

SECTION A

PART I: Multiple Choice Questions [30 marks]

Choose the correct answer and write down the letter of your chosen answer in the Answer Booklet against the question number e.g. 31 (d). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. Which testing is concerned with behaviour of whole product as per specified requirements?
 - a) Component testing
 - b) System testing
 - c) Acceptance testing
 - d) Integration testing

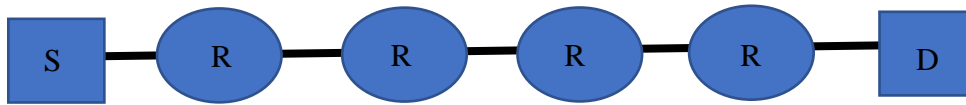
2. What is the size of MSS if the MTU is 1500 bytes, and the IP and TCP headers are 20 bytes each?
 - a) 1460 bytes
 - b) 1540 bytes
 - c) 1480 bytes
 - d) 1520 bytes

3. Which one of the following is the most important language for Data Science?
 - a) Java
 - b) Ruby
 - c) R or Python
 - d) None of the above

4. How many /48 networks can you build from a /32 IPv6 allocation?
 - a) 2^{32}
 - b) 2^8
 - c) 2^{48}
 - d) 2^{16}

5. The huge numbers of devices connected to the IoT has to communicate automatically, not via humans is called as
 - a) Bot to Bot (B2B)
 - b) Machine to Machine (M2M)
 - c) InterCloud
 - d) Skynet

6. Assume that the source “S” and the destination “D” are connected through four intermediate routers labeled R as shown in the diagram. Determine how many times each packet must visit the network layer and the data link layer during a transmission from S to D.



- a) Network layer – 6 times and Data link layer – 10 times
b) Network layer – 4 times and Data link layer – 4 times
c) Network layer – 4 times and Data link layer – 6 times
d) Network layer – 6 times and Data link layer – 6 times
7. What is the MAC address used to send Layer 2 broadcast traffic in the IPv4 broadcast domain?
a) FF:FF:FF:FF:FF:FF
b) AA:AA:AA:AA:AA
c) FF:FF:FF:FF:FF:11
d) 11:FF:FF:FF:FF:11
8. Each block of a Blockchain consist of _____.
a) a hash pointer to the previous block
b) timestamp
c) list of transactions
d) All of the above
9. _____ is an “umbrella” activity that is applied throughout the software engineering process.
a) Debugging
b) Software quality assurance
c) Testing
d) Designing
10. Which of the following is IPv6 loopback address?
a) ::1/128
b) FE80::/48
c) ::1/128
d) FF00::/64
11. Which one of the following is Database Language?
a) Query Language
b) Data Definition Language
c) Data Manipulation Language
d) All of the above

12. Which of the following keys are known only to the owner in the Public-key Infrastructure?
- Protected key
 - Private key
 - Public key
 - Unique key
13. Which of the following is the broadcast address of 10.1.1.0/26?
- 10.1.1.64
 - 10.1.1.63
 - 10.1.1.255
 - 255.255.255.255
14. Conversion method in which users being used to an old system continue to use the old system along with the new system is
- Multi processing
 - Multitasking
 - Parallel run
 - None of the above
15. Which one of the following is NOT one of the Data Link layer features?
- VLAN
 - STP
 - LACP
 - OSPF
16. The RCSC's MaX-Managing for Excellence System is an example of
- Transaction processing system
 - Interactive decision support system
 - Management control system
 - Expert system
17. FF02::1 is _____.
- Global IPv6 Address
 - Loopback IPv6 Address
 - Link-local IPv6 Address
 - Multicast IPv6 Address
18. Which of the following statements is TRUE about blockchain?
- A blockchain is a decentralized, distributed, and oftentimes public, digital ledger consisting of records called blocks.
 - A blockchain database is managed autonomously using a peer-to-peer network and a distributed timestamping server.
 - A blockchain has been described as a value-exchange protocol.
 - All of the above.

19. What types of errors are not done by Black-Box Testing and can be uncovered by White-Box testing?
- a) Performance errors
 - b) Behavioral errors
 - c) Logic errors
 - d) None of the above.
20. After obtaining the IPv4 address from the DHCP server, which protocol is used by the DHCP client to prevent the IP conflict?
- a) Internet relay chat
 - b) Border gateway protocol
 - c) Address resolution protocol
 - d) Neighbor discovery protocol
21. What is the primary goal of an Ethical Hacker?
- a) Avoiding detection
 - b) Determining return of investment (RoI) for security measures
 - c) Resolving security vulnerabilities
 - d) Testing security controls
22. Which of the following byte is the start frame delimiter (SFD) in the ethernet frame?
- a) 10101010
 - b) 10101011
 - c) 00000000
 - d) 11111111
23. Which multiple access technique is used by IEEE 802.11 standard for wireless LAN?
- a) CSMA/CA
 - b) CDMA
 - c) TDMA
 - d) CSMA/CD
24. Bluetooth transceiver devices operate in _____ band.
- a) 2.7 GHz ISM
 - b) 2.5 GHz ISM
 - c) 2.6 GHz ISM
 - d) 2.4 GHz ISM
25. The TTL field has value 10. How many routers (maximum) can process this datagram?
- a) 11
 - b) 5
 - c) 10
 - d) 2^{10}

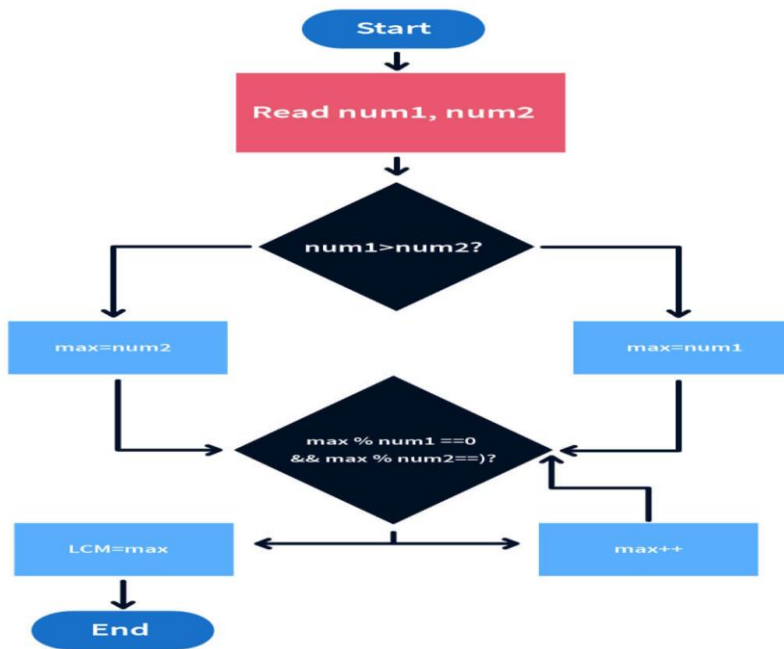
26. A websites URL contains index.php?page=home.php. The page=parameter allows remote URLs to be passed and it loads them. What is this an example of?
- Remote File Inclusion
 - Remote File Injection
 - Remote File Impersonation
 - Remote File Implementation
27. What makes cryptocurrency secure?
- Servers
 - Cryptographic Math
 - Government Banks
 - Insurance Companies
28. Which of the following usually observe each activity on the Internet of the victim, gather all information in the background, and send it to someone else?
- Malware
 - Spyware
 - Adware
 - All of the above
29. What is a node in Cryptocurrency?
- A computer connected to a blockchain network
 - A blockchain server
 - A type of cryptocurrency
 - An exchange
30. The keys used in cryptography is/are
- Secret key
 - Private key
 - Public key
 - All of the above

PART II – Short Answer Questions [20 marks]

This part has 4 Short Answer Questions. Answer ALL the questions. Each question carries 5 marks. Mark for each sub-question is indicated in the brackets.

1. Recently, RMA had partnered with Ripple Tech to pilot digital currency. What do you understand by Private blockchain/ledger and Public ledger/blockchain? What type of ledger/blockchain technology will be used for this collaboration with Ripple by RMA? Why?
(2 + 1 + 2 = 5 marks)
2. What do you mean by DHCP? Explain how DHCP works by describing/illustrating the DHCP operation. (5 Marks)

3. Write a simple program to find LCM (Lowest Common Multiple) for the two numbers.
Hint: LCM flowchart given for reference.



4. A central office is maintaining the record of their employees as follows:

Table: Employee

ID	FirstName	MiddleName	LastName	DeptID	Position	Salary
1	Sonam		Dorji	1	Chief	30000
2	Pema	Dorji	Tshering	2	DCFO	25000
3	Sangay	Lhamo	Dorji	3	Adm	20000
4	Tshering		Dema	1	ITO	20000

Table: Department

ID	DeptName
1	IT
2	Accounts
3	ADM

Base on the above record, answer the following questions:

1. Write SQL query to fetch employees who belongs to IT department as below. (2 marks)

FirstName	LastName	Depratment	Position	Salary
Sonam	Dorji	IT	Chief	30000
Tshering	Dema	IT	ITO	20000

2. Write SQL query to insert all the records from the above two tables into table TempEmployee where the last name starts with 'd' as in the following table. (3 marks)

Table: TempEmployee

ID	FirstName	MiddleName	LastName	Depratment	Position	Salary
1	Sonam		Dorji	IT	Chief	30000
3	Sangay	Lhamo	Dorji	ADM	Adm	20000
4	Tshering		Dema	IT	ITO	20000

SECTION B: Case Study [50 marks]

Choose either CASE I OR CASE II from this section. Each case study carries 50 marks. Mark for each sub-question is indicated in the brackets.

CASE I

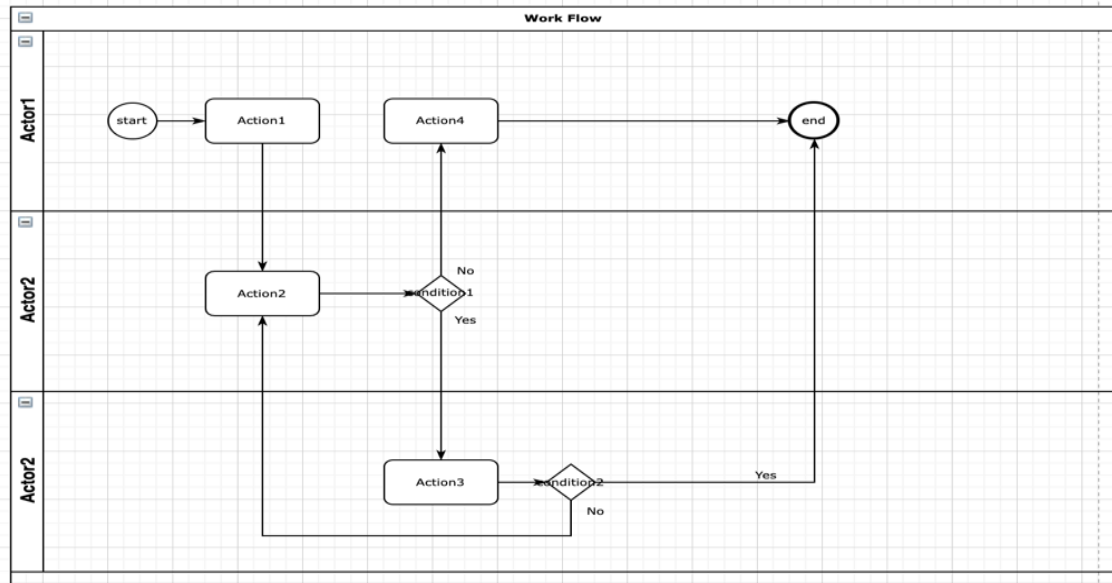
The Royal Government of Bhutan provides free health services to the people in the country. However, it has been challenging to keep track of the patient history and their treatments. With the objective to enhance health services, the government hired you to develop e-PIS (electronic Patient Information System).

e-PIS is to manage the patient information, their medical and treatment histories. With this system, doctors from different hospitals should be able to access the details of the patients, their treatments, and the diagnostic results. The doctor shall update their findings and new advice/treatments into the e-PIS for record keeping and for further necessary actions that may require. Diagnostic Department will carry out the test/investigation based on Doctor's advice and accordingly update the findings. Pharmacy Department will have access to the information to prepare for the medication and dispatch medicines accordingly.

Based on the above scenario, answer the following questions:

1. Identify the 4 key actors and their roles. (4 marks)

2. Based on the actors identified, draw a process flow diagram to capture the entire processes. Use the sample process flow diagram provided below. (10 marks)



3. From many Software Development Life Cycle (SDLC) models, write 4 important SDLC models and explain briefly and provide one use case each for the models. Which one do you prefer and why? (12 + 3 marks)
4. Write two differences between UML and ER-Diagram. (2 marks)
5. Using the actors identified, draw ER-Diagram and their relationship. (10 marks)
6. In DBMS, what does DDL and DML stands for? Briefly explain. (4 marks)
7. Based on above ER-Diagram you have created, answer the following:
- Create one of the tables identified in your ER-Diagram. (2 marks)
 - Insert one record into your newly created table. (1 mark)
 - Now you realised that you have missed one field. Alter table to include the missing field. (1 mark)
 - Write SQL statement to update the record with Primary Key = 1. (1 mark)

CASE II

The Ministry of Agriculture and Forests (MoAF) is revamping their Local Area Network (LAN) to improve their network performance. You have been hired as a consultant to design their LAN.

The MoAF has five departments located in four buildings with following details:

Building No.	Department Name	Divisions	No. of Users
1	Department of Agriculture	Agriculture Research and Extension	32
		Agriculture Production	50
		Agriculture Engineering	55
		Research and Development Centre	75
2	Department of Livestock	Livestock Research and Extension	20
		Livestock Production	62
		Animal Health	200
		Animal Nutrition	40
		Livestock Development Centre	100
3	Department of Forests and Park Services	Nature Conservation	20
		Forest Protection and Enforcement	25
		Forest Resource Management	64
		Social Forestry and Extension	90
		National Park	100
4	Department of Agricultural Marketing and Cooperatives	Marketing Development	90
		Cooperatives Development	62
		Market Information and Research	45
1	Directorate	Human Resource (HR)	10
		Finance Division	16
		ICT Division	20

All the divisions of the respective buildings are in separate floors.

Data center is in Building number 1 - it houses 12 critical G2C and 12 G2G services. G2C services are made available to public where as G2G services are made available only to government agencies. MoAF ICT Division has developed 16 different systems for Human Resource (HR) and Financial management including Network Monitoring and Management systems. MoAF ICT team wants to restrict the access to the HR and Financial management systems to the employees in the MoAF campus.

Border router is installed in the data center and is connected to Government Network (GovNET). GovNET interconnects all other government agencies and is further connected to the Internet Service Provider. GovNET team has assigned MoAF with 220.148.214.32/27 IPv4 and 2400:1440:1::/48 IPv6 addresses from its 220.148.212.0/22 and 2400:1440::/32 pool of addresses.

MoAF wants all their employees in the campus to access the Internet including their HR/Finance systems hosted in their data center using both Wired and Wireless LAN.

1. Prepare a logical network diagram of MoAF based on the information given in the case study. (5 marks)
2. Shorten IPv6 address - 2400:1400:0001:0000:0000:0000:875B:031B. (3 marks)
3. A computer in the ICT division, MoAF has “06:f5:2a:e4:fe:d2” as its MAC Address. Calculate Link Local IPv6 Address using EUI-64 method. (7 marks)
4. Prepare IPv4 Address Plan for MoAF. ICT Division has asked you to design the LAN with IPv4 address 10.10.0.0/21. GovNET team at Ministry of Information and Communications has assigned MoAF 220.148.214.32/27. (10 marks)
5. Prepare IPv6 Address Plan for MoAF. (15 marks)
6. Explain how you would enable access to G2G services hosted in the MoAF data center to only government agencies. (1 mark)
7. MoAF ICT division would like to extend G2G systems access to its employees over public Internet. Explain how you would ensure secure connection over Internet. (2 marks)
8. State and explain three types of IPv4 address. (3 marks)
9. Name all types of IPv6 unicast address. Give one example each. (4 marks)

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