

Group Assignment: Data Representation in Computer Systems

In groups of 3 or 5, prepare well structured notes on the subtopic allocated to the group and present it to the class.

Every group should cover these sections;

1. Introduction to the subtopic
2. Key concepts and definitions
3. How the representation works
4. Examples
5. Advantages and limitations, where applicable
6. Real life application
7. BIDA application
8. Diagrams/ tables, where appropriate
9. Practical activity
10. Conclusion
11. References

Group	Subtopic	Areas to cover	Practical activity	Prepare a question for the class
1	Foundations of Data Representation and Binary Systems	• Meaning of data • Meaning of data representation • Why computers need data representation • Analog versus digital data • Digital representation • Binary number system • Bits and Bytes • Decimal-to-binary conversion • Binary-to-decimal conversion • Hexadecimal number system • Octal number system	Convert a list of decimal numbers into binary and hexadecimal using Excel	
2	Numerical Data Representation	• Integer representation • Positive and negative numbers • Signed and unsigned numbers • Two's complement • Fixed-point representation • Floating-point representation • Precision	Demonstrate how incorrect data types or rounding can affect calculations	

		• Rounding • Overflow • Underflow • Numerical errors		
3	Character and Text Representation	• Character representation • Character encoding • ASCII • Extended ASCII • Unicode • UTF-8 • Character sets • Text files • Encoding versus decoding • Importance of standardization	Investigate what happens when inappropriate character encoding is used	
4	Boolean and Logical Data Representation	• Boolean data • True and False • 1 and 0 • ON and OFF • Logical operations • AND • OR • NOT • Truth tables • Boolean expressions	Create an Excel dataset with Boolean variables and use logical functions	
5	Date, Time and Categorical Representation	• Date representation • Time representation • Date-time values • Timestamps • Date formats • Time zones • Date calculations • Problems caused by storing dates as text • Nominal categories • Ordinal categories • Coding categories • Label encoding • One-hot encoding	Compare different formats of dates and time Explain why numerical codes do not necessarily represent numerical quantities.	
6	Image and Graphics Representation	• Digital images • Pixels • Image resolution • Colour depth • Bitmaps/raster images • Vector graphics • RGB	Investigate if higher resolution always mean better data for analytics	

		• Grayscale • Image file formats • Image compression		
7	Audio and Video Representation	• Sound waves • Digital audio • Sampling • Sampling rate • Quantization • Bit depth • Audio file size • Video frames • Frame rate • Resolution • Digital video • Audio-video synchronization • Streaming	Investigate how changing video resolution and frame rate would affect file size and analytical requirements	
8	Data Structures and Formats	Structured data • relational tables • Excel spreadsheets • SQL databases Semi-structured data • JSON • XML • HTML Unstructured data • documents • images • audio • video • social-media posts Data formats • CSV • XLSX • JSON • XML • TXT • PDF • JPEG • PNG • MP3	Use a real life example to identify the different forms of data produced and explain how each could be represented, stored and analyzed	

		• MP4		
9	Data Compression	• Meaning of compression • Lossless compression • Lossy compression • Advantages • Disadvantages • Compression in databases • Compression in multimedia	Demonstrate compression of text and files	

Presentation Requirement

Each group is expected to prepare a brief 3-5 page document of notes on the subtopic assigned, 3-5 slides showing diagrams/ tables/ illustrations/ worked out examples and demonstrate the subtopic using at least one digital tool.

Presentation date: 14/10/2026 and 16/10/2026

Submission date: 17/10/2026

Group participation: 5 marks

Individual participation: Each group member is expected to present (5 marks)