INFORMATICS INSTITUTE OF TECHNOLOGY

UNIVERSITY OF WESTMINSTER

Informatics Institute of Technology

Department of Computing

(B.Eng.) in Software Engineering

Module: 5COSC020C – Database Systems

Module Leader: Mr. Ragu Sivaraman

INDIVIDUAL COURSEWORK - Part A + B

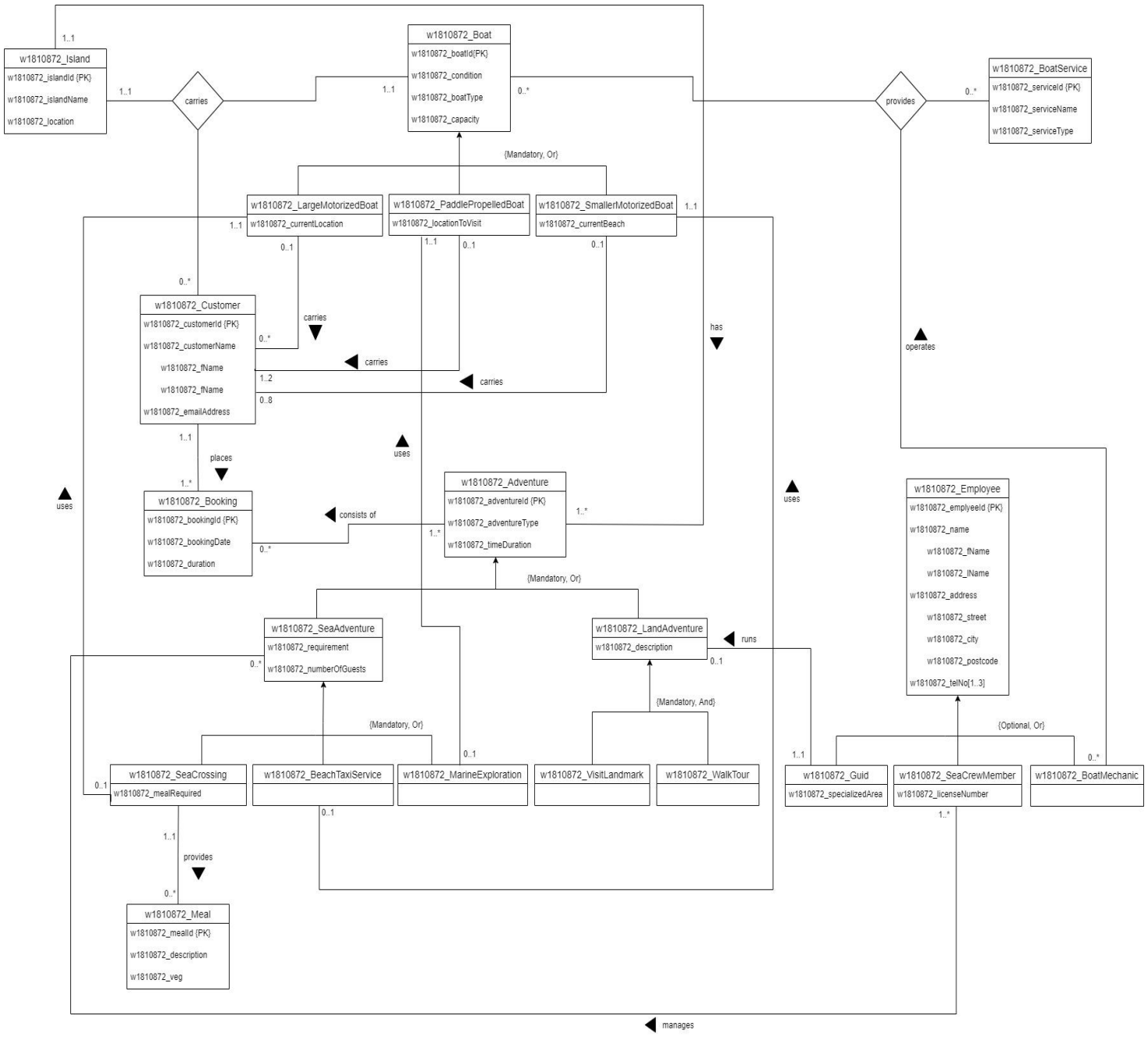
Student ID	:	2019160
Student UoW ID	:	w1810872
Student Name	:	Chithara Jithmanthi Karunasekera
Tutorial Group	:	Group C
Due Date	:	6th December 2021

Contents

Table of figures

Part A

1. Conceptual ERD for ArchipelagoCrazy (Part – A).



2. Data dictionary to document entities for ArchipelagoCrazy (Part–A).

Entity name	*Description*
w1810872_Island	General term describing all islands with attractive sites including mainland, that belong to ArchipelagoCrazy.
w1810872_Boat	General term describing all types of boats that belong to ArchipelagoCrazy.
w1810872_Customer	General term that describes all customers of ArchipelagoCrazy.
w1810872_Booking	General term that describes bookings placed for services offered by ArchipelagoCrazy.
w1810872_Adventure	General term that describes all adventures organised by ArchipelagoCrazy.
w1810872_Employee	General term describing all staff members employed by ArchipelagoCrazy.
w1810872_BoatService	General term describing all types of services done to boats.
w1810872_Meal	General term describing all meals organized by ArchipelagoCrazy.

General entity	*Specialized entity*	*Explanation*
w1810872_Boat	w1810872_LargMotorizedBoat	A specialized term that describes large boats which can handle higher number of customers.
	w1810872_PaddlePropelledBoat	A specialized term that describes a boat which can be used for marine exploration.
	w1810872_SmallMotorizedBoat	A specialized term that describes small boat which can be used for local beach taxi service.
w1810872_Adventure	w1810872_SeaAdventure	A specialised term that describes adventures related to sea.
	w1810872_LandAdventure	A specialised term that describes adventures related to land.

w1810872_SeaAdventure	w1810872_SeaCrossing	A specialised term describing the sea adventure of crossing between one or more islands.
	w1810872_BeachTaxiService	A specialised term describing the sea adventure of moving between beaches.
	w1810872_MarineExploration	The specialised term that describes the sea adventure of exploring islands, accessing remote bays and creeks.
w1810872_LandAdventure	w1810872_VisitLandmark	A specialised term that describes the land adventure of visiting landmark.
	w1810872_WalkingTour	A specialised term that describes the land adventure of a walking tour with a guid.
w1810872_Emplyee	w1810872_Guid	A specialised term that describes the tour guid who guides customers as an employee
	w1810872_SeaCrewMember	A specialised term for members of the sea crew who organises and manages boat service as an employee.
	w1810872_BoatMechanic	A specialised term that describes boat mechanics who services boats as an employee.

3. Data Dictionary to document relationships and multiplicities for ArchipelagoCrazy (Part – A).

3.1. Binary Relationships.

Entity name	*Multiplicity*	*Relationship*	*Multiplicity*	*Entity name*	*Justifications for the multiplicity (4 statements for each relationship)*
w1810872_Island	1..1	has	1..*	w1810872_Adventure	An island must have at least one adventure
					An island may have many adventures
					An adventure must belong to at least one island
					An adventure must belong to one and only one island
w1810872_Customer	1..1	places	1..*	w1810872_Booking	One customer must place at least one booking
					One customer may place many bookings
					One booking must belong to at least one customer
					One booking must belong to one and only one customer
w1810872_Boat		carries		w1810872_Customer	A boat may or may not carry a customer to an island.
					A boat may carry many customers to one islands.

					A customer must use at least one boat to visit an island.
					A customer must use one and only one boat to visit an island.
w1810872_Booking	0..*	consists of	1..*	w1810872_Adventure	One booking consists of at least one adventure
					One booking may consist of many adventures
					One adventure may or may not be booked.
					One adventure may or may be booked by many.
w1810872_LargeMotorizedBoat	0..1	carries	0..*	w1810872_Customer	A large motorized boat may or may not carry any customer
					A large motorized boat may carry many customers.
					A customer may or may not be carried by any large motorized boat.
					A customer must be carried by one and only one large motorized boat.
w1810872_PaddlePropelledBoat	0..1	carries	1..2	w1810872_Customer	A paddle boat must carry at least one customer
					A paddle boat can carry a maximum of two customers
					A customer may or may not be carried by a paddle boat
					A customer may be carried by one and only one paddle boat

w1810872_SmallerMotorizedBoat	0..1	carries	0..8	w1810872_Customer	A small motorized boat may or may not carry any customer.
					A small motorized boat may carry a maximum of eight customers.
					A customer may or may not be carried by any small motorized boat.
					A customer may be carried by one and only one small motorized boat.
w1810872_Guid	1..1	runs	0..1	w1810872_LandAdventure	One guide may or may not run any land adventure.
					One guide may run one and only one land adventure
					One land adventure must be run by at least one guide
					One land adventure must be run by one and only one guide
w1810872_SeaCrewMember	1..*	manages	0..*	w1810872_SeaAdventuere	One member of sea crew may or may not manage any sea adventure
					One sea crew member may manage many sea adventures
					One sea adventure must be managed by at least one member of sea crew
					One sea adventure may be managed by many sea crew members

w1810872_SeaCrossing	0..1	uses	1..1	w1810872_LargeMotorizedBoat	One sea crossing must use at least one large motorized boat.
					One sea crossing must use one and only one large motorized boat.
					One large motorized boat may or may not be used for an sea crossing.
					One large motorized boat may be used for one and only one sea crossing.
w1810872_BrachTaxiService	0..1	uses	1..1	w1810872_SmallerMotorizedBoat	One beach taxi service must use at least one smaller motorized boat.
					One beach taxi service may use one and only one smaller motorized boat.
					One smaller motorized boat may or may not be used by any beach taxi service.
					One smaller motorized boat may be used for one and only one beach taxi service.
w1810872_MarineExploration	0..1	uses	1..1	w1810872_PaddlePropelledBoat	One marine exploration must use at least one paddle boat
					One marine exploration may use one and only one paddle boat

					One paddle boat may or may not be used by any marine exploration
					One paddle boat may be used by one and only one paddle boat
w1810872_SeaCrossing	1..1	provides	0..*	w1810872_Meal	One sea crossing may or may not provide a meal.
					One sea crossing may provide many meals.
					One meal must be provided by at least one sea crossing
					One meal may be provided by one and only one sea crossing

3.2. Turnery Relationships.

Entity name	*Multiplicity*	*Relationship*	*Multiplicity*	*Entity name*	*Justifications for the multiplicity*
w1810872_Boat	1..1	carries	0..* 1..1	w1810872_Customer w1810872_Island	A boat may or may not carry any customer to at least one island.
					A boat may carry many customers to one and only one island.
					A customer may be carried to at least one island by at least one boat
					A customer may be carried to one and only one island by one and only one boat
					An island may or may not be carried customers by at least one boat.
					An island may be carried many customers by one and only one boat.
w1810872_BoatMechanic	0..*	provides	0..* 0..*	w1810872_BoatService w1810872_Boat	One Boat mechanic may or may not provide any boat service to any boat.
					One boat mechanic may provide many services to many boats.
					One boat service may or may not be provided to any boat by any boat mechanic.

					One boat service may be provided to many boats by many boat mechanics.
					One boat may or may not be provided any service by any boat mechanic.
					One boat may be provided many services by many boat mechanics.

4. Data dictionary to document attributes and primary keys for each entity for ArchipelagoCrazy (Part – A).

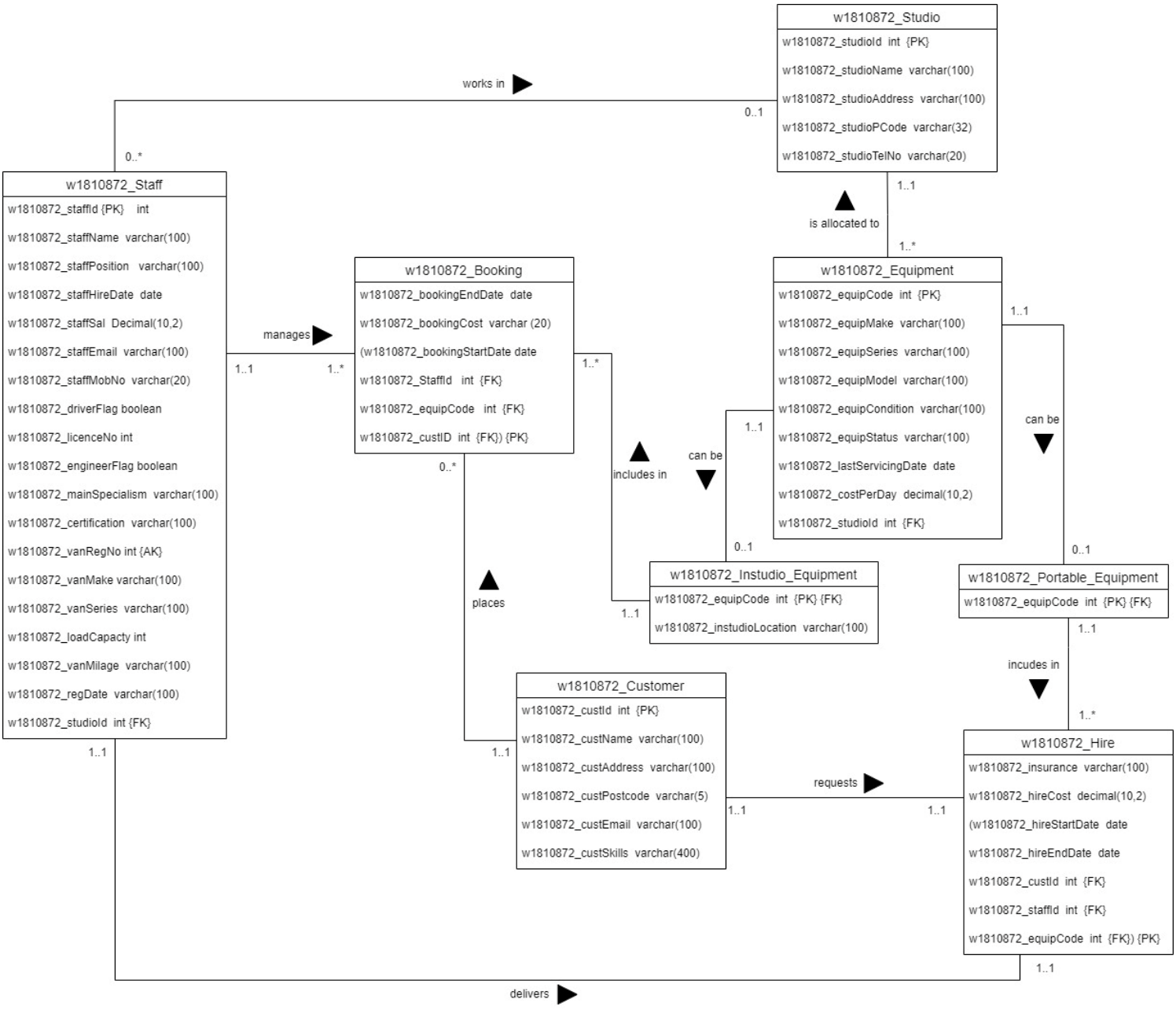
Entity name	*Attribute for this entity*	*justification*
w1810872_Island	w1810872_islandId {PK}	To uniquely identify every island
	w1810872_islandName	Ever island has a name
	w1810872_location	Every island has its own geographic location
w1810872_Boat	w1810872_boatId {PK}	Uniquely identifies a boat
	w1810872_condition	About the condition status of the boat
	w1810872_boatType	Type of the boat
	w1810872_capacity	Capacity of each boat
w1810872_LargeMotorizedBoat	w1810872_currentLocation	Current location where the large, motorized boat is
w1810872_PaddlePropelledBoat	w1810872_locationToVisit	Location it must visit if available
w1810872_SmallerMotorizedBoat	w1810872_currentBeach	Current beach it is located in
w1810872_Customer	w1810872_customerId {PK}	Uniquely identifies a customer
	w1810872_customerName	
	w1810872_fName	First name of customer
	w1810872_lName	Last name of customer
	w1810872_emailAddress	E-mail address of customer
w1810872_Booking	w1810872_bookingId {PK}	Each booking has a number to uniquely identify
	w1810872_bookingDate	Date the booking was made
	w1810872_duration	Time duration taken for a particular event booked
w1810872_Adventure	w1810872_adventureId {PK}	Each adventure has a unique ID number
	w1810872_adventureType	Type of adventure

	w1810872_timeDuration	Time consuming to complete adventure
w1810872_SeaAdventure	w1810872_requirement w1810872_numberOfGuests	Requirements for the sea adventure Number of guests participating in an adventure
w1810872_SeaCrossing	w1810872_crossingLocation w1810872_mealRequired	To which island is the sea crossing is for Whether a meal is required or not
w1810872_BeachTaxiService		
w1810872_MarineExploration		
w1810872_LandAdventure	w1810872_description	Short description about the land adventure
w1810872_VisitLandmark		
w1810872_WalkTour		
w1810872_Employee	w1810872_emplyeeId {PK} w1810872_name w1810872_fName w1810872_lName w1810872_Address w1810872_street w1810872_city w1810872_postcode w1810872_tellNo[1..3]	Each employee has an ID to be uniquely identified First name of employee Last name of employee Street name of address of employee City of employee's address Postcode of address Telephone number of each employee
w1810872_Guid	w1810872_specializedArea	Specialise area of study regarding various landmarks
w1810872_SeaCrewMember	w1810872_licenseNumber	Diving/ Swimming license number of each sea crew member
w1810872_BoatMechanic		

w1810872_BoatService	w1810872_serviceId {PK} w1810872_serviceName w1810872_serviceType	To uniquely identify each service Name of service Type of service based on various parts of boat
w1810872_Meal	w1810872_mealId {PK} w1810872_description w1810872_veg	Uniquely identifies each meal Short description about what is included in the meal Is the meal vegetarian or non-vegetarian

Part B

5. LOGICAL ERD for SoundStuff (Part B).



6. SQL queries to create tables, populate tables and retrieving required output (Part B).

6.1. SQL Queries to create tables.

Create table Studio.

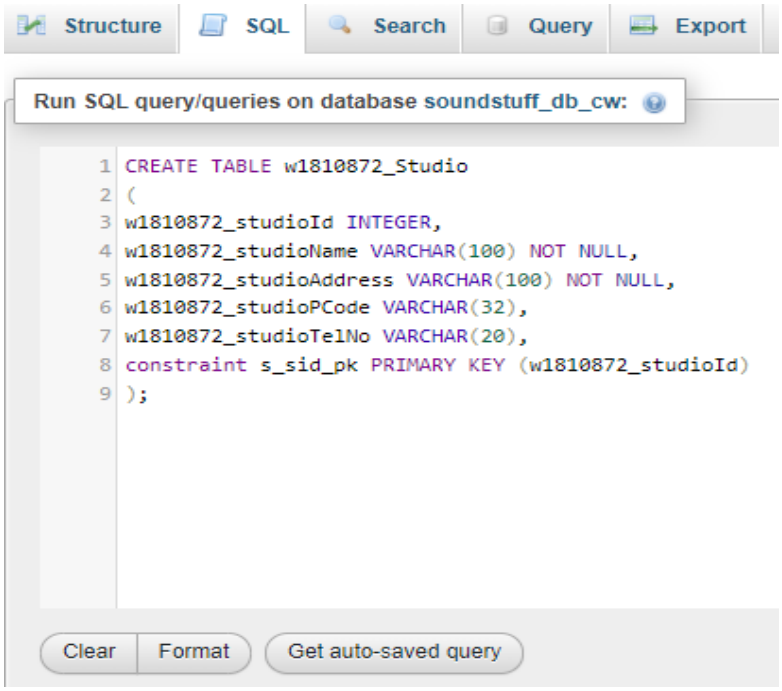


Figure 1: Create table Studio

Successfully created table studio.

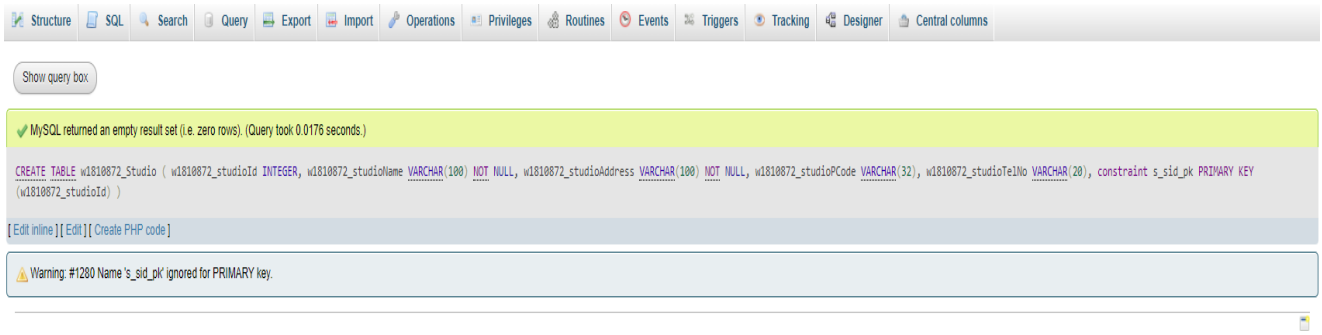


Figure 2: Successfully created Studio table

Create table Equipment

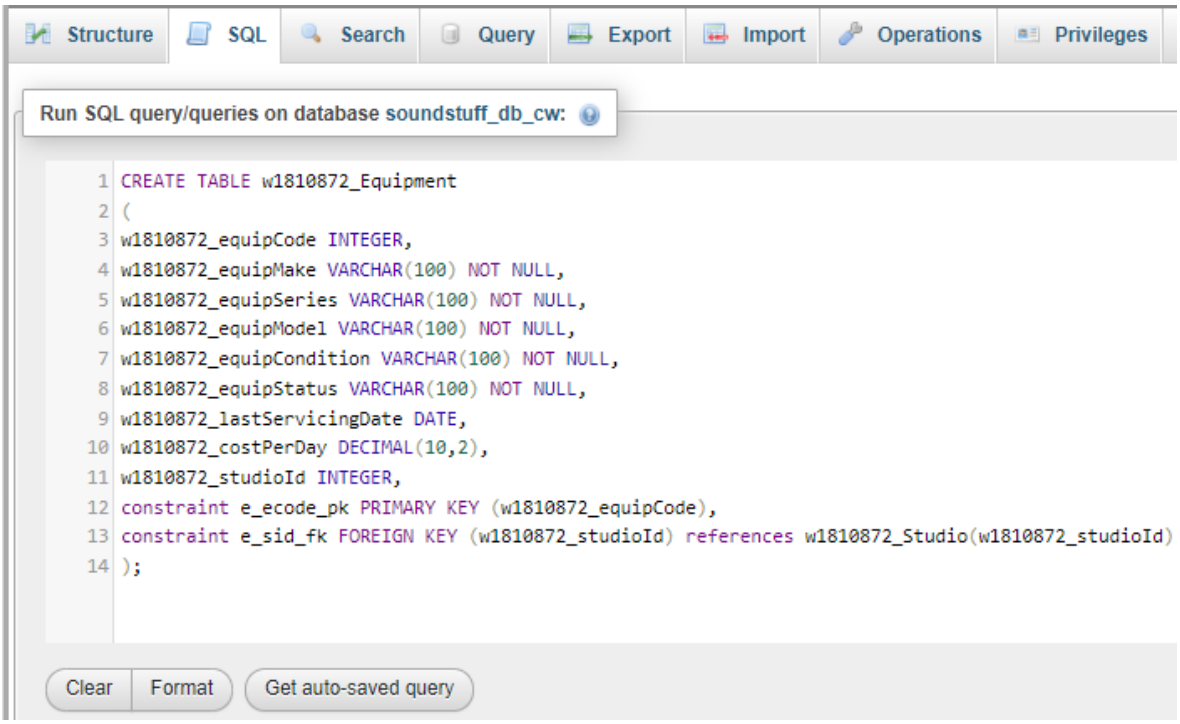


Figure 3: Create table Equipment

Successfully created table equipment.

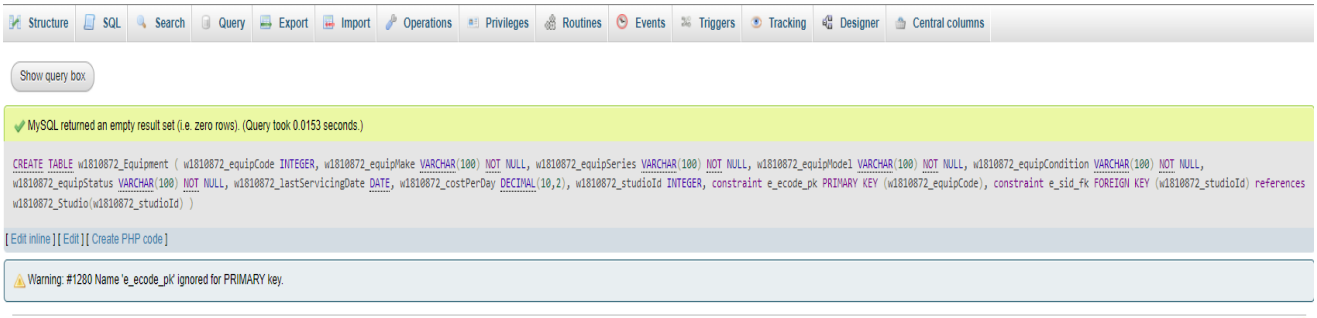


Figure 4: Successfully created table Equipment

6.2. SQL Queries to populate tables.

Populating Studio table.

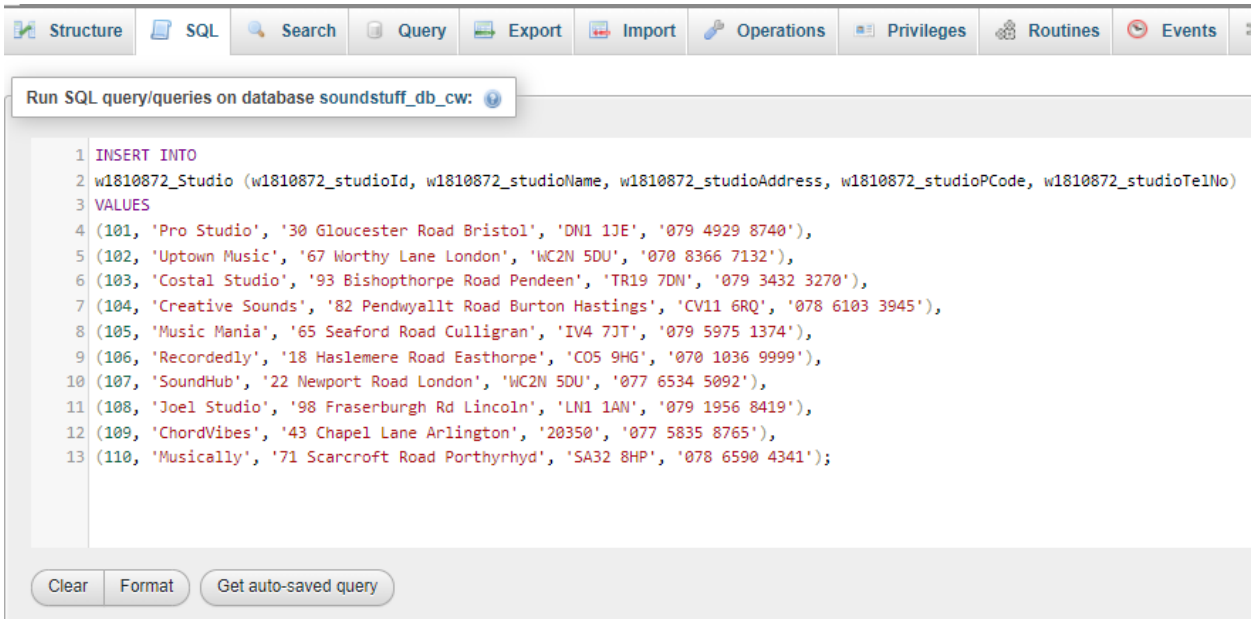


Figure 5: Populating studio table with data

Successfully inserted data to Studio table.

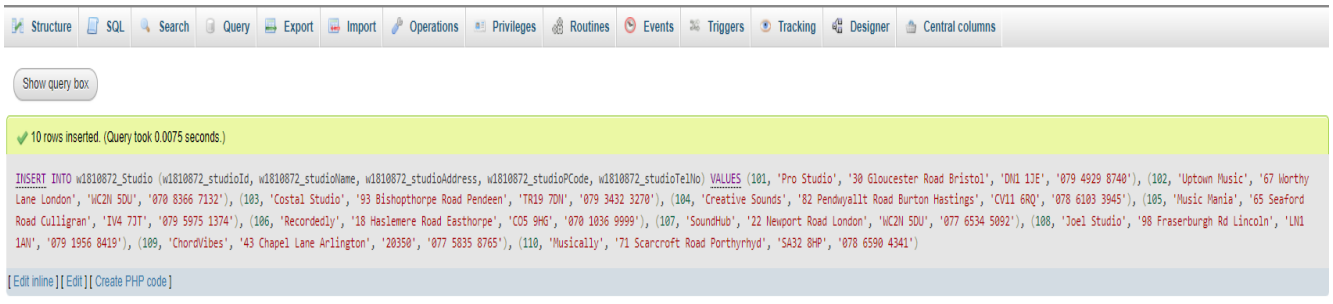


Figure 6: Successfully inserted data to Studio table

Populate Equipment table with data.

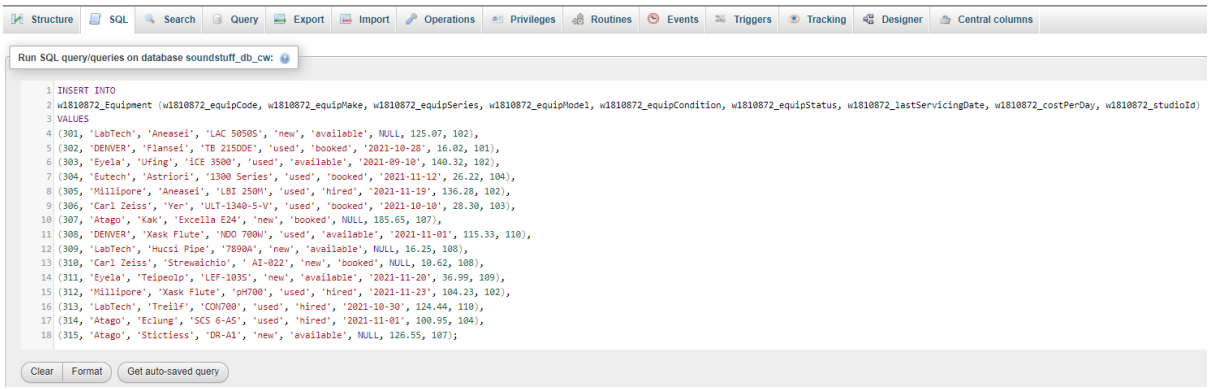


Figure 7: Populate Equipment table with data

Successfully inserted data to equipment table.

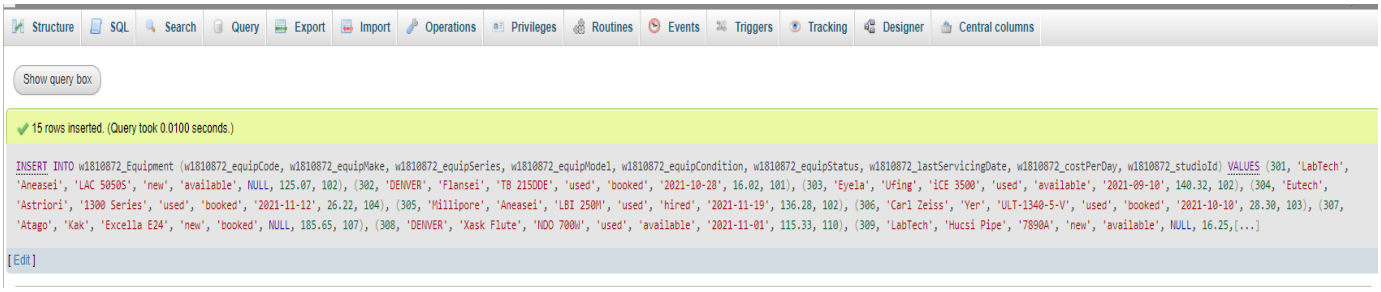


Figure 8: Successfully inserted data to Equipment table

6.3. Studio table and Equipment table after populating

w1810872_studioId	w1810872_studioName	w1810872_studioAddress	w1810872_studioPCode	w1810872_studioTelNo
101	Pro Studio	30 Gloucester Road Bristol	DN1 1JE	079 4929 8740
102	Uptown Music	67 Worthy Lane London	WC2N 5DU	070 8366 7132
103	Costal Studio	93 Bishopthorpe Road Pendeen	TR19 7DN	079 3432 3270
104	Creative Sounds	82 Pendwyallt Road Burton Hastings	CV11 6RQ	078 6103 3945
105	Music Mania	65 Seaford Road Culligran	IV4 7JT	079 5975 1374
106	Recordedly	18 Haslemere Road Easthorpe	CO5 9HG	070 1036 9999
107	SoundHub	22 Newport Road London	WC2N 5DU	077 6534 5092
108	Joel Studio	98 Fraserburgh Rd Lincoln	LN1 1AN	079 1956 8419
109	ChordVibes	43 Chapel Lane Arlington	20350	077 5835 8765
110	Musically	71 Scarcroft Road Porthyrhyd	SA32 8HP	078 6590 4341

Figure 9: Studio table with sample data

w1810872_equipCode	w1810872_equipMake	w1810872_equipSeries	w1810872_equipModel	w1810872_equipCondition	w1810872_equipStatus	w1810872_lastServicingDate	w1810872_costPerDay	w1810872_studioId
301	LabTech	Aneasei	LAC 5050S	new	available	*NULL*	125.07	102
302	DENVER	Flansei	TB 215DDE	used	booked	2021-10-28	16.02	101
303	Eyela	Ufing	iCE 3500	used	available	2021-09-10	140.32	102
304	Eutech	Astriori	1300 Series	used	booked	2021-11-12	26.22	104
305	Millipore	Aneasei	LBI 250M	used	hired	2021-11-19	136.28	102
306	Carl Zeiss	Yer	ULT-1340-5-V	used	booked	2021-10-10	28.30	103
307	Atago	Kak	Excella E24	new	booked	*NULL*	185.65	107
308	DENVER	Xask Flute	NDO 700W	used	available	2021-11-01	115.33	110
309	LabTech	Hucsi Pipe	7890A	new	available	*NULL*	16.25	108
310	Carl Zeiss	Strewaichio	AI-022	new	booked	*NULL*	10.62	108
311	Eyela	Teipeolp	LEF-103S	new	available	2021-11-20	36.99	109
312	Millipore	Xask Flute	pH700	used	hired	2021-11-23	104.23	102
313	LabTech	Treilf	CON700	used	hired	2021-10-30	124.44	110
314	Atago	Eclung	SCS 6-AS	used	hired	2021-11-01	100.95	104
315	Atago	Stictiess	DR-A1	new	available	*NULL*	126.55	107

Figure 10: Equipment table with sample data

6.4. SQL Query to retrieve studios in London, along with makes, series, and models of equipment that cost more than £125 a day to hire.

(Cost per day displayed to confirm output).

SQL Query for the required output

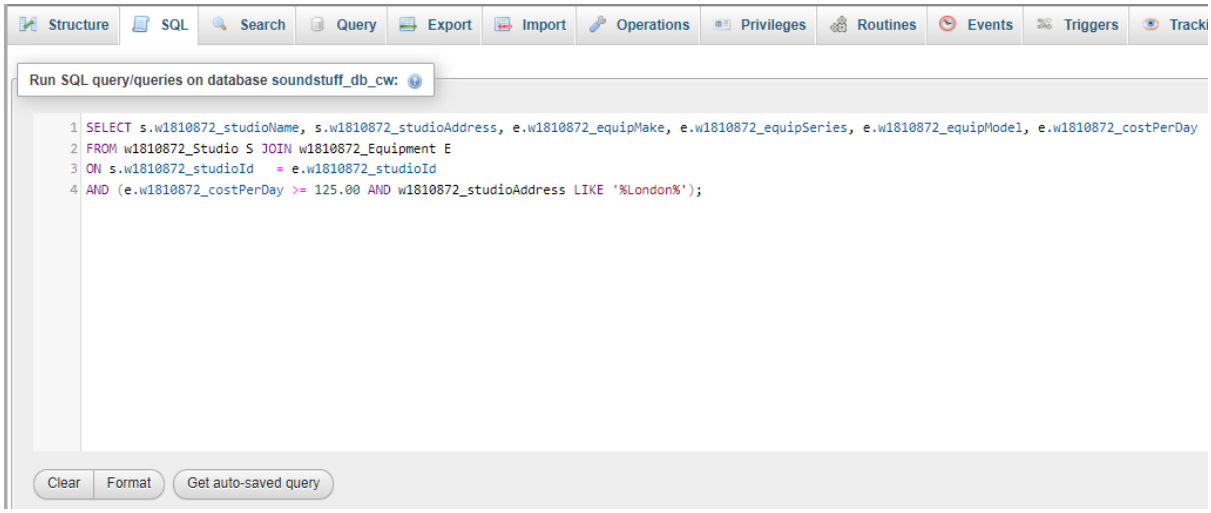


Figure 11: SQL Query for required output

Output based on required conditions.

7. Comparative analysis table (Part B).

	Relational Databases	NoSQL databases
schemas	In relational databased as a Fixed schema is used, it is required to it is required to define the schema before adding data. Changing schema in this type of database could be extremely expensive and require time consuming service interruptions.	Allowed to use unstructured data as Dynamic schemas are used. Therefore, NoSQL database can be applied without having to define the schema first. It is easy to change data as requirements change.
data consistency	High consistency (Follows acid properties such as Atomicity, Isolation, Durability). Not patrician tolerance. Provisioned to single server.	Eventually consistent. Database with BASE consistency mode. Prefers availability over consistency of replicated data at write time.
storage	Stores data according to a specific schema. Has fixed rows and columns. Data is stored in a tabular structure.	Can be stored in any structure, by providing a way to update that data when changing structure. Data is stored in Document based, graph based, as key-value pairs, or as wide - column stores
performance	Vertically scalable, but expensive.	Allows to work without any schema with unstructured data. Less expensive.
workload	Flexible, Low redundancy, easy to backup data, and simple diester recovery as some facts that make the workload more efficient though its costly.	Availability over consistency, key-value pairs and flexible schemas make the work much easier with an efficient cost.
infrastructures	Also known as SQL databases. Has a tabular structure, with	Document based, graph databases, key-value pairs or

	strict pre-defined schema. Vertically scaled and more expensive.	wide column stores are known as non-relational databases. Horizontally scaled and more cost-effective.
security	Role-based security, encrypted communications, and support for row and field access control, as well as access control through user-level permissions on stored procedures, are all integrated components of relational database security.	Authentication and encryption are practically non-existent in NoSQL databases or are extremely poor when implemented. External encryption techniques such as LDAP, Kerberos, and others are not supported. The data files do not have encryption functionality. Both the client and the servers have weak authentication.
Scaling	Vertically scalable. As relational databases use single database to host databases it is required to have bigger expensive servers.	Cheap commodity servers can be used in NoSQL databases as the capacity can be added by scaling horizontally.
Data structure	Table based as relational database was introduced during a time that data was mostly structured and defined by their relationships.	Document based/ graph based/ as key-value pairs/ or as wide -column stores. As mow data is much more complex NoSQL databases are designed to handle complex, unstructured data Ex: text, social media posts, phots, email
Relationships	Database connections are associations between tables that are built by retrieving data using join statements. On each	Can store relationship data. Stored differently than in relational databases. Relational data don't split between tables.

	side of the relationship, there can only be one record in each table. Each primary key value corresponds to either none or one entry in the corresponding table.	NoSQL databases may have modelling relationship data.
Examples	Microsoft SQL server, Oracle databases, MySQL, and IBM DB2	MongoDB, CouchBase, Cassandra, HBase, Redis, Riak, Neo4J

8. References

- Oracle.com. 2021. *What is a relational database?*. [online] Available at: <https://www.oracle.com/database/what-is-a-relational-database/> [Accessed 25 November 2021].
- Docs.microsoft.com. 2021. *Relational vs. NoSQL data*. [online] Available at: <https://docs.microsoft.com/en-us/dotnet/architecture/cloud-native/relational-vs-nosql-data> [Accessed 25 November 2021].
- MongoDB. 2021. *NoSQL vs Relational Databases*. [online] Available at: <https://www.mongodb.com/scale/nosql-vs-relational-databases> [Accessed 25 November 2021].
- Education, I., 2021. *relational-databases*. [online] Ibm.com. Available at: <https://www.ibm.com/cloud/learn/relational-databases> [Accessed 25 November 2021].
- Connolly, T. and Begg, C., n.d. *Database systems* A Practical Approach to Design, Implementation, and Management.
- Dindoliwala, V. and Morena, R., 2018. Comparative Study of Integrity Constraints, Storage and Profile Management of Relational and Non-Relational Database using MongoDB and Oracle. *International Journal of Computer Sciences and Engineering*, 6(7), pp.831-837.