

Information Technology - Theory. Category Cheat sheet V4

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Data representation

System Technologies – Hardware and software including OS

GR 10	GR 11	GR 12	Ref	Master topic - Sub topics
			D1	Data representation
✓			D2	Counting in decimal
✓			D3	Counting in binary
✓			D4	Counting in hexadecimal
✓			D5	Conversions from decimal to binary and hex
✓			D6	Conversions from binary to decimal and hex
✓			D7	Conversions from hexadecimal to binary and decimal
✓			D8	Word size
✓			D9	Data storage
✓			D10	Unsigned integers numbers
✓			D11	Largest and smallest unsigned integers
✓			D12	Signed integers
✓			D13	Largest and smallest signed integers
✓			D14	Primitive data types
✓			D15	Digital character representation
✓			D16	ASCII, Unicode, UTF-8
✓			B1	Boolean Logic (see LU 7 in grade 10 text book)
✓			B2	Seaching
✓		✓	B3	Searching using logical operators - NOT, AND OR
✓		✓	B4	Order of operations for logical operators
✓	✓		B5	Truth tables - two variables
	✓	✓	B6	Truth tables - three variables
	✓	✓	B2	Boolean Logic (see LU 1 in grade 11 text book)
	✓	✓	B3	Possible combinations with fixed number of bits
	✓	✓	B4	Binary addition
	✓	✓	B5	Integers with a fixed number of bits
	✓	✓	B6	Positive integers
	✓	✓	B7	Negative integers
	✓	✓	B8	Sign and size
	✓	✓	B9	Two's complement
	✓	✓	B10	Overflow and underflow
	✓	✓	B11	Unsigned
	✓	✓	B12	Signed
	✓	✓	B13	Represent real numbers
	✓	✓	B14	Mantissa and exponent
	✓	✓	B15	Compression - replacing binary with hexadecimal
	✓	✓	B16	Truth tables
	✓	✓	B17	De Morgan's Law
	✓	✓	B18	Truth tables with three variables
	✓	✓	B19	Truth tables with four variables

			S1	Computer Hardware devices
✓				Computer
✓				Laptop
✓				Tablet
✓				Smart phone
			S2	Types of computers
✓	✓	✓		Desktop
✓	✓	✓		Laptop (notebook)
✓	✓	✓		Chromebook
✓	✓	✓		Tablet
✓	✓	✓		Server
✓	✓	✓		Smart phone
✓	✓	✓		Server
✓	✓	✓		Embedded computer
✓	✓	✓		Single board computer (SOC)
✓	✓	✓		Smart wear
			S3	CPU – (The processor)
	✓	✓		Arithmetic logic unit – ALU
	✓	✓		Control unit – CU
	✓	✓		The registers - SRAM
		✓		Single, dual, quad core etc
		✓		L1 cache - SRAM
		✓		Maths coprocessor
		✓		Integrated graphics
			S3.2	Co-processors
		✓		Graphics Processors
		✓		Maths co-processor, now integrated into the CPU
			S4	Memory
✓	✓	✓		RAM -DRAM, SRAM
✓	✓	✓		Primary memory - volatile
✓	✓	✓		Secondary memory – non-volatile
			S4.2	Virtual Memory
✓	✓	✓		HDD/SDD
	✓	✓		Paging and swapping
	✓	✓		Performance
			S5	Primary memory
✓	✓			ROM

✓	✓			RAM – DRAM
	✓	✓		BIOS – resides on ROM
	✓	✓		CMOS – volatile (needs battery)
	✓	✓		UEFI
			S6	Secondary memory
✓	✓	✓		Hard drive (mechanical) - HDD
✓	✓	✓		Solid state hard drive – SSD
✓	✓	✓		Flash drives
✓	✓	✓		Optical drives
✓	✓	✓		SD cards
	✓	✓		External hard drives
	✓	✓	S6.2	M.2 card on motherboard
	✓	✓		Cloud storage
			S7	Motherboard
	✓	✓		System clock
	✓	✓		Connectivity
✓	✓	✓		Power
	✓	✓		Overclocking
	✓	✓		Busses – internal
	✓	✓		Busses – external
	✓	✓		Integrated may offer graphics, network, Wi-Fi, sound
			S8	Input devices
✓		✓		Keyboard, mouse
✓		✓		Scanners
✓		✓		Barcode and QR scanners
✓		✓		Magnetic stripe
✓		✓		Biometric devices
✓		✓		Microphones
✓		✓		sensors
			S9	Output devices
✓				Monitors
✓				Printers
✓				Speakers
✓				Headphones
			S10	Hardware – components
✓				The computer case/tower
✓				Power supply
✓				Motherboard
✓				CPU
✓				RAM
		✓	S10.2	Integrated on motherboard – (Wi-Fi, graphics,
	✓	✓		network card, sound etc)

	✓	✓	S10.3	Hard drive (mechanical) - HDD
	✓	✓		Solid state hard drive – SSD
			S11	Busses
	✓			Internal - Front side bus (FSB)
	✓			External – also called an interface
				Internal
	✓	✓		Control bus
	✓	✓		Address bus
	✓	✓		Data bus
			S12	External bus (interface)
	✓	✓		PCI express (PCIe)
	✓	✓		SATA
	✓	✓		USB
	✓	✓		NVMe
	✓	✓		M.2 format
			S13	Modular design?
		✓		Desktops – yes
		✓		Laptops – not really
		✓		Single board computers – no
		✓	S14	Expansion cards for slots
		✓		Graphics, sound, WLAN, RAID, serial port,
		✓		USB interface, cellular cards, TV card, video capture.
			S15	Hardware – peripherals
✓				Hard drive (mechanical) - HDD
✓				Solid state hard drive – SSD
✓				Mouse
✓				Keyboard
✓				Printer
✓				Scanner
✓				Storage drives
			S16	Storage
✓				Local storage
✓				Off-site storage
✓	✓	✓		Cloud storage
			S17	Technology/standard/interface
	✓	✓		PCI express (PCIe), SATA, USB
	✓	✓		NVMe, M.2 (form factor, socket, card)
	✓	✓	S17.2	HDMI and DisplayPort
	✓	✓		Ethernet

	✓			USB 1, USB 2, USB 3
	✓			USB A, USB B, USB C
	✓			USB mini A and B
	✓			USB micro
			S18	Ports
✓	✓			USB port (is a serial port)
✓	✓			HDMI
✓	✓			Network – RJ45
	✓			DisplayPort
	✓			Thunderbolt
			S19	Processing
	✓			Serial processing
	✓			Parallel processing
	✓	✓		Hyperthreading (hardware)
	✓	✓		Multiprocessing (hardware)
	✓	✓		Multitasking (software)
	✓	✓		Multithreading (software)
			S20	Performance enhancement
	✓	✓		Hyperthreading
	✓	✓		Multiprocessing
	✓	✓		More RAM, Faster DRAM
	✓	✓		Overclocking
	✓	✓		More L1, L2, L3 cache (in theory)
	✓	✓		Separate video card
	✓	✓		NVMe/SSD/PCIe to replace HDD/SATA
	✓	✓		Virtual memory (comment)
			S21	Concepts
	✓			Latency
	✓			Interrupts
	✓			Virtual memory
	✓			File compression
	✓			Synchronization
	✓			Backup
	✓			Archive
	✓			Broadcast/Point to point
	✓			Simplex/duplex
			S22	Cache
	✓	✓		Processor cache – on chip cache
	✓	✓		Disk cache
	✓	✓		Browser cache
	✓	✓		Web cache server
	✓	✓	S22.2	Proxy server often doubles as a web cache server

			S23	Best practice
✓	✓	✓		Backup
✓	✓	✓		Strong passwords
✓	✓	✓		Files and folders
✓	✓	✓		Descriptive file names
	✓	✓		Hieratical folder structure
	✓	✓		Up to date – OS, software etc
	✓	✓		Uninstall old software
	✓	✓		Delete/archive old files
	✓	✓		Delete cookies, browser history
			S24	Software
	✓			BIOS / UEFI
✓	✓			Operating system (OS)
✓	✓			Application software
✓	✓			Your own data
	✓	✓		Drivers
	✓	✓		Utilities
	✓	✓		Programming languages
	✓	✓		Programming tools – IDEs
	✓	✓		Malware and anti-malware
	✓	✓		Network OS for multiuser environments (for servers)
	✓	✓		often included with the OS. Handles user profiles,
	✓	✓		rights and permissions to access network resources
			S25	Operating systems
✓	✓			Desktop OS
	✓			Mobile OS
	✓			Embedded OS (for IoT)
	✓			Kernel – always in memory
	✓			Control panel
	✓			Utilities
	✓			Graphical user interface
	✓			Command line interface
✓	✓			Windows
✓	✓			MacOS
✓	✓			Linux
	✓			Chrome OS
	✓			
✓	✓			iOS
✓	✓			Android
			S26	Role of the OS
✓	✓			Manage resources

✓	✓			Memory management
✓	✓			Management of software (install and uninstall)
	✓			Load programs (and allocate memory)
	✓			Run programs
	✓			Interface between application software and hardware
	✓			Provides a user interface
			S27	Programming languages
	✓	✓		translators
	✓	✓		Source code
	✓	✓		Compiled code
	✓	✓		Executable code
	✓	✓		Compiled
	✓	✓		Interpreted
	✓	✓		Compiled bytecode interpreted line by line (Java)
		✓		High level languages
		✓		Low level languages
		✓		Machine code
			S28	Application software
		✓		Stand-alone desktop apps
		✓		Network apps – client/server
		✓		Web based applications running in the browser
		✓		(cloud based) (thin client model)
		✓		Mobile applications – dedicated, customized,
		✓		and optimized for mobile
			S29	Software Licensing models
		✓		Proprietary
		✓		Free and open source
		✓		Creative commons
		✓		Freeware
		✓		Freemium software
Networking				
			N1	Networking
✓				Nodes
✓				Network interface cards (NIC)
✓				Connecting devices
✓				Connecting media
✓				Broadcast/Point to point
			N2	Network devices/nodes
✓	✓			Client workstations
✓	✓			Server

✓	✓			NIC
	✓			Switch
	✓			Router
	✓			Firewall
	✓			Bridge
	✓			Connecting media
			N3	NOTE: ADSL router, DSL modem, DSL gateway,
	✓			modem/router, residential gateway
				– all the same thing (with a telephone
				connector). Offers DSL modem + router
				+ 4 port switch + firewall + wireless
				access point all in one unit often
				used in a SOHO. See WLAN for more.
			N4	Connecting media
✓				Bounded – cables
✓				Unbounded – wireless
			N5	Media bounded
✓				Copper
✓				UTP/STP
✓	✓			Fibre optic cable
	✓			Fibre optic backbone for WANs
	✓		N6	Media unbounded
	✓			Wireless
	✓			Bluetooth
	✓			Near field communication (NFC)
	✓			Radio waves - satellite
	✓			Microwaves
	✓	✓	N7	Connection devices - LAN
	✓	✓		NIC
	✓	✓		Hub
	✓	✓		Switch
	✓	✓		Repeater
	✓	✓		Bridge
	✓	✓		Router
				WAN
	✓	✓		Gateways
			N8	Networking Protocols
	✓	✓		Address resolution protocol (ARP)
	✓	✓		Dynamic host configuration protocol (DHCP)

	✓	✓		Domain name servers (DNS)
	✓	✓		TCP/IP
	✓	✓		UDP v TCP
			N9	Topology
	✓			Star
	✓			Bus
	✓			Ring
		✓		Hybrid –
		✓		star LAN plus bus backbone
		✓		Mesh – usually for wireless
			N10	Networks
✓				PAN, LAN, WAN, GAN
			N11	Types
	✓			Peer to peer (P2P)
	✓			Client server
			N12	Wireless LAN (WLAN)
	✓	✓		Wireless access point
	✓	✓		Wireless router
	✓	✓		Wireless bridge
	✓	✓		Wi-Fi router
	✓	✓		Wireless mesh network
	✓	✓		Hotspot
	✓	✓	N13	Networking addressing
	✓	✓		IP address
	✓	✓		IPv4
	✓	✓		IPv6
	✓	✓		MAC address
			N14	LAN
		✓		Centralized processing
		✓		Distributed processing
		✓		Thin clients - Fat clients
		✓		Smart clients
			N15	IoT
		✓		Computing devices with sensors

		✓		and embedded OS that can
		✓		communicate without human
		✓		intervention over the internet.
		✓		Humans can access the devices
		✓		via an app over the internet.
			N16	From ethernet LAN to internet
		✓		Via a Bridge
		✓		Ethernet frames to . . .
		✓		Internet packets
		✓		IP addressing, source destination
		✓		Payload, frame checks
		✓		VLAN tag
Internet			I1	Email protocols
	✓	✓		POP3
	✓	✓		IMAP
	✓	✓		SMTP
			I2	Internet protocols – offers routing functionality
	✓	✓		over the global internet
	✓	✓		TCP/IP
	✓	✓		UDP v TCP
			I3	Web protocols – works locally with internet browser
	✓	✓		HTTP
	✓	✓		HTTPS
	✓	✓		FTP – download, uploaded
	✓	✓		WebDAV – enhanced HTTP - remote editing + sharing
			I4	Internet content
✓				Website
✓				Blog
✓				Microblogging e.g. Twitter
✓				Podcast/Vodcast
✓				Video
✓				Wiki
✓	✓	✓		e-commerce
			I5	Transmission of data
		✓		Downloading v streaming
		✓		Video on demand
		✓		VOIP
		✓		Podcast/Vodcast
			I6	Compression technology
	✓	✓		Lossy v Lossless
	✓	✓		Lossy for audio
			I7	Evolution of internet

	✓	✓		Web 1.0. Web 2.0, Web 3.0, Web 4.0
	✓	✓		Scripting – client and server
	✓	✓		Cookies
	✓	✓		Web based applications
	✓	✓		Mobile applications
	✓	✓		Plug ins and extensions
			18	Internet tools
	✓			To communicate, plan, collaborate, organize and
	✓			for productivity
	✓			Office productivity suites e.g. Google docs, Office 365
	✓			Email
	✓			Calendar
	✓			Online storage
	✓			Responsible use of internet
			19	Internet service technologies
		✓		Location based Services (LBS)
		✓		Cloud computing
		✓		Effects on local hardware
		✓		Cloud applications
		✓		Cloud storage -
		✓		Advantages and disadvantages
			110	Sharing over internet
		✓		Peer-to-peer file sharing
		✓		Centralized v decentralized
		✓		BitTorrent (for large files)
		✓		Remote access
		✓		VPN
		✓		Sharing allows collaboration and tracking of edits etc
			111	Searching
	✓	✓		Boolean logic in the search
	✓	✓		Text, audio
	✓	✓		Images – reverse image lookup
	✓	✓		Adv search with logical operators
	✓	✓		Search engine optimization
			112	Errors – source
		✓		Human error
		✓		Arithmetic errors
		✓		Data transmission errors
		✓		Programming logic errors
		✓		Runtime errors
			113	Errors – solutions

		✓		Verification v validation
		✓		Input techniques – hardware
		✓		Input – GUI
		✓		RFID
		✓		Biometric
		✓		Optical character recog (OCR)
			I14	Data validation checks
		✓		Presence
		✓		Range
		✓		Unique
		✓		Length
		✓		Type
		✓		Logic
		✓		Check digit
		✓		Check sum
		✓		parity
			I15	Data integrity and protection
		✓		Hardware failure
		✓		Power failure
		✓		Malware
		✓		Social engineering
		✓		Botnets, zombie armies
		✓		Denial of service (DDOS)
		✓		Open ports
		✓		Wi-Fi vulnerabilities
			I16	Solutions to protect data
		✓		RAID – level 1 and 5
		✓		Backups – local and remote
		✓		UPS
		✓		Redundant power supplies
		✓		Strong password
		✓		Biometric input
		✓		User rights
		✓		Encryption and digital signatures
		✓		Network security
		✓		TKIP – Wi-Fi security protocol
		✓		Firewalls
		✓		Audit trails
		✓	I16.2	Anti-malware
		✓		Updates and upgrades
		✓		Two step authentications
		✓	I16.3	Educate users against social engineering
			I17	Malware

