

Unit 1: Digital Information

1. Be able to count in binary! (or convert decimal numbers to binary)

1/0	1/0	1/0	1/0	1/0	1/0
2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	2 ⁻¹

2. Explain why binary was chosen as a method of communication in computing.

To make sense of complicated data, your computer has to encode it in binary. Binary is a base 2 number system. Base 2 means there are only two digits—1 and 0—which correspond to the on and off states your computer can understand.

3. Describe how to represent fractions in the binary number system.

1/0	1/0	1/0	1/0	1/0	1/0
2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	2 ⁻¹

4. Understand that overflow and round off errors result from real-world limitations in representing place value.

Digits are not enough bits to accurately represent a number.
Roundoff: not enough bit in the decimal place

5. Understand the relationship between the powers of 2 and the number of bits needed to express a number of a certain magnitude. e.g. How many bits do I need to represent the number “15”, or “32”, or “1492”?

1/0	1/0	1/0	1/0	1/0	1/0
2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	2 ⁻¹

6. Explain how bits are grouped to represent abstractions like numbers and text. (be able to use an ASCII table)

ASCII TABLE

Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char
0	0	[NULL]	32	20	[SPACE]	64	40	@	96	60	`
1	1	[START OF HEADING]	33	21	!	65	41	A	97	61	a
2	2	[START OF TEXT]	34	22	"	66	42	B	98	62	b
3	3	[END OF TEXT]	35	23	#	67	43	C	99	63	c
4	4	[END OF TRANSMISSION]	36	24	\$	68	44	D	100	64	d
5	5	[ENQUIRY]	37	25	%	69	45	E	101	65	e
6	6	[ACKNOWLEDGE]	38	26	&	70	46	F	102	66	f
7	7	[BELL]	39	27	'	71	47	G	103	67	g
8	8	[BACKSPACE]	40	28	(	72	48	H	104	68	h
9	9	[HORIZONTAL TAB]	41	29	)	73	49	I	105	69	i
10	A	[LINE FEED]	42	2A	*	74	4A	J	106	6A	j
11	B	[VERTICAL TAB]	43	2B	+	75	4B	K	107	6B	k
12	C	[FORM FEED]	44	2C	,	76	4C	L	108	6C	l
13	D	[CARRIAGE RETURN]	45	2D	.	77	4D	M	109	6D	m
14	E	[SHIFT OUT]	46	2E	-	78	4E	N	110	6E	n
15	F	[SHIFT IN]	47	2F	/	79	4F	O	111	6F	o
16	10	[DATA LINK ESCAPE]	48	30	0	80	50	P	112	70	p
17	11	[DEVICE CONTROL 1]	49	31	1	81	51	Q	113	71	q
18	12	[DEVICE CONTROL 2]	50	32	2	82	52	R	114	72	r
19	13	[DEVICE CONTROL 3]	51	33	3	83	53	S	115	73	s
20	14	[DEVICE CONTROL 4]	52	34	4	84	54	T	116	74	t
21	15	[NEGATIVE ACKNOWLEDGE]	53	35	5	85	55	U	117	75	u
22	16	[SYNCHRONOUS IDLE]	54	36	6	86	56	V	118	76	v
23	17	[ENG OF TRANS. BLOCK]	55	37	7	87	57	W	119	77	w
24	18	[CANCEL]	56	38	8	88	58	X	120	78	x
25	19	[END OF MEDIUM]	57	39	9	89	59	Y	121	79	y
26	1A	[SUBSTITUTE]	58	3A	:	90	5A	Z	122	7A	z
27	1B	[ESCAPE]	59	3B	;	91	5B	[	123	7B	{
28	1C	[FILE SEPARATOR]	60	3C	<	92	5C	\	124	7C	|
29	1D	[GROUP SEPARATOR]	61	3D	=	93	5D	]	125	7D	}
30	1E	[RECORD SEPARATOR]	62	3E	>	94	5E	^	126	7E	~
31	1F	[UNIT SEPARATOR]	63	3F	?	95	5F	_	127	7F	[DEL]

7. Explain how bits can be used to represent the individual pixels of a black and white image

1 for black and 0 for white.

8. Explain how bits can be used to represent the individual pixels of a color image

The number of bits used to represent the colours of pixels in a particular image is sometimes referred to as its "colour depth" or "bit depth". For example, an image or display with a colour depth of 8-bits has a choice of 256 colours for each pixel.

9. Explain how sampling is used to create a digital form of an analog image

Sampling is the process of converting a signal (e.g., a function of continuous time or space) into a numeric sequence (a function of discrete time or space). The process is also called analog-to-digital conversion, or simply digitizing

10. Compare data compression algorithms to determine which is best in a particular context.

11. Explain how copyright and Creative Commons Licenses can be applied to digital creative works.

Unit 2: The Internet

12. Differentiate between a hierarchical and a distributed system, and the difference between closed and open protocols.

13. Describe the way the Internet Protocol helps uniquely identify one another on the internet.

Each device has an unique address to identify each other.

14. Differentiate between IPv4 and IPv6, and explain why the system needed an update.

15. Describe the redundancy of routing between two points on the Internet and why it is beneficial.

16. Be able to identify the shortest route between two computers on the internet.

17. Evaluate the benefits and security concerns associated with the use of a routed system of sending packets.

18. Explain how packet numbering and reordering can allow for large messages to reliably be sent even if packets are dropped or arrive out of order.

19. Explain how subdomains of a website are represented by DNS.

20. Give a few reasons why DNS is useful and necessary.

21. Describe at least one vulnerability of DNS and how an attack on it works.

22. Describe the difference between the internet and the World Wide Web.

23. Explain how different layers of protocols on the Internet build upon and rely on one another.

24. Describe how a protocol or layer of the internet acts as an "abstraction" for other layers.

Unit 1:

Abstraction	A simplified representation of something that is more complex.
ASCII	American Standard Code for Information Interchange; the universally recognized raw text format that any computer can understand.
Hexadecimal	1, 2,3,4,5,6,7,8,9,0,a,b,c,d,e,f→16 options
RGB	Red, Green, Blue
Binary	A way of representing information using only two options.
Analog	Non digital
Bit	"binary digit"; a single unit of information in a computer, typically represented by 0 or 1
Byte	8 bits
Protocol	A set of rules governing the exchange or transmission of data between devices.
Algorithm	a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer.
Heuristic	Approximate solution because the same step won't always achieve the goal.
Lossy compression	a method of data compression in which the size of the file is reduced by eliminating data in the file.
Lossless compression	compression technique that does not lose any data in the compression process. Lossless compression "packs" data into a smaller file size by using a kind of internal shorthand to signify redundant data.
Sampling	process used in statistical analysis in which a predetermined number of observations are taken from a larger population.
Copyright	the exclusive legal right, given to an originator or an assignee to print, publish, perform, film, or record literary, artistic, or musical material, and to authorize others to do the same.
Creative Commons	Creative Commons licenses give everyone from individual creators to large institutions a standardized way to grant the public permission to use their creative work under copyright law.
Open Source	denoting software for which the original source code is made freely available and may be redistributed and modified.
Open Access	Open access (OA) refers to free, unrestricted online access to research outputs such as journal articles and books. OA content is open to all, with no access fees. There are two main routes to making research outputs openly accessible.

Unit 2:

DNS	(Domain Name System) — The service that translates URLs to IP addresses
HTTP	Hyper Text Transfer Protocol - the protocol used for transmitting web pages over the Internet
IETF	Internet Engineering Task Force - develops and promotes voluntary Internet standards and protocols, in particular the standards that comprise the Internet protocol suite (TCP/IP).
Internet	A group of computers and servers that are connected to each other.

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WWW	The World Wide Web (WWW) is combination of all resources and users on the Internet that are using the Hypertext Transfer Protocol (HTTP)
IP	Internet Protocol
IP Address	A number assigned to any device that is connected to the Internet.
Scalability	Scalability is the measure of a system's ability to increase or decrease in performance and cost in response to changes in application and system processing demands.
Net Neutrality	the principle that all Internet traffic should be treated equally by Internet Service Providers.
Network Redundancy	having multiple backups to ensure reliability during cases of high usage or failure
Fault tolerance	Fault tolerance is a process that enables an operating system to respond to a failure in hardware or software. This fault-tolerance definition refers to the system's ability to continue operating despite failures or malfunctions.
Packets	Small chunks of information that have been carefully formed from larger chunks of information.
Metadata	a set of data that describes and gives information about other data. (file size)
Bandwidth	a range of frequencies within a given band, in particular that used for transmitting a signal.
SSL/TLS	Transport Layer Security (TLS) is the successor protocol to SSL. TLS is an improved version of SSL(Secure Sockets Layer). It works in much the same way as the SSL, using encryption to protect the transfer of data and information. The two terms are often used interchangeably in the industry although SSL is still widely used.
Router	A type of computer that forwards data across a network
TCP	(Transmission Control Protocol) - provides reliable, ordered, and error-checked delivery of a stream of packets on the internet. TCP is tightly linked with IP and usually seen as TCP/IP in writing.
UDP	User Datagram Protocol (UDP) – a communications protocol that facilitates the exchange of messages between computing devices in a network. It's an alternative to the transmission control protocol (TCP).
URL	(Uniform Resource Locator) - an easy-to-remember address for calling a web page.
DDos attack	The DDoS attack will send multiple requests to the attacked web resource – with the aim of exceeding the website's capacity to handle multiple requests... and prevent the website from functioning correctly.