

CIE AS Level Computer Science '24 Notes — Chapters 1 & 2

Information Representation and Communication

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1 Information Representation

1.1 Data Representation

Candidates should be able to:

1.1.1 Show understanding of binary magnitudes and the difference between binary prefixes and decimal prefixes.

1. Explain the concept of binary magnitudes and provide an example.
2. Differentiate between binary prefixes and decimal prefixes, providing specific examples for each.
3. Calculate the value of 1 kibi in binary notation.
4. How is the use of binary prefixes different from decimal prefixes in the context of data storage?

1.1.2 Show understanding of different number systems.

1. Describe the binary number system and its significance in computing.
2. Explain the octal and hexadecimal number systems and their applications.
3. How does the binary number system differ from the decimal number system?
4. Convert the decimal number 47 to its binary equivalent.

1.1.3 Perform binary addition and subtraction.

1. Perform binary addition for the numbers 1101 and 1011.
2. Perform binary subtraction for the numbers 11010 and 1011.
3. Calculate the result of adding 1111 and 1010 in binary.

1.1.4 Describe practical applications where Binary Coded Decimal (BCD) and Hexadecimal are used.

1. Explain the application of Binary Coded Decimal (BCD) in computing or electronics.
2. Describe scenarios where hexadecimal representation is more advantageous than decimal representation.
3. How is BCD used in the context of real-time clocks or timers?

1.1.5 Show understanding of and be able to represent character data in its internal binary form, depending on the character set used.

1. Explain the concept of character encoding and its significance.
2. Describe the ASCII character set and provide an example of its usage.
3. Demonstrate how the character "A" is represented in binary according to the ASCII standard.
4. Differentiate between ASCII, extended ASCII, and Unicode character encoding.

1.2 Multimedia Graphics

Candidates should be able to:

1.2.1 Show understanding of the effects of changing elements of a bitmap image on the image quality and file size.

1. Explain how changing the resolution of a bitmap image affects its quality and file size.
2. Describe the impact of altering the color depth (bit depth) on the quality and file size of a bitmap image.
3. Provide examples of scenarios where reducing image quality is acceptable due to file size constraints.

1.2.2 Show understanding of how data for a vector graphic are encoded.

1. Explain the encoding method used for vector graphics.
2. Differentiate between raster (bitmap) and vector graphics, highlighting their encoding differences.
3. Describe how scalable vector graphics (SVG) are encoded and their advantages.

1.2.3 Justify the use of a bitmap image or a vector graphic for a given task.

1. Explain when it is more appropriate to use a bitmap image rather than a vector graphic.
2. Justify the choice of vector graphics for creating logos or illustrations.
3. Describe a scenario where the use of a bitmap image is the best choice.

1.3 Sound

Candidates should be able to:

1.3.1 Show understanding of how sound is represented and encoded.

1. Explain the representation of sound using analog and digital data.
2. Define sampling and sampling rate in the context of sound representation.
3. Describe how analog sound is converted into digital format.

1.3.2 Show understanding of the impact of changing the sampling rate and resolution.

1. Explain how increasing the sampling rate affects the quality and file size of a digital audio recording.
2. Describe the impact of changing the resolution (bit depth) on the accuracy and file size of a sound recording.
3. Justify the choice of a specific sampling rate for recording music.

1.4 Compression

Candidates should be able to:

1.4.1 Show understanding of the need for and examples of the use of compression.

1. Explain the purpose and significance of data compression in computing.
2. Provide real-world examples of situations where data compression is essential.
3. Describe the benefits of data compression in terms of storage and transmission.

1.4.2 Show understanding of lossy and lossless compression and justify the use of a method in a given situation.

1. Define lossy compression and its application in scenarios where some data loss is acceptable.
2. Explain lossless compression and situations where preserving data integrity is critical.
3. Justify the choice between lossy and lossless compression based on specific use cases.

1.4.3 Show understanding of how a text file, bitmap image, vector graphic, and sound file can be compressed, including the use of run-length encoding (RLE).

1. Explain the principles of compressing text files and provide an example.
2. Describe the techniques and methods used to compress bitmap images.
3. Explain how vector graphics can be compressed to reduce file size.
4. Describe the use of Run-Length Encoding (RLE) in compressing data and provide an RLE example.

2 Communication

2.1 Networks including the internet

Candidates should be able to:

2.1.1 Show understanding of the purpose and benefits of networking devices.

1. Explain the purpose and role of a router in a network.
2. Describe the function and benefits of using network switches in a LAN.
3. Differentiate between a modem and a router and explain their distinct purposes.

2.1.2 Show understanding of the characteristics of a LAN (local area network) and a WAN (wide area network).

1. Define a LAN and its typical size and scope.
2. Explain the characteristics and geographical scope of a WAN.
3. Describe situations where a LAN is more suitable than a WAN and vice versa.

2.1.3 Explain the client-server and peer-to-peer models of networked computers.

1. Define the client-server model and provide examples of its use.
2. Describe the peer-to-peer model and its application in a network environment.
3. Differentiate between client-server and peer-to-peer network architectures.

2.1.4 Show understanding of thin-client and thick-client and the differences between them.

1. Explain the concept of a thin client and its role in a networked environment.
2. Describe what a thick client is and when it is more appropriate to use one.
3. Compare and contrast thin-client and thick-client models in terms of advantages and disadvantages.

2.1.5 Show understanding of the bus, star, mesh, and hybrid topologies.

1. Define and describe the bus network topology.
2. Explain the characteristics and benefits of a star network topology.
3. Describe the mesh network topology and its application in specific scenarios.
4. Explain the concept of a hybrid network topology and provide examples of its use.

2.1.6 Show understanding of cloud computing.

1. Explain the concept of cloud computing and its significance.
2. Describe the different service models in cloud computing (IaaS, PaaS, SaaS).
3. Explain the benefits and potential drawbacks of using cloud services.

2.1.7 Show understanding of the differences between and implications of the use of wireless and wired networks.

1. Differentiate between wired and wireless network connections.
2. Describe the implications of using a wired network in terms of reliability and speed.
3. Explain the advantages and challenges of wireless networks in terms of mobility and security.

2.1.8 Describe the hardware that is used to support a LAN.

1. List and describe the essential hardware components of a local area network (LAN).
2. Explain the role of a network interface card (NIC) in a LAN.
3. Describe the purpose and function of a wireless access point (WAP) in a LAN.

2.1.9 Describe the role and function of a router in a network.

1. Explain the role of a router in directing data packets in a network.
2. Describe how a router connects multiple networks and forwards data between them.
3. Explain the concept of network address translation (NAT) and its role in a router.

2.1.10 Show understanding of Ethernet and how collisions are detected and avoided.

1. Explain what Ethernet is and its importance in network communications.
2. Describe the Carrier Sense Multiple Access/Collision Detection (CSMA/CD) method used to detect and manage collisions.
3. Explain how CSMA/CD helps ensure efficient data transmission in Ethernet networks.

2.1.11 Show understanding of bit streaming.

1. Define bit streaming and its relevance in media streaming.
2. Describe the methods of bit streaming, including real-time and on-demand streaming.
3. Explain the importance of bit rates in the context of media streaming.

2.1.12 Show understanding of the differences between the World Wide Web (WWW) and the internet.

1. Differentiate between the World Wide Web (WWW) and the internet.
2. Explain the structure and function of the World Wide Web as a subset of the internet.
3. Describe how the WWW relies on the internet's infrastructure for connectivity.

2.1.13 Describe the hardware that is used to support the internet.

1. List and describe the key hardware components that support the functioning of the internet.
2. Explain the role of data centers and servers in providing internet services.
3. Describe the importance of internet exchange points (IXPs) in global internet connectivity.