic cable:Correct mention of the type i.e Fiber-optic cable	0.5
	Correct description of Fiber-optic cable (consider other logical descriptions)	1
	Correct speed	0.5
b	Leased Line (Consider any valid description)	2
	A poor description is awarded 1 mark	
	Digital Subscriber Line (DSL) (Consider any valid description)	2
	A poor description is awarded 1 mark	
c	Blockchain:	
	A description of blockchain being a distributed database/ledger or a similar mention	1
d	How the Domain Name and Internet Protocol (IP) Addressing System works:	
	A valid description of how the Internet works and how it is linked to the Internet Protocol (IP) address	1
	Any valid discussion of Internet Protocol (IP) address and/or its format	1
	A valid description of how a Domain Name System (DNS) converts IP addresses to domain names	1
	Any valid example of a web page used in the discussion	1
	Any valid explanation of a Domain Name System	1
	A valid graphic demonstration of the Domain Name System	1
e	THREE devices for wireless transmission:	3
	A simple outline/mention is sufficient and explaining is not penalised	

Qn	Description	Marks
	3 devices * 1 mark = 3 maximum marks Consider other possible devices	
	Total	**20**

Detailed Answer

a) Tabulate THREE types of physical transmission media used by networks clearly indicating the type, brief description, and speed for each type.

1.

Transmission medium	Description	Speed
1 Twisted pair wire (CAT 5)	Strands of copper wire twisted in pairs for voice and data communications. Twisted pairs of copper wires are used mostly for analogue voice signals but also for data. CAT 5 is the most common 10 Mbps LAN cable. Maximum recommended run of 100 meters.	10–100+ Mbps
2 Coaxial cable	Thickly insulated copper wire, which is capable of high-speed data transmission and less subject to interference than twisted wire. Currently used for cable TV and for networks with longer runs (more than 100 meters).	Up to 1 Gbps
3 Fiber-optic cable	Strands of clear glass fiber, transmitting data as pulses of light generated by lasers. Useful for high-speed transmission of large quantities of data. More expensive than other physical transmission media; used for last-mile delivery to customers and the Internet backbone.	15 Mbps to 6+ Tbps

b) Distinguish between Leased Line and Digital Subscriber Line (DSL) broadband network service technologies.

Leased Line: This is a permanent connection between two points normally set up by a telecommunications company. Typically, leased lines are used by businesses to connect geographically distant offices. Unlike normal dial-up connections, a leased line is always active. The fee for the connection is a fixed monthly rate. The primary factors affecting the monthly fee are the distance between end points and the speed of the circuit. Because the connection doesn't

carry anybody else's communications, the carrier (supplier) can assure the business (customer) a certain level of quality where as

Digital Subscriber Line (DSL) Broadband: DSL technologies use sophisticated modulation schemes to send data at high speeds over standard copper telephone wires. DSL can be used to provide high-speed connection to the internet.

c) Define the term blockchain.

Blockchain: Distributed ledger system that stores permanent and tamper-proof records of transactions and shares them among a distributed network of computers.

OR **Blockchain** is a distributed database technology that enables firms and organizations to create and verify transactions on a network nearly instantaneously without a central authority.

d) Demonstrate how the Domain Name and Internet Protocol (IP) Addressing System works.

The Internet is based on the Transmission Control Protocol/Internet Protocol **(TCP/IP)** networking protocol suite. Every device connected to the Internet (or another TCP/IP network) is assigned a unique Internet Protocol (IP) address consisting of a string of numbers. When a user sends a message to another user on the Internet or another TCP/IP network, the message is first decomposed into packets. Each packet contains its destination address. The packets are then sent from the client to the network server and from there on to as many other servers as necessary to arrive at a specific computer with a known address. At the destination address, the packets are reassembled into the original message. The format of an IP address is a 32-bit numeric address written as four numbers separated by periods. Each number can be zero to 255. For example, 1.10.10.220 could be an IP address.

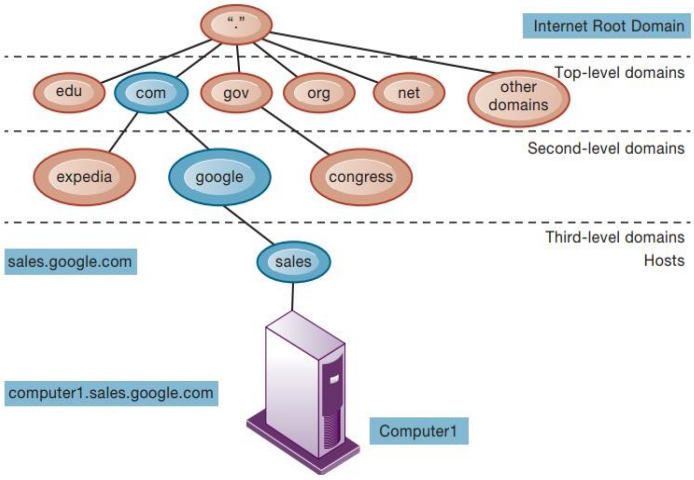
A Domain Name System (DNS) converts IP addresses to domain names. A name identifies one or more IP addresses. For example, the domain name Microsoft.com represents about a dozen IP addresses. Domain names are used in Uniform Resource Locators (URLs) to identify particular web pages. For example, in the https://www.icparwanda.com, the domain name is icparwanda.com. DNS has a hierarchical structure (see Figure 4.1) At the top of the DNS hierarchy is the root domain. The child domain of the root is called a top-level domain, and the child domain of a top-level domain is called a second-level domain. Top-level domains are two- and three-character names you are familiar with from surfing the web; for example, .com, .edu, .gov, and the various country codes such as .rw for Rwanda. Second-level domains have two parts, designating a top-level name and a second-level name—such as buy.com or mtn.co.rw. A host name at the bottom of the hierarchy designates a specific computer on either the Internet or a private network. The following list shows the most common domain extensions currently available and officially approved. Countries also have domain names such as .rw, .uk, .au, and .fr (Rwanda, United Kingdom, Australia, and France, respectively), and

there is a new class of internationalized top-level domains that use non-English characters. Every domain name has a suffix that indicates which top-level domain (TLD) it belongs to.

There are only a limited number of such suffixes. For example:

- gov - Government agencies
- edu - Educational institutions
- org - Organizations (non-profit)
- mil - Military
- com - commercial business
- net - Network organizations

Figure 4.1: The Domain Name System



e) List THREE devices for wireless transmission.

Devices for wireless transmission include:

1. E-mail handheld devices
2. Cellular telephones (Cell phones)
3. Smart phones such as the iPhone, Android phones, and BlackBerry
4. Tablets
5. Wireless-enabled personal computers etc

QUESTION FIVE:

Qn	Description	Marks
a	Internet business models:	5
	Each model should be briefly stated with no need for detailed explanations	
	5 models * 1 mark = 5 maximum marks	
	Only listed answers are awarded 0.5 marks	
	Consider any five models	
b	FIVE e-commerce benefits to businesses:	5
	Each benefit should be briefly stated with no need for detailed explanations	
	5 models * 1 mark = 5 maximum marks	
	Only listed answers are awarded 0.5 marks	
	Consider other logical benefits	
c	FOUR categories of m-commerce services:	6
	Each category should be briefly stated with no need for detailed explanations	
	6 categories * 1 mark = 6 maximum marks	
	Only listed answers are awarded 0.5 marks	
d	FOUR unique features of the Internet and e-commerce technologies:	4
	Each feature should be briefly mentioned with no need for detailed explanations	
	4 features * 1 mark = 4 maximum marks	
	Only listed answers are awarded 0.5 marks	
	Consider any four features	
	Total	**20**

Detailed Answer

a) State FIVE of the of the most important Internet business models for electronic commerce.

The following is a description some of the most important Internet business models that have emerged::

i. Virtual storefront/E-tailer: These sell physical products directly to consumers or individual businesses. Online retail stores are also called e-tailers. Examples include Amazon and Murukari

ii. Information broker: These provide product, pricing, and information to individuals and businesses. They generate revenue from advertising and from directing buyers to sellers.
iii. Transaction broker: The transaction broker processes online sale transactions for consumers and generates a fee each time. Expedia is an example.
iv. Online marketplace/Market creator: An online marketplace provides a digital environment where buyers and sellers meet, search for and display products, and set prices for those products. It can also provide online auctions facilities to users. Examples include eBay.
v. Content provider: A content provider creates revenue by providing digital content, such as digital news, music, photos, or video on the Web. Some newspapers and magazines such as IGIHE and Inyarwanda are now pursuing this online strategy.
vi. Online service provider: The online service provider supplies online services for individuals and businesses and generates revenue from subscription or transaction fees and from advertising. An example of an online service provider is salesforce.com who provides a Web based Customer Relationship Management (CRM) solution for businesses.
vii. Virtual community/Community provider: The virtual community provides an online meeting place where people with similar interests can communicate and find useful information. These include YouTube, and social networking sites such as Facebook and Twitter.
viii. Portal: The portal provides an initial point of entry to the Web along with specialized content and other services. Examples of portals include Google, Bing, Yahoo, MSN etc.

b) Briefly describe FIVE e-commerce benefits to businesses.

The benefits of e-commerce to businesses include:

i. Global reach: e-commerce expands the company's marketplace to national and international markets.
ii. Cheaper supplies: Enables companies to buy materials and services from other companies rapidly and at less cost.
iii. Reduced Costs: Decreases the cost of creating, processing, distributing, storing, and retrieving information by digitizing the process.
iv. Speeds up the flow of goods: Allows businesses to carry lower levels of inventories by facilitating just in time strategies.
v. Improved customer service: It enables companies to provide product support and creates the possibility of a 24-hour service. It also allows companies to provide enhanced services to customers.
vi. Others: It helps small businesses compete against large companies and it provides advertising opportunities.

c) State SIX categories of m-commerce services.

The following are categories of m-commerce services:

i. Information-based services: Applications include instant messaging, e-mail, searching for a movie or restaurants using a smartphone or handheld device.

ii. Transaction-based services: Applications include purchasing concert tickets, music, or games. It includes searching for the best price for an item using a smartphone and buying it from an e-commerce site.
iii. Financial Services: Many banks now allow customer to use their mobile phone to check account balances, transfer funds between accounts and pay bills.
iv. Location Based services: Services that anticipate what a customer wants based on that person's location or data profile, such as traffic information and location of the closest hotels. There are many smartphone applications that offer services that enable mobile phone users to access relevant traffic information, calculate journey lengths, and search for nearby garages, hotels and restaurants.
v. Wireless Advertising: In this form of marketing, a company will send a text based add to thousands of mobile users or tailor advertising on Web sites based on the location of the user when they access those sites.
vi. Games and Entertainment: Many mobile phone services offer downloadable digital games and ring tones. Many smartphone phone users can view TV programs, store digital music, and download and watch video clips on their phone.

d) **Mention FOUR unique features that make the Internet and e-commerce technologies richer and more powerful than previous technology revolutions such as radio, television, and the telephone**.

i. Ubiquity. Internet/web technology is available everywhere: at work, at home, and elsewhere by desktop and mobile devices. Mobile devices extend service to local areas and merchants.
ii. Global Reach. The technology reaches across national boundaries, around the earth.
iii. Universal Standards. There is one set of technology standards, namely Internet standards.
iv. Richness. Video, audio, and text messages are possible.
v. Interactivity. The technology works through interaction with the user.
vi. Information Density. The technology reduces information costs and raises quality.
vii. Personalization/Customization. The technology allows personalized messages to be delivered to individuals as well as to groups.
viii. Social Technology. The technology supports content generation and social networking.

QUESTION SIX:

Qn	Description	Marks
	Overall presentation of the report Must be decently presented in a report format with key attributes such as addressee, author, date, title, introductory sentence, conclusion, sign off Award 0.5 marks for a poor presentation and no mark for no presentation	1
a	Difference between Artificial Intelligence (AI) and Machine Learning (ML): Each term must be at least defined to be awarded a full mark 2 terms * 1 mark = 2 maximum marks Consider other correct definitions/descriptions suggested by candidates	2
b	THREE main categories of enterprise-wide knowledge management system: Each category must be discussed in detail and sufficiently 3 categories * 2 mark = 6 maximum marks Poorly discussed or undiscussed categories are awarded 1 mark Consider other logical discussions for each category	
	Structured knowledge systems	2
	Semi-structured Knowledge Systems	2
	Knowledge Network Systems (Mostly tacit knowledge) - If a candidate only mentions tacit knowledge systems, please award full marks	2
c	THREE key roles of knowledge workers: Each role should be briefly stated with no requirement to explain but explaining does not get penalised 3 roles * 1 mark = 3 maximum marks Consider other logical roles suggested by candidates	3
d	How a typical expert system works: Consider the description as whole and consider it sufficiently explains how the system works The explanation should be made using key components of the expert system A definition/short description of what expert systems are	1

Qn	Description	Marks
	Diagrammatic illustration of how the expert system works (consider alternative correct diagrams if it demonstrates how key components interact)	1
	Linking the discussion to the knowledge base	1
	Linking the discussion to the inference engine	1
	Linking the discussion to the user interface	1
	Linking the discussion to the explanation facility	1
	Linking the discussion to the current data storage	1
	Linking the discussion to the knowledge engineer	1
	Total	**20**

Detailed Answer

To: Chief Medical Officer (CMO)

Kimironko Referral Hospital

Kimironko, Kigali

30 November 2021

From: Knowledge Manager

Kigali, Rwanda

Re: Report on Kimironko Referral Hospital staff key issues regarding the enterprise-wide knowledge management system

Dear CMO,

It is my pleasure to present to you a report that addresses key issues raised by your staff regarding your enterprise-wide knowledge management system:

a) Differentiate between Artificial Intelligence (AI) and Machine Learning (ML)

Artificial intelligence and machine learning are the part of computer science that are correlated with each other. These two technologies are the most trending technologies which are used for creating intelligent systems.

Although these are two related technologies and sometimes people use them as a synonym for each other, but still, both are the two different terms in various cases.

Artificial intelligence is a field of computer science which makes a computer system that can mimic human intelligence. It is comprised of two words ‘Artificial’ and ‘intelligence’, which means ‘a human-made thinking power.’

Whereas

Machine learning is a subfield of artificial intelligence, which enables machines to learn from past data or experiences without being explicitly programmed.

b) Discuss THREE main categories of enterprise-wide knowledge management system that Kimironko Referral Hospital can use.

i. **Structured knowledge systems:** Knowledge that has been captured and recorded in structured documents and reports. Businesses have realized over the years that most problems or situations are in most cases new versions of previously experienced difficulties. By creating structured knowledge systems, employees can research how the problem was solved in the past and can then adapt the old solution to the current situation. This saves time, money, and frustration. Examples include structured reports and presentations.

ii. **Semi-structured Knowledge Systems:** A semi-structured knowledge system is a system for organising and storing less structured information, such as e-mail, voice mail, videos, graphics and brochures. A centralised repository can be created to pull data from employees, customers, partners, and suppliers and feed it back into the company through a portal.

iii. **Knowledge Network System (Mostly tacit knowledge):** A major problem for organisations is the difficulties they experience in accessing undocumented knowledge. Because knowledge cannot be conveniently found, employees use up significant time and energy rediscovering knowledge. Knowledge network systems seek to turn tacit unstructured and undocumented knowledge into explicit knowledge that can be stored in a database. Knowledge networks provide an online directory of corporate experts in well-defined knowledge domains and use communication technologies to make it easy for employees to find the appropriate expert in a company.

c) Outline THREE key roles that knowledge workers at Kimironko Referral Hospital will perform.

Knowledge workers perform three key roles in an organisation:

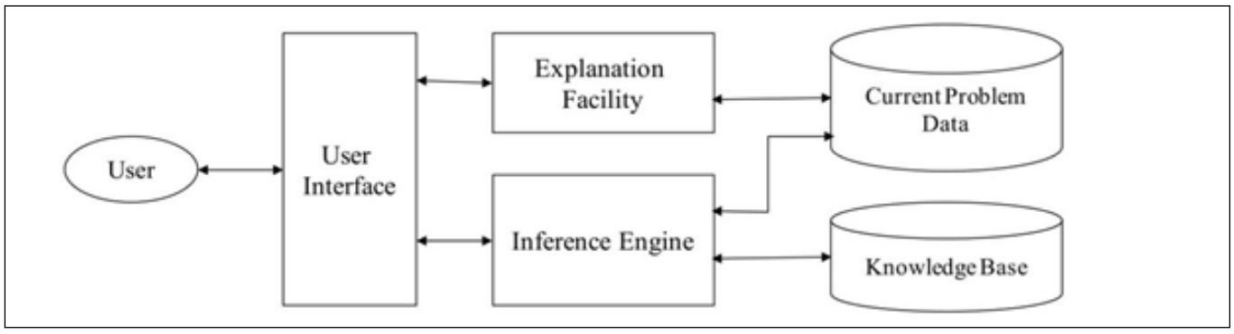
i. They keep the organization up to date in knowledge as it develops in the external world; in technology, science and the arts.
ii. They monitor the changes taking place, identifying opportunities and threats.
iii. They serve as internal consultants in the areas appropriate to their knowledge.
iv. They act as change agents; appraising, initiating, and promoting change projects.

d) With reference to its key components, illustrate and explain how a typical expert system works.

An expert system is a system that uses human knowledge captured in a computer to solve problems that ordinarily require human expertise. It is a computer program that simulates the judgement and behaviour of a human or an organisation that has expert knowledge and experience in a particular field.

Expert systems (see Figure 6.1) model human knowledge as a set of rules that collectively are called the **knowledge base**. Expert systems can have from a handful to many thousands of rules, depending on the complexity of the decision-making problem. The strategy used to search through the collection of rules and formulate conclusions is called the **inference engine**. The inference engine works by searching through the rules and firing those rules that are triggered by facts the user gathers and enters through a **user interface**. Expert systems have a number of limitations, the most important of which is that even experts can't explain how they make decisions: they know more than they can say. They provide recommendations through an **explanation facility** and store input data related to the current problem in a **current data storage.** The person who pulls the data from the human expert and fits it into the expert system is called the **knowledge engineer.** People drive cars, for instance, but are challenged to say how they do it. The knowledge base can become chaotic as the number of rules can reach into the thousands. In rapidly changing environments, say medical diagnosis, the rules change and need to be continually updated. Expert systems are not useful for dealing with unstructured problems that managers and employees typically encounter, and do not use real-time data to guide their decisions. Expert systems do not scale well to the kinds of very large data sets produced by the Internet and the Internet of Things (IoT), and they are expensive to build. For these reasons, expert system development has slowed in the last decade to small domains of expert knowledge such as automobile diagnosis.

Figure 6.1: A simplified model of an Expert System



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Happy to meet to discuss the report. Should you or your staff have further questions, please let me know and I will be happy to address them.

Yours Sincerely,

Knowledge Manager

[*Signature*]

QUESTION SEVEN:

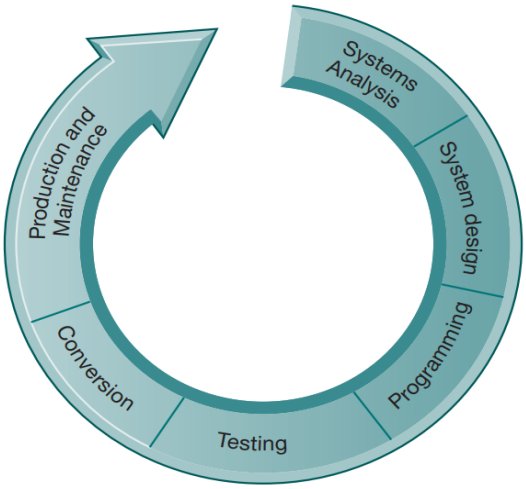
Qn	Description	Marks
a	Core activities of developing a system: Each activity should be explained in detail 6 activities * 2 marks = 12 maximum marks (Award 1 mark for a poorly (and unexplained) explained activity If a candidate explains an additional activity 'System Investigation', award 1 mark for it and 1 mark for 'Systems analysis'. Consider alternative but logical explanations offered by candidates	12
b	The four-step model of a prototyping: Each step should be briefly stated and no need for detailed explanation but if offered, no penalty nor additional marks 4 steps * 1 mark + 1 mark for a correct diagram = 5 maximum marks Award 0.5 marks if a step is just mentioned with no accompanying note Consider other logical answers	5
c	THREE benefits of outsourcing information systems: Each benefit should be briefly stated. No penalty and no additional marks for explanations 3 benefits * 1 marks = 3 maximum marks Award 0.5 marks for a poorly or just listed) stated benefit Consider alternative but logical benefits offered by candidates	3
	Total	**20**

Detailed Answer

a) Discuss core activities Ubaka Tech Ltd will follow in developing the library system for the UoG.

New information systems are an outgrowth of organizational problem solving. A new information system is built as a solution to some type of problem or set of problems the organization perceives it is facing. Systems development is a structured kind of problem solved with distinct activities. These activities consist of systems analysis, systems design, programming, testing, conversion, and production and maintenance. Figure 7.1 illustrates the systems development process. The systems development activities depicted usually take place in sequential order. But some of the activities may need to be repeated or some may take place simultaneously depending on the approach to system building that is being employed.

Figure 7.1: The Systems Development Process



Systems analysis: This is the analysis of a problem that a firm tries to solve with an information system. It consists of defining the problem, identifying its causes, specifying the solution, and identifying the information requirements that must be met by a system solution. The systems analyst creates a road map of the existing organization and systems, identifying the primary owners and users of data along with existing hardware and software. The systems analyst then details the problems of existing systems. By examining documents, work papers, and procedures, observing system operations, and interviewing key users of the systems, the analyst can identify the problem areas and objectives a solution would achieve. Often, the solution requires building a new information system or improving an existing one. The systems analysis also includes a feasibility study to determine whether that solution is feasible, or achievable, from a financial, technical, and organizational standpoint.

Systems Design: Systems analysis describes what a system should do to meet information requirements, and systems design shows how the system will fulfill this objective. The design of an information system is the overall plan or model for that system. Like the blueprint of a building or house, it consists of all the specifications that give the system its form and structure. The systems designer details the system specifications that will deliver the functions identified during systems analysis. These specifications should address all of the managerial, organizational, and technological components of the system solution.

Programming: During the programming stage, system specifications that were prepared during the design stage are translated into software program code. Today, many organizations no longer do their own programming for new systems. Instead, they purchase the software that meets the requirements for a new system from external sources such as software packages from a commercial software vendor, software services from a software service provider, or outsourcing firms that develop custom application software for their clients.

Testing: Exhaustive and thorough testing must be conducted to ascertain whether the system produces the right results. Testing answers the question: Will the system produce the desired results under known conditions? Some companies are starting to use cloud computing services for

this work. The amount of time needed to answer this question has been traditionally underrated in systems project planning. Testing is time-consuming: Test data must be carefully prepared, results reviewed, and corrections made in the system. In some instances, parts of the system may have to be redesigned. The risks resulting from glossing over this step are enormous. Testing an information system can be broken down into three types of activities: unit testing, system testing, and acceptance testing.

Implementation/Conversion: Conversion is the process of changing from the old system to the new system. Four main conversion strategies can be employed: the parallel strategy, the direct cutover strategy, the pilot study strategy, and the phased approach strategy. In a parallel strategy, both the old system and its potential replacement are run together for a time until everyone is assured that the new one functions correctly. The direct cutover strategy replaces the old system entirely with the new system on an appointed day. The pilot study strategy introduces the new system to only a limited area of the organization, such as a single department or operating unit. The phased approach strategy introduces the new system in stages, either by functions or by organizational units. Moving from an old system to a new one requires that end users be trained to use the new system. Detailed documentation showing how the system works from both a technical and end-user standpoint is finalized during conversion time for use in training and everyday operations.

Production and Maintenance: After the new system is installed and conversion is complete, the system is said to be in production. During this stage, the system will be reviewed by both users and technical specialists to determine how well it has met its original objectives and to decide whether any revisions or modifications are in order. In some instances, a formal post-implementation audit document is prepared. After the system has been fine-tuned, it must be maintained while it is in production to correct errors, meet requirements, or improve processing efficiency. Changes in hardware, software, documentation, or procedures to a production system to correct errors, meet new requirements, or improve processing efficiency are termed maintenance. Routine maintenance consumes a large percentage of many firms' IT budgets, but could be reduced significantly through more up-to-date systems-building practices and technology.

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b) Illustrate and describe the four-step model of a prototyping process for a system to users.

Prototyping consists of building an experimental system rapidly and inexpensively for end users to evaluate. By interacting with the prototype, users can get a better idea of their information requirements. The prototype endorsed by the users can be used as a template to create the final system.

Figure 7.2 shows a four-step model of the prototyping process, which consists of the following:

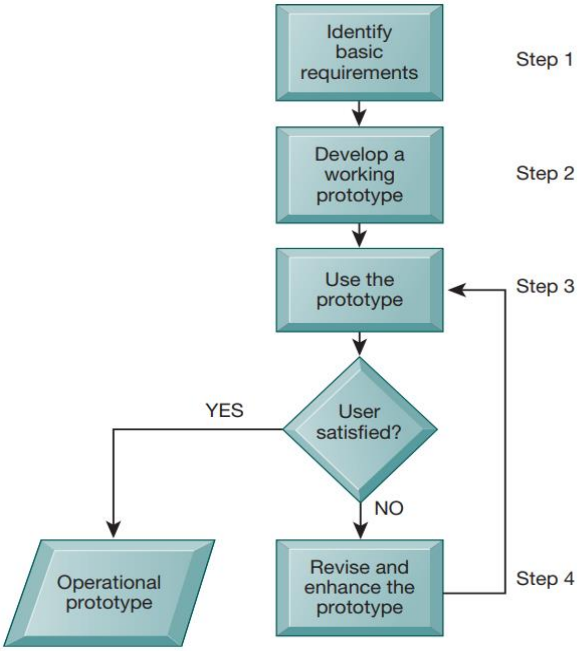
Step 1: Identify the user's basic requirements. The systems designer (usually an information systems specialist) works with the user only long enough to capture the user's basic information needs.

Step 2: Develop an initial prototype. The systems designer creates a working prototype quickly, using tools for rapidly generating software.

Step 3: Use the prototype. The user is encouraged to work with the system to determine how well the prototype meets his or her needs and to make suggestions for improving the prototype.

Step 4: Revise and enhance the prototype. The system builder notes all changes the user requests and refines the prototype accordingly. After the prototype has been revised, the cycle returns to Step 3. Steps 3 and 4 are repeated until the user is satisfied.

Figure 7.2: The Prototyping Process



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c) State THREE benefits of outsourcing information systems to organisations.

Organisations can realise the following benefits from outsourcing:

i. **Cost savings**: Outsourcing can lower the overall cost of the service to the business. Increasingly using outsourcing to low cost economies through off-shore outsourcing.
ii. **Improve quality**: By contracting out the development to specialist developer the quality of the systems is improved.
iii. **Knowledge**: Outsourcing provides access to wider experience and knowledge.
iv. **Contract**: Services will be provided to a legally binding contract with financial penalties and legal redress. This is not the case with internal services.
v. **Operational expertise**: Access to operational best practice.
vi. **Staffing issues**: Outsourcing provides access to a larger talent pool in a cost effect way as the capacity management becomes the responsibility of the supplier and the cost of any excess capacity is borne by them.

vii. **Catalyst for change**: An organisation can use an outsourcing agreement as a catalyst for change that it would not achieve on its own. It can bring new innovations that will drive change in organisations.

viii. **Reduce time to market**: The speeding of system development that are required to support new product and service can reduce the time for these products and services.

ix. **Risk management**: By working closely with the outsourcer on risk management many types of risks can be lessened.

x. **Time zone**: In the case of off-shore outsourcing work can be done in different time zones thus speeding up the development process and keeping costs down.