Introduction to IT Systems (4311602) - Summer 2023 Solution

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Question Question 1(a) [03 marks]

Discuss the main components of the Computer.

Solution

Answer:

Table 1. Main Components of Computer

Component	Function	Example
Input Unit	Receives data and instructions	Keyboard, Mouse
CPU	Processes data and controls operations	Intel i5, AMD Ryzen
Memory	Stores data temporarily/permanently	RAM, Hard Disk
Output Unit	Displays processed results	Monitor, Printer

Key Components:

- **Hardware**: Physical parts like CPU, RAM, motherboard
- **Software**: Programs and operating systems
- **Data**: Information processed by computer

Mnemonic

"I Can Make Output (Input-CPU-Memory-Output)"

Question Question 1(b) [04 marks]

Explain the web browser and its type.

Solution

Answer: A **web browser** is software that accesses and displays web pages from the internet.

Table 2. Types of Web Browsers

Browser Type	Features	Examples
Graphical	GUI interface, multimedia support	Chrome, Firefox
Text-based	Command line, fast loading	Lynx, Links
Mobile	Touch interface, optimized for phones	Safari Mobile, Chrome Mobile

Features:

- **Navigation**: Forward, back, refresh buttons
- **Bookmarks**: Save favorite websites
- **Tabs**: Multiple pages in one window

- **Security**: HTTPS support, popup blockers

Mnemonic

"Browse Safely Online (Bookmarks-Security-Online)"

Question Question 1(c) [07 marks]

Explain LAN, MAN and WAN with example.

Solution

Answer:

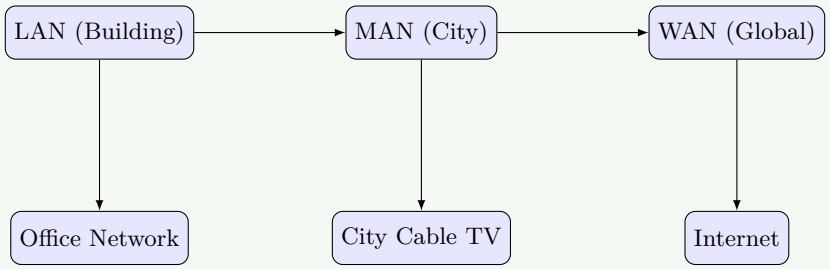
Table 3. Network Types Comparison

Network	Coverage	Speed	Example	Cost
LAN	Building/Campus	High (100Mbps-1Gbps)	Office network	Low
MAN	City/Metropolitan	Medium (10-100Mbps)	Cable TV network	Medium
WAN	Country/Global	Variable (1-100Mbps)	Internet	High

Detailed Explanation:

- **LAN (Local Area Network)**:
  - **Coverage**: Within building or small area
  - **Technology**: Ethernet, Wi-Fi
  - **Example**: Computer lab, home network
- **MAN (Metropolitan Area Network)**:
  - **Coverage**: Across city or metropolitan area
  - **Technology**: Fiber optic, microwave
  - **Example**: City-wide cable internet
- **WAN (Wide Area Network)**:
  - **Coverage**: Multiple cities/countries
  - **Technology**: Satellite, fiber optic
  - **Example**: Internet, bank ATM networks

Diagram:



Mnemonic

"Local Metro World (LAN-MAN-WAN)"

Question Question 1(c OR) [07 marks]

Difference between DOS and Unix Operating system.

Solution

Answer:

Table 4. DOS vs Unix Comparison

Feature	DOS	Unix
Interface	Command Line (text-based)	Command Line + GUI
Multi-user	Single user	Multi-user support
Multitasking	Limited	Full multitasking
Security	Basic	Advanced security
File System	FAT16/FAT32	Various (ext3, ext4)
Cost	Commercial (Microsoft)	Free/Open source variants

Key Differences:

- **DOS (Disk Operating System)**:
  - **Architecture**: 16-bit, single-user
  - **Memory**: Limited to 640KB conventional
  - **Commands**: DIR, COPY, DEL
  - **File naming**: 8.3 format limitation
- **Unix**:
  - **Architecture**: 32/64-bit, multi-user
  - **Memory**: Advanced memory management
  - **Commands**: ls, cp, rm, grep
  - **File naming**: Case-sensitive, long names

Examples:

- **DOS**: MS-DOS, PC-DOS
- **Unix**: Linux, Solaris, AIX

Mnemonic

"DOS Simple, Unix Powerful (Single vs Multi-user)"

Question Question 2(a) [03 marks]

List out features of operating system.

Solution

Answer:

Table 5. Operating System Features

Feature	Description
Process Management	Controls program execution
Memory Management	Allocates RAM efficiently
File Management	Organizes data storage
Device Management	Controls hardware devices

Core Features:

- **User Interface**: GUI or command line
- **Security**: User authentication, access control
- **Multitasking**: Run multiple programs simultaneously
- **Resource Allocation**: CPU, memory distribution

Mnemonic

"Please Manage Files Properly (Process-Memory-File-Device)"

Question Question 2(b) [04 marks]

Define half duplex and full duplex transmission modes.

Solution

Answer:

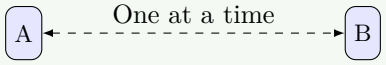
Table 6. Transmission Modes Comparison

Mode	Direction	Example	Efficiency
Half Duplex	Bidirectional (one at a time)	Walkie-talkie	Medium
Full Duplex	Bidirectional (simultaneous)	Telephone	High

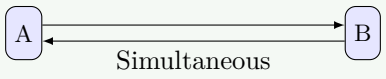
Definitions:

- **Half Duplex**:
  - **Communication**: Two-way but not simultaneous
  - **Example**: Radio communication, old Ethernet hubs
  - **Limitation**: Turn-taking required
- **Full Duplex**:
  - **Communication**: Two-way simultaneous
  - **Example**: Modern Ethernet, telephone calls
  - **Advantage**: No waiting time

Diagram:



Half Duplex



Full Duplex

Mnemonic

"Half waits, Full flows (Half=waiting, Full=simultaneous)"

Question Question 2(c) [07 marks]

Difference between open source and proprietary software.

Solution

Answer:

Table 7. Open Source vs Proprietary Software

Aspect	Open Source	Proprietary
Source Code	Freely available	Hidden/Protected
Cost	Usually free	Paid licenses
Modification	Allowed	Restricted
Support	Community-based	Vendor support
Security	Transparent	Security through obscurity
Examples	Linux, Firefox, Apache	Windows, MS Office

Detailed Comparison:

- **Open Source Software**:
  - **Definition**: Source code publicly available
  - **Licensing**: GPL, MIT, Apache licenses
  - **Benefits**: Cost-effective, customizable, transparent
  - **Examples**: LibreOffice, GIMP, MySQL
- **Proprietary Software**:
  - **Definition**: Owned by individual/company
  - **Licensing**: End User License Agreement (EULA)
  - **Benefits**: Professional support, guaranteed updates
  - **Examples**: Adobe Photoshop, Oracle Database

Advantages & Disadvantages:

- **Open Source Pros**: Free, flexible, community support
- **Open Source Cons**: Limited professional support
- **Proprietary Pros**: Professional support, warranty
- **Proprietary Cons**: Expensive, vendor lock-in

Mnemonic

"Open = Free to See, Proprietary = Pay to Use"

Question Question 2(a OR) [03 marks]

Differentiate between RAM and ROM.

Solution

Answer:

Table 8. RAM vs ROM Comparison

Feature	RAM	ROM
Full Form	Random Access Memory	Read Only Memory
Volatility	Volatile (loses data)	Non-volatile (retains data)
Access	Read/Write	Read only
Speed	Very fast	Slower than RAM

Key Differences:

- **Purpose**: RAM for temporary storage, ROM for permanent
- **Cost**: RAM more expensive per GB
- **Usage**: RAM for programs, ROM for firmware

Mnemonic

"RAM Runs, ROM Remembers (temporary vs permanent)"

Question Question 2(b OR) [04 marks]

Explain AND logic gate with Example.

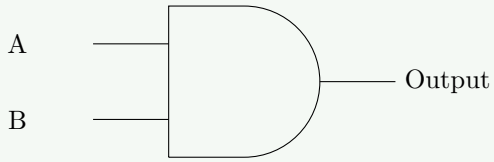
Solution

Answer: AND Gate Definition: Output is HIGH only when ALL inputs are HIGH.
Truth Table:

Table 9. AND Gate Truth Table

Input A	Input B	Output (A AND B)
0	0	0
0	1	0
1	0	0
1	1	1

Symbol:



Example Applications:
- **Security System**: Door opens only with key AND card
- **Car Starting**: Engine starts with key AND foot on brake
- **Boolean Expression**: $Y = A \cdot B$ or $Y = A \wedge B$

Real-life Example: Washing machine starts only when door is closed AND power button is pressed.

Mnemonic

"ALL inputs True = Output True"

Question Question 2(c OR) [07 marks]

Explain the Ethernet Cable Color code.

Solution

Answer: Standard: TIA/EIA-568B Color Code
Table: Wire Color Sequence

Table 10. Ethernet Pinout (568B)

Pin	Color	Function
1	White/Orange	Transmit+
2	Orange	Transmit-
3	White/Green	Receive+
4	Blue	Not used
5	White/Blue	Not used
6	Green	Receive-
7	White/Brown	Not used
8	Brown	Not used

Cable Types:

- **Straight-Through Cable (568B both ends)**:
  - **Use**: Computer to switch/hub
  - **Color sequence**: Same on both ends
- **Cross-Over Cable (568A one end, 568B other)**:
  - **Use**: Computer to computer direct
  - **Pins swapped**: 1 ↔ 3, 2 ↔ 6

Preparation Steps:

1. Strip outer jacket (1 inch)
2. Arrange wires in color order
3. Cut wires evenly
4. Insert into RJ-45 connector
5. Crimp with crimping tool

Mnemonic

"White Orange, Orange, White Green, Blue, White Blue, Green, White Brown, Brown"

Question Question 3(a) [03 marks]

Compare wired and Wireless Communication.

Solution

Answer:

Table 11. Wired vs Wireless Communication

Aspect	Wired	Wireless
Medium	Cables (copper/fiber)	Radio waves/infrared
Speed	Higher (up to 100Gbps)	Lower (up to 1Gbps)
Security	More secure	Less secure
Mobility	Limited	High mobility
Cost	Higher installation	Lower installation
Interference	Minimal	Signal interference

Key Points:

- **Wired**: Reliable, fast, secure but limited mobility
- **Wireless**: Mobile, flexible but security concerns

Mnemonic

"Wires are Fast, Wireless is Free (speed vs mobility)"

Question Question 3(b) [04 marks]

Discuss the different types of computer systems.

Solution

Answer:

Table 12. Computer System Types

Type	Size	Processing Power	Example
Supercomputer	Room-sized	Extremely high	Weather forecasting
Mainframe	Large cabinet	Very high	Bank transactions
Minicomputer	Desk-sized	Medium	Small business
Microcomputer	Desktop/laptop	Low to medium	Personal use

Classifications:

- **By Size & Power**:
  - **Supercomputer**: Scientific calculations, research
  - **Mainframe**: Large organizations, concurrent users
  - **Personal Computer**: Individual users, office work
  - **Embedded Systems**: Specific functions (washing machines)
- **By Purpose**:
  - **General Purpose**: Versatile, multiple applications
  - **Special Purpose**: Dedicated tasks (ATM, gaming console)

Mnemonic

"Super Main Mini Micro (decreasing size order)"

Question Question 3(c) [07 marks]

Write short note on TDM, FDM, and OFDM.

Solution

Answer: Multiplexing Techniques for Efficient Communication

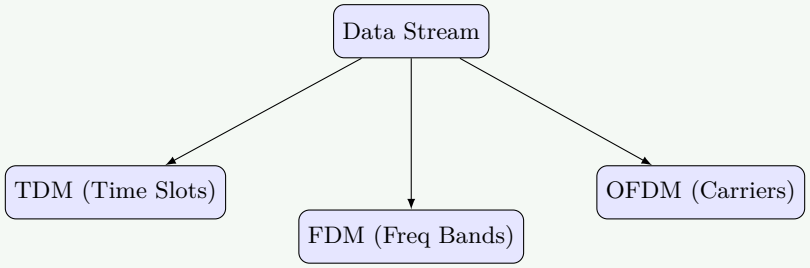
Table 13. Multiplexing Comparison

Technique	Division Method	Application	Advantage
TDM	Time slots	Digital telephony	Simple implementation
FDM	Frequency bands	Radio/TV broadcasting	Simultaneous transmission
OFDM	Multiple carriers	Wi-Fi, 4G/5G	High data rates

Descriptions:

- **Time Division Multiplexing (TDM)**:
  - **Principle**: Each user gets fixed time slot
  - **Example**: Digital telephone systems, GSM
  - **Advantage**: Efficient use of bandwidth
- **Frequency Division Multiplexing (FDM)**:
  - **Principle**: Each user gets unique frequency band
  - **Example**: FM radio, cable TV
- **Orthogonal Frequency Division Multiplexing (OFDM)**:
  - **Principle**: Multiple orthogonal subcarriers
  - **Example**: Wi-Fi (802.11), LTE, DSL

Diagram:



Mnemonic

"Time Frequency Orthogonal (TDM-FDM-OFDM)"

Question Question 3(a OR) [03 marks]

Discuss FSK and PSK.

Solution

Answer:

Table 14. FSK vs PSK

Aspect	FSK	PSK
Parameter	Frequency	Phase
Complexity	Simple	Complex
Noise Immunity	Good	Excellent
Bandwidth	Higher	Lower

Digital Modulation Techniques:

- **FSK (Frequency Shift Keying)**: Different frequencies for 0 and 1 (f1 for '0', f2 for '1'). Example: Computer modems.
- **PSK (Phase Shift Keying)**: Phase changes represent data (0° for '0', 180° for '1'). Example: Wi-Fi.

Mnemonic

"Frequency Shifts, Phase Shifts (FSK-PSK)"

Question Question 3(b OR) [04 marks]

Differentiate between Multitasking and Multi programming OS.

Solution

Answer:

Table 15. Multitasking vs Multiprogramming

Feature	Multitasking	Multiprogramming
User Interaction	Interactive	Batch processing
Response Time	Fast	Slower
CPU Sharing	Time slicing	Job switching
Example	Windows, Linux	Early mainframes

Comparison:

- **Multitasking**: Multiple tasks run seemingly simultaneously; interactive user experience.
- **Multiprogramming**: Multiple programs in memory; switch CPU only on I/O wait; for CPU utilization.

Mnemonic

"Tasks are Interactive, Programs are Batched"

Question Question 3(c OR) [07 marks]

Write short note on network topologies.

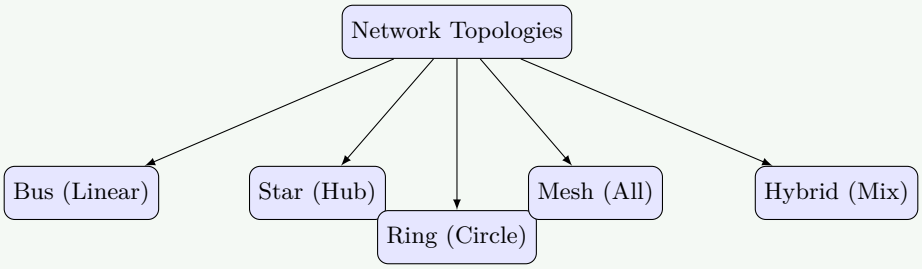
Solution

Answer:

Table 16. Topology Comparison

Topology	Structure	Advantages	Disadvantages
Bus	Linear	Simple, cost-effective	Single point failure
Star	Central hub	Easy troubleshooting	Hub failure affects all
Ring	Circular	Equal access	Break affects network
Mesh	Interconnected	High reliability	Complex, expensive
Hybrid	Mixed	Flexible	Complex management

Diagram:



Mnemonic

"Bus Star Ring Mesh Hybrid (increasing complexity)"

Question Question 4(a) [03 marks]

Explain Switch.

Solution

Answer: Network Switch: Connects devices in a LAN at Data Link Layer (Layer 2).

Table 17. Switch Characteristics

Feature	Description
Function	Connects devices in LAN
Method	MAC address learning
Collision	Eliminates collisions
Bandwidth	Dedicated per port

Functions:
- **Frame Forwarding**: Sends data to specific port
- **Address Learning**: Builds MAC address table
- **Loop Prevention**: Spanning Tree Protocol

Mnemonic

"Switch Learns MAC Addresses"

Question Question 4(b) [04 marks]

Define Cyberthreat with an example.

Solution

Answer: Cyberthreat: Malicious attempt to damage, disrupt, or gain unauthorized access to computer systems.

Table 18. Cyberthreat Types

Type	Method	Example
Malware	Malicious software	Virus, Trojan
Phishing	Fake emails/websites	Fake bank emails
Ransomware	Encrypt files	WannaCry attack
DDoS	Traffic overload	Server flooding

Example - Phishing Attack:
- **Method**: Fake email from "bank" requesting login credentials
- **Result**: Account compromise
- **Prevention**: Verify sender authenticity

Mnemonic

"Cyber Criminals Create Chaos (threats cause damage)"

Question Question 4(c) [07 marks]

Compare TCP/IP and OSI networking models.

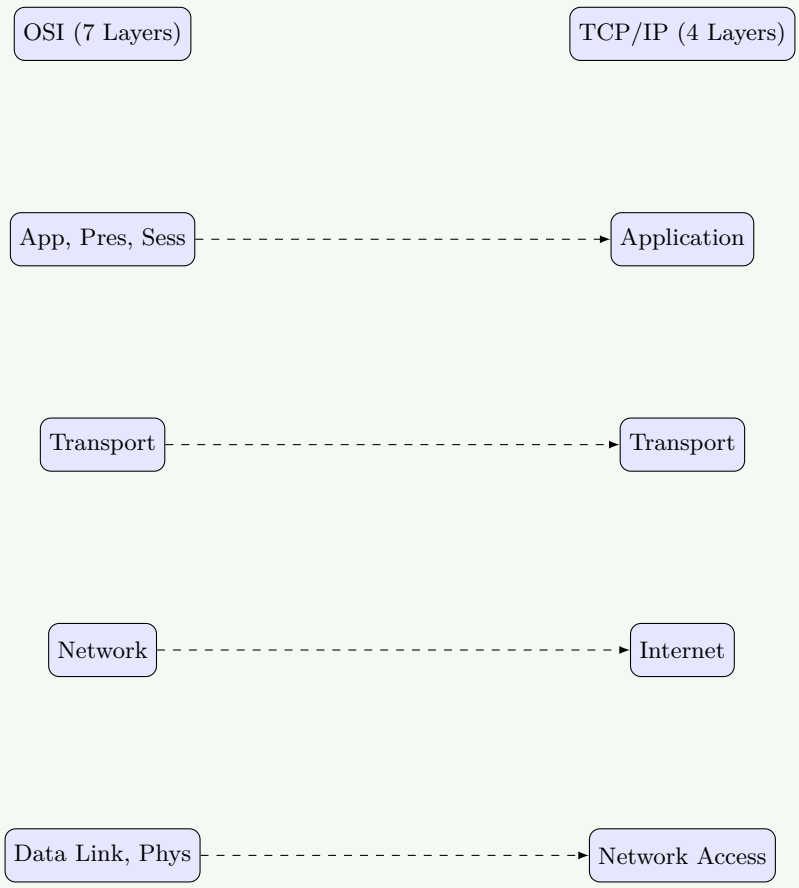
Solution

Answer:

Table 19. TCP/IP vs OSI Model Comparison

OSI Layer	OSI Function	TCP/IP Layer	TCP/IP Function
Application	User interface	**Application**	User services
Presentation	Data formatting	**Application**	(Combined)
Session	Session management	**Application**	(Combined)
Transport	Reliable delivery	**Transport**	End-to-end delivery
Network	Routing	**Internet**	IP addressing
Data Link	Frame handling	**Network Access**	Physical transmission
Physical	Electrical signals	**Network Access**	(Combined)

Diagram:



Mnemonic

"OSI is Perfect Theory, TCP/IP is Practical Reality"

Question Question 4(a OR) [03 marks]

Write main objectives of cyber security.

Solution

Answer:

Table 20. Cyber Security Objectives (CIA Triad)

Objective	Description	Example
Confidentiality	Protect from unauthorized access	Encryption
Integrity	Ensure accuracy/completeness	Checksums
Availability	Ensure system accessibility	Backups

Additional Objectives: Authentication, Authorization, Non-repudiation.

Mnemonic

"CIA protects data (Confidentiality-Integrity-Availability)"

Question Question 4(b OR) [04 marks]

List out different types of networking devices used in the networking.

Solution

Answer:

Table 21. Networking Devices

Device	Layer	Function
Hub	Physical	Signal repeater
Switch	Data Link	Frame forwarding
Router	Network	Packet routing
Bridge	Data Link	Network segmentation
Gateway	All layers	Protocol conversion
Repeater	Physical	Signal amplification
Access Point	Data Link	Wireless connectivity
Firewall	Network+	Security filtering

Mnemonic

"Hubs Switch Routes Bridges Gateways"

Question Question 4(c OR) [07 marks]

Write different types of security attacks.

Solution

Answer:

Table 22. Attack Types and Characteristics

Type	Method	Target	Prevention
Passive	Eavesdropping	Information	Encryption
Active	Modification	Integrity	Authentication
Physical	Hardware access	Equipment	Locks
Social Eng.	Manipulation	Users	Education

Categories:
- **Network Attacks**: Man-in-the-Middle, DDoS, Packet Sniffing
- **Application Attacks**: SQL Injection, XSS
- **Malware**: Virus, Worm, Trojan, Ransomware
- **Social Engineering**: Phishing, Pretexting
- **Cryptographic**: Brute Force, Dictionary Attack

Mnemonic

"Network Application Malware Social Crypto (attack categories)"

Question Question 5(a) [03 marks]

Calculate binary of (5AB.4) hexadecimal number.

Solution

Answer: Hexadecimal to Binary Conversion: Convert each hex digit to 4-bit binary.

Table 23. Hex to Binary

Hex	Binary	Hex	Binary
5	0101	B	1011
A	1010	4	0100

Steps:
- 5 → 0101
- A → 1010
- B → 1011
- . → .
- 4 → 0100

Final Answer: $(5AB.4)_{16} = (10110101011.01)_2$

Mnemonic

"Each Hex = 4 Bits"

Question Question 5(b) [04 marks]

List out the main features of Digi-Locker, e-rupi.

Solution

Answer:

Table 24. Digital Platform Features

Platform	Purpose	Key Features
Digi-Locker	Document storage	Cloud storage, Aadhaar auth, Paperless
e-RUPI	Digital payment	QR/SMS voucher, Contactless, Prepaid

Benefits:
- **Digi-Locker**: Secure access to genuine documents anytime
- **e-RUPI**: Leak-proof delivery of welfare benefits

Mnemonic

"Digi Stores, e-RUPI Pays (storage vs payment)"

Question Question 5(c) [07 marks]

Describe different generations of a computer system.

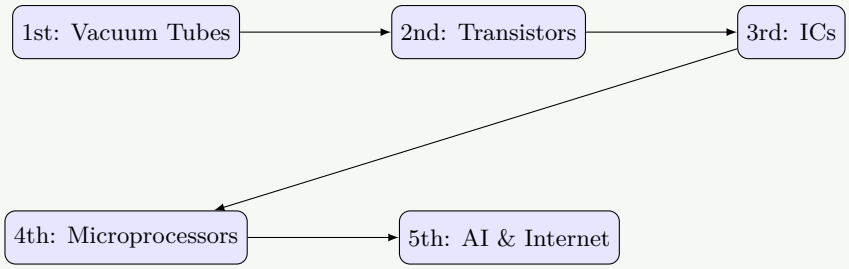
Solution

Answer:

Table 25. Computer Generations

Gen	Period	Technology	Example
1st	1940-56	Vacuum Tubes	ENIAC
2nd	1956-63	Transistors	IBM 1401
3rd	1964-71	ICs	IBM 360
4th	1971-80s	Microprocessors	PC
5th	1980s+	AI/Parallel	Smartphone

Diagram:



Mnemonic

"Vacuum Transistor IC Micro AI"

Question Question 5(a OR) [03 marks]

Write Difference between Data and Information with example.

Solution

Answer:

Table 26. Data vs Information

Aspect	Data	Information
Definition	Raw facts/figures	Processed data
Meaning	No context	Has context
Example	85, 92, 78	Avg: 85%

Mnemonic

"Data is Raw, Information is Refined"

Question Question 5(b OR) [04 marks]

Compare analog modulation and digital modulation.

Solution

Answer:

Table 27. Analog vs Digital Modulation

Feature	Analog	Digital
Signal	Continuous	Discrete (0s, 1s)
Noise Immunity	Poor	Excellent
Examples	AM, FM	FSK, PSK

Mnemonic

"Analog is Simple, Digital is Smart"

Question Question 5(c OR) [07 marks]

Discuss the range of IP addresses in IPv4

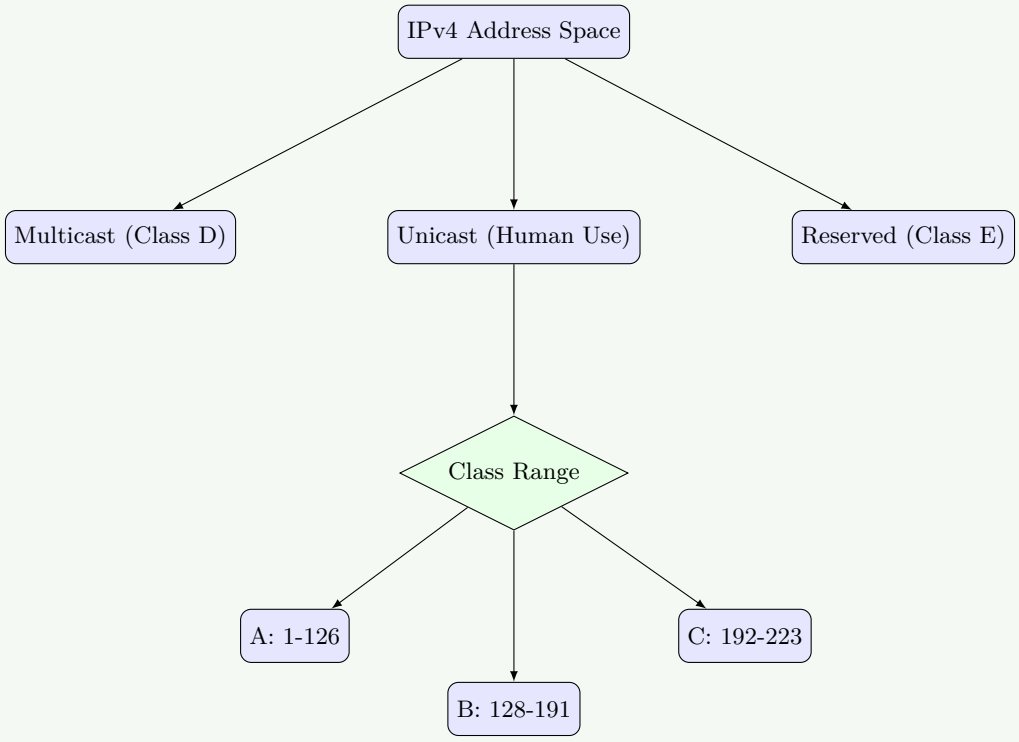
Solution

Answer:

Table 28. IPv4 Address Classes

Class	Range	Networks	Purpose
A	1.0.0.0 - 126.0.0.0	Large	Govt/Big Corp
B	128.0.0.0 - 191.255.0.0	Medium	Universities
C	192.0.0.0 - 223.255.255.0	Small	Small Business
D	224 - 239	N/A	Multicast
E	240 - 255	N/A	Experimental

Diagram:



Mnemonic

"A Big Company Delivered Everything (Classes A-B-C-D-E)"