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DAT601 Assessment

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Contents

An introduction to data modelling in information systems that includes an outline of the fundamental principles of effective data management. Include an overview of Conceptual, Logical data modelling and Physical implementation. (5 marks)

Developing information systems that efficiently gather, handle, and use data, require Data Modelling. It consists of creating physical, logical, and conceptual representations of connections and data structures inside an organisation. The key ideas that ensure data accuracy, consistency, integrity, and accessibility throughout time are the foundation of effective data management.

Fundamental Principles of Effective Data Management found on(*What Is an Entity Relationship Diagram (ERD)?*, n.d.):

1. **Data Quality**: Making sure that data is relevant, accurate, thorough, and consistent with the requirements of a business is of the highest significance. To guarantee that mistakes are kept to a minimum and that strict standards are maintained, regular usage of data quality measures is required.
2. **Data Governance**: Data governance is the action of creating policies, procedures, and positions for the management of data resources inside an organisation. This method ensures accountability, compliance with regulations, and strategic alignment with corporate objectives.
3. **Data Security**: There are safeguards in place to prevent illegal data from being accessed, altered, or disclosed. These include implementing use restrictions, limiting access to only authorised staff via authentication, and conducting regular security audits to guarantee the preservation of sensitive data.
4. **Data Integration**: Ensure that data is flowing smoothly between the various systems and applications used by the company. Through integration, discrete information pockets are removed, ensuring data consistency and enhancing decision-making abilities.
5. **Data Lifecycle Management**: The systematic approach from development to archiving or removal is called Data Management. This involves developing procedures for gathering, storing, retrieving, archiving, and destroying data while considering legal and regulatory requirements.
6. **Metadata Management**: Metadata documentation and upkeep provide context and meaning to data. The ability to interact with learning and interpretation of data are all enhanced by metadata management.

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An Overview of Data Modeling (*What Is Data Modeling?*, 2024):

1. **Conceptual Data Modeling**: Understanding business needs, creating overarching concepts, and creating relationships between different data components are the main focus points throughout this phase. To make the data structure understandable for non-technical people, conceptual models are usually used.
2. **Logical Data Modeling**: Now the Conceptual model has been further developed into a more detailed diagram with components like relationships, keys, and data properties. Logical models of data show their structure independently of database systems; they are mostly used to define database schemas as they are represented graphically by Entity-Relationship Diagrams or the Unified Modelling Language (UML).
3. **Physical Implementation**: The conceptual data model must finally be transformed into a physical database structure that is compatible with the selected database management system. To do this, tables and columns must be created, data types must be specified, indexes must be established, and restrictions must be based on efficiency, storage capacity, and security standards. The physical design's implementation gives a quick and easy way to manipulate data while providing an effective way to store or retrieve it.

A description of conceptual modeling using Enhanced Chen Entity Relationship Diagramming (ERD). An introduction to conceptual modelling using Chen ERDs with a depiction and description of all components of a Chen ERD, including extended components. Describe how the fundamental principles of data management are applied through of the enhanced Chen ERD in enterprise modelling. (10 marks)

(*How To Make Chen ER Diagram | Entity Relationship Diagram - ERD - Software for Design Chen ER Diagrams | ERD Symbols and Meanings | What Is Chen Notation*, n.d.)

The underlying idea of the Enhanced Chen ERD is to represent entities, attributes, relationships, and cardinality restrictions using a variety of symbols and notations. While attributes are used to show different aspects, like an order date or a customer's name, entities stand for things or concepts that exist in the real world, such as customers, items, or orders. There is another improvement in the system that involves weak entities. These are entities without

unique identification through their attributes; they require a strong entity for adequate recognition. Weak entities appear as double-bordered rectangles in diagrams, indicating reliance on other related entities for existence.

A comprehensive conceptual modelling framework that takes into account subtypes, weak entities, and participation limits is provided by the Enhanced Chen ERD. Using this technique helps stakeholders better understand the relationships and structure found in a database, allowing the database to be better designed with reliable solutions that work well.

(*ER Diagrams in DBMS*, n.d.)

Components of Chen's Entity-Relationship Diagram:
Attributes are the attributes or characteristics of an entity. Ovals connected to the appropriate entities can be used in Chen ERDs to express those details, which specify an entity's specific attributes. Each attribute has a name that is exclusive to it and explains the data it contains.
The primary key serves as a unique identifier for every entity instance in a database. It differs from other attributes because it uniquely distinguishes each entry within a table. When creating Chen Entity-Relationship Diagrams, the primary key is highlighted by underlining its attribute oval. Associations between entities are represented by relationships, which delineate their connections and interactions. Chen ERDs utilizes diamond shapes connected via lines to connect the related entities. Every relationship is given a descriptive name that precisely indicates its nature.
The concept of cardinality involves determining the quantity of associations between instances of different entities in a relationship. In Chen ERDs, symbols placed near the lines representing relationships are used to indicate cardinality. The notations frequently employed for indicating cardinality include "1" (one), "M" (many), and "0"(zero). An instance where there is one entity associated with multiple instances from another would be denoted as “1:M” within this system.

Extended Elements of Chen's ERD:
Weak entities lack their own primary key attribute and thus depend on a related strong entity to furnish a partial or complete identifier. These types of entities are depicted by dual rectangles in Chen ERDs and linked to their identifying strong entities through a double-diamond relationship.
Derived attributes are those that may be obtained from other attributes that are part of the same entity. These attributes are computed or produced based on requirements rather than being explicitly stored. A dashed oval in Chen ERDs denotes derived qualities, such as age.
Multivalued attributes refer to the characteristic of having more than one value for a singular instance of an entity. They are visually represented using twin ovals in Chen ERDs.

Enterprise modelling applies fundamental data management concepts to guarantee efficient data representation and organisation inside an organization's information systems. For this, the Enhanced Entity-Relationship Diagram (ERD), created by Peter Chen, is frequently employed.

Objects or concepts from the real world that are present in an organisation are represented by entities in the Chen Entity-Relationship Diagram. First, it is critical to accurately identify and characterise these entities to incorporate into the model all relevant components related to organisational processes.

The entities in the Chen ERD have characteristics or attributes that are defined by assigned specifications. To provide comprehensive data visualisation, these properties need to be determined and well-categorised. Exact specification of the characteristics makes it possible to efficiently collect all relevant information about each item, enabling precise administration of data sets.

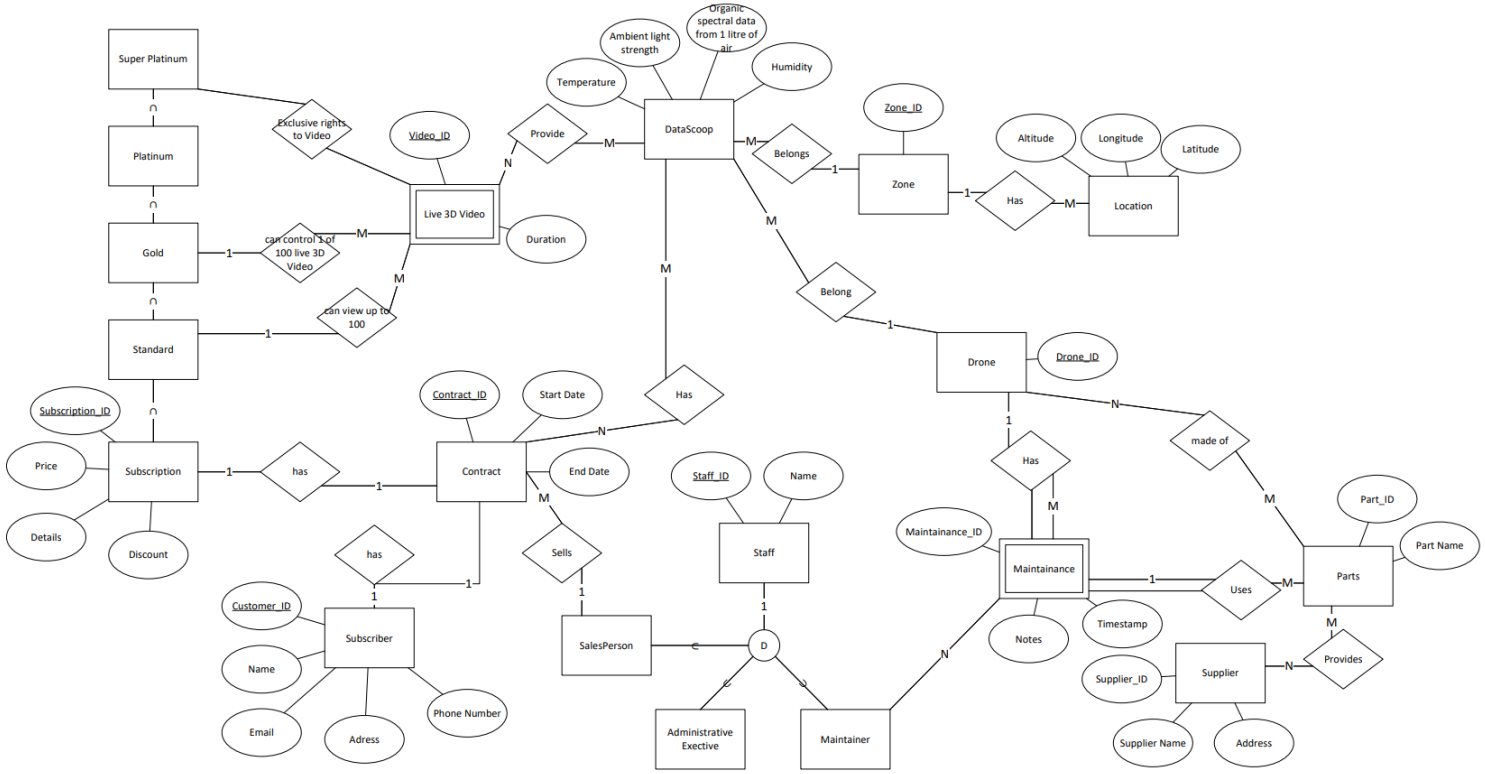
Understanding how entities interact is crucial to understanding the different parts of the organisation. The creation of various relationships (one-to-one, one-to-many, and many-to-many) between things is made possible by Chen's ERD. The organization's data structure's complex interactions and dependencies may be more easily modelled with this method.

The connectivity between entities is determined by the cardinality and optionality constraints, which control the number of instances from one entity that may be linked to another and whether or not such an instance is required for their association. Maintaining these restrictions ensures data coherence and integrity in data management.

In database architecture, normalisation is a data management technique that lessens dependencies and redundancies. It is possible to break down large items into smaller parts with clear connections between them by using normalisation techniques on Chen ERD. By doing this, redundancies in information storage are reduced and information storage becomes more efficient, improving data management procedures.

Data integrity is enforced to maintain data reliability, consistency, and dependability. Chen ERD allows for the imposition of certain constraints, such as entity integrity, referential integrity, or domain integrity, to avoid mistakes or inconsistencies in the data that is stored and accessed. This ensures that an organization's priceless assets continue to be reliable and of high quality.

A conceptual ER model using Chen Enhanced ERD notation of the database as derived from the project brief /case study. Accompany this with your rationale; describe and explain the reasoning and purpose of all parts of the model. Write and reflect on how the fundamental principles of data management are applied through conceptual ER modelling using the Chen Extended ERD. (20 Marks)



A data dictionary using the template provided on the course website, which covers the following:

- Entities (e.g., name description, aliases, occurrences)
- Relationships (e.g., name, multiplicity)
- Attributes (e.g., name, description, domain, aliases, composite, derived, nulls, key, default value).

Accompany this with your rationale; describe and explain the reasoning and purpose of all parts of the model. Write and reflect on how the fundamental principles of data management are applied by using data dictionaries. (LO1, LO4) (10 marks)

Table 1: Document Entities

Entity Name	Description	Aliases	Occurrence
datascoop	A collection of live 3d video	DataScoop	
live3dvideo		Live 3D Video	
zone		Zone	
subscriber		Subscriber	
contract		Contact	
maintenance		Maintenance	
supplier		Supplier	
administrative_executive		Administrative Executive	
drone	Records Live 3D Video	Drone	

Table 2: Document Relationships

Entity Name	Cardinality	Participation	Relationship	Participation	Cardinality	Entity Name
DataScoop - Temporary Backup						
DataScoop - Maintenance Record						
DataScoop - Contract						
DataScoop - Location						
DataScoop - Zone						
Zone - Contract						
Subscriber - Subscription						
Subscriber - Subscription Level						
Contract - Subscription Level						
Subscription - Price						
Administrative Executive - Subscription Price						
Administrative Executive - Contract Details						
Remote Roaming - DataScoop Sharing						

Table 3: Document Attributes

Entity Name	Attributes	Description	Domain	Aliases	Composite	Derived	Nulls	Key?	Default Value
DataScoop		Remote data sensing capability (latitude, longitude, altitude)							
		Data storage capacity (one month onboard)							
		Sensing parameters (temperature, humidity, ambient light, organic spectral data)							
		Communication methods (satellite, ground-based mobile cellular networks)							
		Configuration options (Jungle, Forest, Savannahs, Ice and Snow, Mountain, Desert, Urban)							
Contract		Subscription services provided							
		Subscription tiers (Standard, Gold, Platinum, Super Platinum)							
		Access rights (Platinum, Super Platinum exclusivity)							
		Geographic deployment (specified bounded regions/Zones)							
		Overlapping regional Zones							
Subscriber		Subscription type (Standard, Gold, Platinum, Super Platinum)							
		Access to 3D stereographic video streams							
		Control interface for DataScoops							
Sales Personnel		Sales channels (booths, shops, e-commerce website)							

Entity Name	Attributes	Description	Domain	Aliases	Composite	Derived	Nulls	Key?	Default Value
		Discount allowance (up to 3%)							
Maintenance Records		Maintenance history							
		Parts maintenance schedule (every five years)							
Staff Roles		Administrative Executive role							
		Permission to change subscription prices							
		Permission to enter contract details							
Geographic Zones		Deployment of DataScoops							
		Overlapping regions							
		Potential sharing of Zones for remote roaming expansion							
Company Metrics		Number of DataScoops deployed							
		Number of Zones covered							
		Number of contracts							

Discuss the assumptions made about the business rules and the reasons for the choices you made. Include a reflection in the outline of how the fundamental principles of data management as they are applied to assumptions about the business rules. (LO1, LO4) (5 marks)

Source

ER Diagrams in DBMS: Entity Relationship Diagram Model | Simplilearn. (n.d.). Simplilearn.Com. Retrieved 1 May 2024, from https://www.simplilearn.com/tutorials/sql-tutorial/er-diagram-in-dbms

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What is an Entity Relationship Diagram (ERD)? (n.d.). Lucidchart. Retrieved 1 May 2024, from https://www.lucidchart.com/pages/er-diagrams

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