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Informatics Institute Of Technology

Database Systems

5COSC020C.1

Part A

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## 1) CONCEPTUAL ERD

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## Assumptions

1. I assume that one trip can be arranged for multiple tourists. As an example, tourists can come in as groups such that causes Archipelago Crazy only keep one record of that entire tour group.
2. I assume that there can be more staff types except for the three types given in the case study. So, I assume that participant constraint should be mandatory. And the disjoint constraint should be or because it strictly says that roles are specialized one staff can only be one, they cannot overlap.
3. I assume that they maintenance a maintain log because in the case study they have given they should record every service carefully and I assume that it should done by boat mechanics.
4. I assume that guided visit does not requires a walking guide (in the case study they have not specifically mentioned it. But have specifically mentioned a walking tour has a guide) guided visit can be a guideline tour which gives only guidelines before the tour.
5. I assume that every tourist must at least visit one island.

## 2) Data Dictionary to document how I identified the entities

|  |  |
| --- | --- |
| **Entity Name** | **Brief Description** |
| w1830179\_Tourist | General term describing all tourists who arrange trips from ArchipelagoCrazy. |
| w1830179\_Boat | General term describing all boats which ArchipelagoCrazy use to provide services that tourist require. |
| w1830179\_Adventure | General term describing all adventures ArchipelagoCrazy provides. |
| w1830179\_Staff | General term describing all staff employed by ArchipelagoCrazy. |
| w1830179\_Island | General term describing all islands which ArchipelagoCrazy organizes trips. |
| w1830179\_Trip | General term describing all trips which ArchipelagoCrazy organizes. |
| w1830179\_Maintenances\_Log | General term describing all maintenance records which ArchipelagoCrazy keep on their boats. |

|  |  |  |
| --- | --- | --- |
| **General entity** | **Specialized entity** | **Brief Explanation** |
| w1830179\_Boat | w1830179\_Large\_Motorised | A general term to describe boats that can carry higher number of passengers in it. This boat type used to carry passengers from the mainland to the islands. |
| w1830179\_Small\_Motorised | A general term to describe boats that can carry between only 6 to 8 people in it. And this is used to provides a local taxi service. |
| w1830179\_Paddle\_propelled | A general term to describe boats that is used carry passengers to more remote bays and creeks. |
| w1830179\_Adventure | w1830179\_Sea\_Adventure | A general term to describe all adventures which take place at sea. This entity has three more specialized entities. |
| w1830179\_Land\_Adventure | A general term to describe all adventures which take place at land. |
| w1830179\_Sea\_ Adventure | w1830179\_Sea\_Crossing | Traveling between islands using lager motorised boat, with having a meal on board if required. |
| w1830179\_Beach\_Taxi Service | A general term to describe travelling among beaches using smaller motorised boats. |
| w1830179\_Marine\_Exploration | A general term to describe exploring remote areas in sea using a paddle-propelled boat. |
| w1830179\_Land\_Adventure | w1830179\_Guided\_Visit | A general term to describe visiting landmarks in the area. |
| w1830179\_Walking\_Tour | A general term to describe land tours which can be nocturnal if required and this requires guide to guide them |
| w1830179\_Staff | w1830179\_Sea\_Crew | A general term to describe Staff which organizes and manages sea adventures for ArchipelagoCrazy. |
| w1830179\_Walking\_Guide | A general term to describe Staff which employs by ArchipelagoCrazy to organizes and manages land adventures for. |
| w1830179\_Boat\_Mechanic | A general term to describe Staff which maintenance all the boats which used by ArchipelagoCrazy. |

## 3) A data dictionary to document how I identified the relationships and multiplicities

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Entity name** | **Multiplicity** | **Relationship** | **Multiplicity** | **Entity name** | **Brief justifications for the multiplicity (4 statements for each relationship)** |
| w1830179\_Trip | 1..1 | have | 1.. \* | w1830179\_Tourist | One trip may have one tourist on it. without a single tourist a trip may not exist. |
| One trip may have many tourists on it. Because tourist can come in as groups. |
| One tourist must have one trip. |
| One tourist can only have up to one trip. |
| W1830179\_Tourist | 0.. \* | visits | 1..12 | W1830179\_Island | One tourist visits at least one island. Tourist must at least visit one island. |
| One tourist can only visit up to twelve islands. |
| One island may not have any tourist visiting it. |
| One island may have many tourists visiting it. |
| W1830179\_Tourist | 0.. \* | books | 0.. \* | W1830179\_adventure | One tourist can book no adventure. |
| One tourist can book many adventures. |
| One adventure can be book by no tourist. |
| One adventure can be book by many tourists. |
| W1830179\_Boat | 1..1 | carries | 0.. \* | W1830179\_Tourist | One boat may be not carrying any tourist on it. Boats can go without tourist to get serviced. |
| One boat can carry many tourists on it. |
| One tourist can be carried by one boat. |
| One tourist can be carried by only one boat. |
| w1830179\_Walking\_Guide | 1.. \* | oversee | 0..1 | w1830179\_Land\_Adventure | One walking guide may not oversee any land adventure. |
| One walking guide can only oversee up to one land adventure. |
| One land adventure can be overseen by at least one walking guide. |
| One land adventure can be overseen by many walking guides. |
| w1830179\_Walking\_Guide | 1.. \* | guides | 0..1 | w1830179\_Walking\_Tour | One walking guide may not guide any walking tour. |
| One walking guide can only guide up to walking tour. |
| One walking tour can be guided by at least one walking guide. |
| One walking tour can be guided by many walking guides. |
| W1830179\_Sea\_Crew | 1.. \* | manages | 0..1 | W1830179\_Sea\_Adventure | One sea crew may not manage any sea adventure. |
| One sea crew can only manage up to one sea adventure. |
| One sea adventure can be managed by at least one sea crew. |
| One sea adventure can be managed by many sea crew. |
| w1830179\_Marine\_Exploration | 0.. 1 | uses | 1..1 | w1830179\_Paddle\_propelled | One marine exploration uses at least one paddle propelled boat. |
| One marine exploration uses up to one paddle propelled boat. |
| One paddle propelled boat may not be used in any marine exploration adventure. |
| One paddle propelled boat can be used in one marine exploration adventure. |
| W1830179\_Boat | 0.. 1 | maintain | 1.. \* | w1830179\_Boat\_Mechanic | One boat maintained by at least one boat mechanic. |
| One boat can be maintained by many boat mechanics. |
| One boat mechanic can maintain no boats. |
| One boat mechanic can maintain up to one boat. |
| w1830179\_Beach\_Taxi\_Service | 0.. 1 | uses | 1..1 | w1830179\_Smaller\_Motorised | One beach taxi service uses at least one smaller motorised boat. |
| One beach taxi service uses up to one smaller motorised boat. |
| One smaller motorised boat may not be used in any beach taxi service. |
| One smaller motorised boat can be used in one beach taxi service. |
| w1830179\_Sea\_Crossing | 0.. 1 | uses | 1..1 | w1830179\_Large\_Motorised | One Sea crossing adventure uses at least one Large motorised boat. |
| One Sea crossing adventure uses up to one Large motorised boat. |
| One Large motorised boat may not be used in any Sea crossing adventure. |
| One Large motorised boat can be used in one Sea crossing adventure. |
| w1830179\_Staff | 1.. \* | Verify | 1.. \* | w1830179\_Boat | One staff member verifies at least one boat in one island. |
| 1.. \* | w1830179\_Island | One staff member may verify many boats in many islands |
|  |  |  |  |  |  |
| w1830179\_Boat | 1.. \* | Verify | 1.. \* | w1830179\_Staff | One boat at least verifies by one staff in one island. |
| 1.. \* | w1830179\_Island | One boat may be verified by many staff members at many islands. |
|  |  |  |  |  |  |
| w1830179\_Island | 1.. \* | Verify | 1.. \* | w1830179\_Staff | One island verifies at least one boat from one staff member. |
| 1.. \* | w1830179\_Boat | One island may verify many boats from many staff members. |
| w1830179\_Boat\_Mechanic | 1.. \* | Keeps | 1.. \* | w1830179\_Maintenances\_Log | One boat mechanic may at least keep one maintenance log for one boat. |
| 1.. \* | w1830179\_Boat | One boat mechanic may keep many maintenance logs for many boats. |
|  |  |  |  |  |  |
| w1830179\_Boat | 1.. \* | Keeps | 1.. \* | w1830179\_Maintenances\_Log | One boat at least keeps one maintenances log from one boat mechanic. |
| 1.. \* | w1830179\_Boat\_Mechanic | One boat may keep many maintenances log from many boat mechanics. |
|  |  |  |  |  |  |
| w1830179\_Maintenances\_Log | 1.. \* | Keeps | 1.. \* | w1830179\_Boat | One maintenances log at least kept for one boat from one boat mechanic. |
| 1.. \* | w1830179\_Boat\_Mechanic | One maintenances log can be kept from many boat mechanics for many boats. |

## 4) Data dictionary to document how I identified the attributes and primary keys

|  |  |  |
| --- | --- | --- |
| **Entity name** | **Attributes for this entity (include PK)** | **Justification** |
| w1830179\_Trip | w1830179\_tripId{pk} | Uniquely identifies a trip. |
| w1830179\_arrivalDate | Arrival date of the tourist or the tourist groups. |
| w1830179\_depatureDate | Departure date of the tourist or the tourist groups. |
| w1830179\_totalTourists | Number of tourists involved in the trip. |
| w1830179\_Tourist | w1830179\_passportNum{pk} | Uniquely identifies a tourist. |
| w1830179\_name | Name of the tourist. |
| w1830179\_country | Country of the tourist. |
| w1830179\_Island | w1830179\_islandId{pk} | Uniquely identifies an island. |
| w1830179\_islandName | Name of the island. |
| w1830179\_Adventure | w1830179\_adventureId{pk} | Uniquely identifies an adventure. |
| w1830179\_location | Adventure held location. |
| w1830179\_Sea\_Adventure | w1830179\_boatId | Id of the boat used in the sea adventure. |
| w1830179\_tripRoute | Trip rout of the adventure. |
| w1830179\_Guided\_Visit | w1830179\_landmarkLocation | Location of the visiting landmark. |
| w1830179\_Walking\_Tour | w1830179\_time | Time of the tour nocturnal or not nocturnal. |
| w1830179\_Sea\_Crossing | w1830179\_mealRequired | Meal required in the adventure it can be null as well. |
| w1830179\_Maintenance\_Log | w1830179\_recordNumberId{pk} | Uniquely identifies a maintenance log. |
| w1830179\_Boat | w1830179\_boatId{pk} | Uniquely identifies a boat |
| w1830179\_capacitiy | Capacity of the boat. |
| w1830179\_engineNum | Engine number. |
| w1830179\_Paddle\_Proplled | w1830179\_type | Type of the paddle propelled boat. |
| w1830179\_Staff | w1830179\_staffId{pk} | Uniquely identifies a staff member. |
| w1830179\_name | Name of the staff member |
| w1830179\_country | Original country of the staff member |
| w1830179\_salary | Salary of the staff member |

## 5) The logical ERD

A picture containing dark, outdoor object, night, night sky

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## 6) SQL query

Creating the databaseGraphical user interface, text, application

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Creating the studio table

Graphical user interface, text, application

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Graphical user interface, text, application, Word

Description automatically generated

Creating the equipment table

Graphical user interface, text, application

Description automatically generated

Graphical user interface, text, application, Word, email

Description automatically generated

Adding data into studio table

Graphical user interface, text, application

Description automatically generated

Graphical user interface, application, Word

Description automatically generated

Graphical user interface, application

Description automatically generated

Adding data into equipment table

Graphical user interface, text, application

Description automatically generated

Graphical user interface, application, Word

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Answer

Graphical user interface, text, application

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Graphical user interface, text, application, email

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## 7) Comparative analysis table Between Relational Databases vs. NoSQL databases with a view to inform the decision-making of the management of a firm.

Before Getting into the comparative analysis table Its Important to know what relational database is and what is NoSQL database.

For years, relational databases have been a widely used technology. They are well-established, well-proven, and widely used. There are several database products, tools, and expertise to choose from. Relational databases keep track of data tables that are connected to one another. These tables have a set schema, manage data with SQL (Structured Query Language), and provide ACID guarantees.(Robvet, 2021)

No-SQL databases refer to high-performance, non-relational data stores. They shine out for their ease of use, flexibility, resilience, and availability. NoSQL stores unstructured or semi-structured data, in key-value pairs or JSON documents, rather than joining tables of normalized data. Beyond the scope of a single database partition, most No-SQL databases do not satisfy ACID guarantees. NoSQL datastores are preferred by high-volume services that demand sub-second response times. (Robvet, 2021)

This will give you an idea about these database systems. Now Using a comparative analysis table, we will get into more details.

|  |  |  |
| --- | --- | --- |
| **Criterion** | **Relational Databases** | **NoSQL databases** |
| 1. schemas | Before you can insert data, you must first define your schema. Changing the schema structure of a relational database is costly, time-consuming, and frequently involves downtime or service interruptions.  (Mohamed, Altrafi and Ismail, 2014) | Have a dynamic schema and work with "unstructured data." This implies you can start developing your application before even defining the schema. NoSQL databases are easier to modify when data and requirements change since they do not require a predefined schema.  (Mohamed, Altrafi and Ismail, 2014) |
| 2. Structure | organize and store data by tables with fixed columns and rows.  (Berga and Franco, 2021) | can be graph, document-oriented, key-value, column-oriented, and others*.*  (Berga and Franco, 2021) |
| 3.Data Consistency | Relational Databases are great at enforcing consistency. (Robvet, 2021) | It relies on the database management system, as some offer high consistency while others merely provide eventual consistency.  (Robvet, 2021) |
| 4. Storage Type | Highly Available Storage (SAN, RAID, etc.).  (Li and Manoharan, 2013) | Commodity drives storage (standard  HDDs, JBOD). (Li and Manoharan, 2013) |
| 5. infrastructures | Relational Databases often require high-end special-purpose hardware.  (Berga and Franco, 2021) | NoSQL Databases are well known for their ability to run using cheap general-purpose hardware and scale horizontally.  (Berga and Franco, 2021) |
| 6. Confidentiality | Since rdbms use encryption techniques to store data encrypted, data confidentiality is frequently accomplished. (Mohamed, Altrafi and Ismail, 2014) | Because data is frequently stored in clear form, data confidentiality is not achieved. (Mohamed, Altrafi and Ismail, 2014) |
| 7. Data Integrity | The ACID properties, that are used in relational databases, ensure that database transactions are processed securely and that data is integrated. (Mohamed, Altrafi and Ismail, 2014) | Since one of the BASE properties principle is that data integrity is not always achieved in NoSQL databases, integrity of data is not always maintained in NoSQL databases. (Mohamed, Altrafi and Ismail, 2014) |
| 8. Auditing | Provide auditing techniques that allow writing to the database. (Mohamed, Altrafi and Ismail, 2014) | Most of NoSQL databases don’t provide auditing. (Mohamed, Altrafi and Ismail, 2014) |
| 9.Cloud | They are not well suited for cloud environments because they do not offer comprehensive data search and scaling them beyond a certain point is hard. (Mohamed, Altrafi and Ismail, 2014) | Cloud databases are not ACID compliant, but they do provide better availability, scalability, performance, and flexibility. They can manage unstructured, semi structured, or structured data. NoSQL databases are particularly desirable for cloud computing because they have all the properties that make them ideal for this purpose.  (Mohamed, Altrafi and Ismail, 2014) |
| 10.Crash Recovery | Grantee crash recovery through the recovery manager, which oversees ensuring transactional atomicity and persistence through the usage of log files as well as the ARIES algorithm.  (Mohamed, Altrafi and Ismail, 2014) | Rely on replication as a backup to recover from a crash, but some have other methods, such as Mango dB’s Journal file.  (Mohamed, Altrafi and Ismail, 2014) |
| 11.Using multiple  Data types. | Relational database takes longer time to store data types such as images If using multiple data types this is not recommended .(Abdullah and Zhuge, 2015) | Much faster when using multiple data type specially using 1000 s of images. This shows a considerable time gap than the relational databases. (Mohamed, Altrafi and Ismail, 2014) |

## 7.1) Citations

Abdullah, A. and Zhuge, Q. (2015). From Relational Databases to NoSQL Databases: Performance Evaluation. *Research Journal of Applied Sciences, Engineering and Technology*, 11 (4), 434–439. Available from https://doi.org/10.19026/rjaset.11.1799.

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Li, Y. and Manoharan, S. (2013). A performance comparison of SQL and NoSQL databases. *2013 IEEE Pacific Rim Conference on Communications, Computers and Signal Processing (PACRIM)*. August 2013. Victoria, BC, Canada: IEEE, 15–19. Available from https://doi.org/10.1109/PACRIM.2013.6625441 [Accessed 3 December 2021].

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