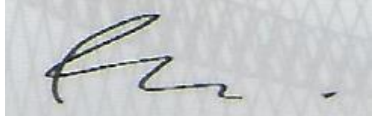


Assignment Declaration

By submitting this assignment, I am aware of the University rule that a student must not act in a manner which constitutes academic dishonesty as stated and explained in the QUT Manual of Policies and Procedures. I confirm that this work represents my individual/our team's effort. I have viewed the final version and declare that it does not contain plagiarized material.

Full Name	Student No.	Signature
Ryan Hafizh Indrananda	10852565	

TASK 1.

Step 1: Transform familiar examples into elementary facts and apply quality checks

Table 1:

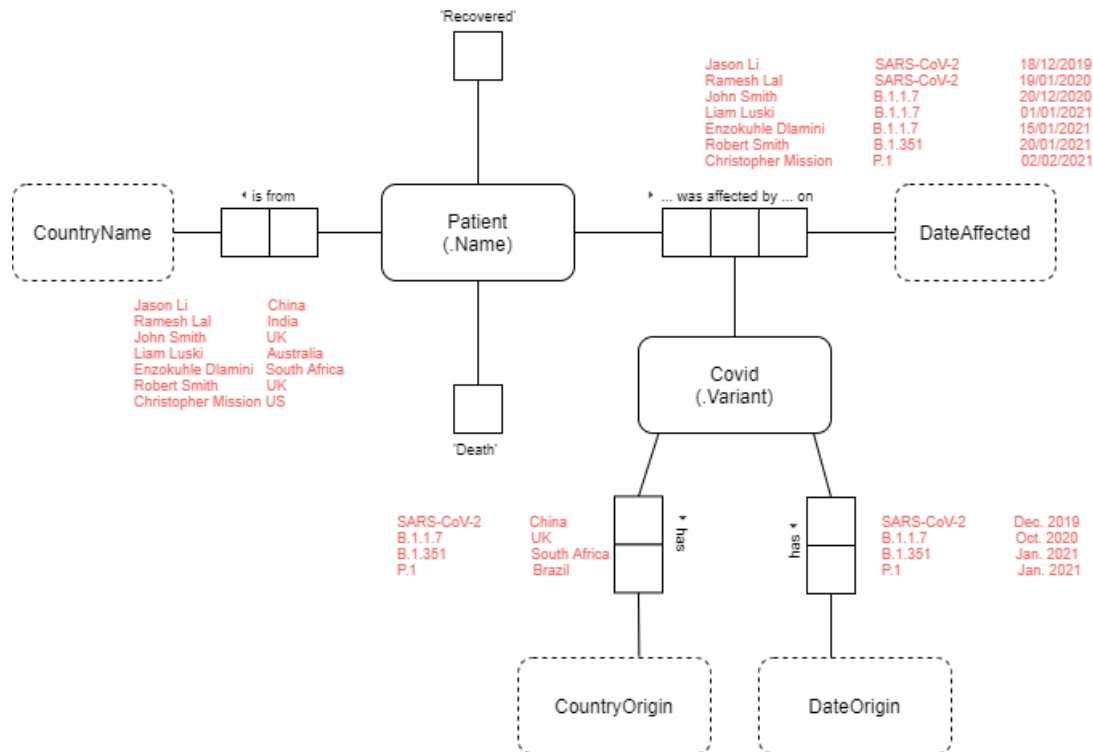
- The Covid Variant with VariantName 'SARS-CoV-2' has CountryOrigin 'China'.
- The Covid Variant with VariantName 'SARS-CoV-2' has DateOrigin 'Dec. 2019'.
- The Covid Variant with VariantName 'B.1.1.7' has CountryOrigin 'UK'.
- The Covid Variant with VariantName 'B.1.1.7' has DateOrigin 'Oct. 2020'.
- The Covid Variant with VariantName 'B.1.351' has CountryOrigin 'South Africa'.
- The Covid Variant with VariantName 'B.1.351' has DateOrigin 'Jan. 2021'.
- The Covid Variant with VariantName 'P.1' has CountryOrigin 'Brazil'.
- The Covid Variant with VariantName 'P.1' has DateOrigin 'Jan. 2021'.

Table 2:

- The Patient with PatientName 'Jason Li' was affected by the Covid Variant with VariantName 'SARS-CoV-2' on DateAffected '18/12/2019'.
- The Patient with PatientName 'Jason Li' is from the Country with CountryName 'China'.
- The Patient with PatientName 'Jason Li' recovered.
- The Patient with PatientName 'Ramesh Lal' was affected by the Covid Variant with VariantName 'SARS-CoV-2' on DateAffected '19/01/2020'.
- The Patient with PatientName 'Ramesh Lal' is from the Country with CountryName 'India'.
- The Patient with PatientName 'Ramesh Lal' died.
- The Patient with PatientName 'John Smith' was affected by the Covid Variant with VariantName 'B.1.1.7' on DateAffected '20/12/2020'.
- The Patient with PatientName 'John Smith' is from the Country with CountryName 'UK'.
- The Patient with PatientName 'John Smith' died.
- The Patient with PatientName 'Liam Luski' was affected by the Covid Variant with VariantName 'B.1.1.7' on DateAffected '01/01/2021'.
- The Patient with PatientName 'Liam Luski' is from the Country with CountryName 'Australia'.
- The Patient with PatientName 'Liam Luski' recovered.
- The Patient with PatientName 'Enzokuhle Dlamini' was affected by the Covid Variant with VariantName 'B.1.1.7' on DateAffected '15/01/2021'.
- The Patient with PatientName 'Enzokuhle Dlamini' is from the Country with CountryName 'South Africa'.
- The Patient with PatientName 'Enzokuhle Dlamini' died.
- The Patient with PatientName 'Robert Smith' was affected by the Covid Variant with VariantName 'B.1.351' on DateAffected '20/01/2021'.
- The Patient with PatientName 'Robert Smith' is from the Country with CountryName 'UK'.
- The Patient with PatientName 'Robert Smith' recovered.

- The Patient with PatientName ‘Christopher Mission’ was affected by the Covid Variant with VariantName ‘P.1’ on DateAffected ‘02/02/2021’.
- The Patient with PatientName ‘Christopher Mission’ is from the Country with CountryName ‘US’.
- The Patient with PatientName ‘Christopher Mission’ recovered.

Step 2: Draw the fact types, and apply a population check.



There are multiple types of arities in the above illustration, for example unary between patient and recovered and death, binary relationships between CovidVariant and CountryOrigin, and ternary relationship between PatientName, CovidVariant, and DateAffected. A sample population is demonstrated below.

Population check illustration:

Original table 1:

Covid Variant	Country Originated	Date known to be originated
SARS-CoV-2	China	Dec. 2019
B.1.1.7	UK	Oct. 2020
B.1.351	South Africa	Jan. 2021
P.1	Brazil	Jan. 2021

Splitting above table:

Covid Variant	Country Originated
SARS-CoV-2	China
B.1.1.7	UK
B.1.351	South Africa
P.1	Brazil

Covid Variant	Date known to be originated
SARS-CoV-2	Dec. 2019
B.1.1.7	Oct. 2020
B.1.351	Jan. 2021
P.1	Jan. 2021

Joined table:

Covid Variant	Country Originated	Date known to be originated
SARS-CoV-2	China	Dec. 2019
B.1.1.7	UK	Oct. 2020
B.1.351	South Africa	Jan. 2021
P.1	Brazil	Jan. 2021

A lossless join, no differentiation between tables and their data. Therefore, a supposed ternary fact between Covid Variant, Country Originated, and Date Originated is false.

Original table 2:

Patient Name	Date affected	Covid Variant	Country	Recovered	Death
Jason Li	18/12/2019	SARS-Cov-2	China	Yes	
Ramesh Lal	19/01/2020	SARS-Cov-2	India		Yes
John Smith	20/12/2020	B.1.1.7	UK		Yes
Liam Luski	01/01/2021	B.1.1.7	Australia	Yes	
Enzokuhle Dlamini	15/01/2021	B.1.1.7	South Africa		Yes
Robert Smith	20/01/2021	B.1.351	UK	Yes	
Christopher Mission	02/02/2021	P.1	US	Yes	

Splitting above table:

Patient Name	Covid Variant	Date affected
Jason Li	SARS-Cov-2	18/12/2019
Ramesh Lal	SARS-Cov-2	19/01/2020
John Smith	B.1.1.7	20/12/2020
Liam Luski	B.1.1.7	01/01/2021
Enzokuhle Dlamini	B.1.1.7	15/01/2021
Robert Smith	B.1.351	20/01/2021
Christopher Mission	P.1	02/02/2021

Patient Name	Country
Jason Li	China
Ramesh Lal	India
John Smith	UK
Liam Luski	Australia
Enzokuhle Dlamini	South Africa
Robert Smith	UK
Christopher Mission	US

Patient Name	Recovered
Jason Li	Yes
Liam Luski	Yes
Robert Smith	Yes
Christopher Mission	Yes

Patient Name	Death
Ramesh Lal	Yes
John Smith	Yes
Enzokuhle Dlamini	Yes

Joined table:

Patient Name	Date affected	Covid Variant	Country	Recovered	Death
Jason Li	18/12/2019	SARS-Cov-2	China	Yes	
Ramesh Lal	19/01/2020	SARS-Cov-2	India		Yes
John Smith	20/12/2020	B.1.1.7	UK		Yes
Liam Luski	01/01/2021	B.1.1.7	Australia	Yes	
Enzokuhle Dlamini	15/01/2021	B.1.1.7	South Africa		Yes
Robert Smith	20/01/2021	B.1.351	UK	Yes	
Christopher Mission	02/02/2021	P.1	US	Yes	

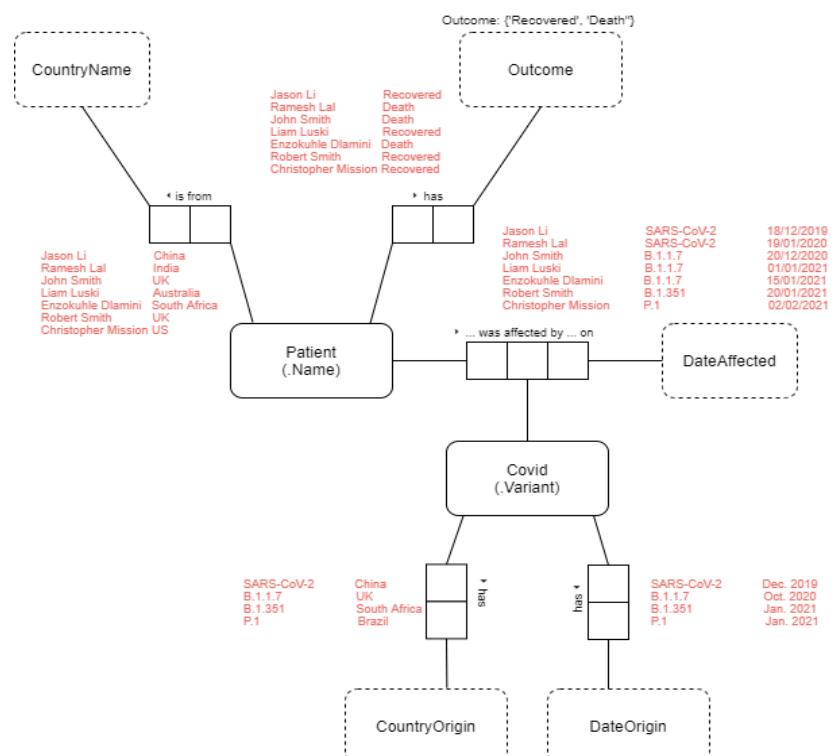
This is also a lossless join.

Step 3: Check for entity types to be combined and note any arithmetic derivations.

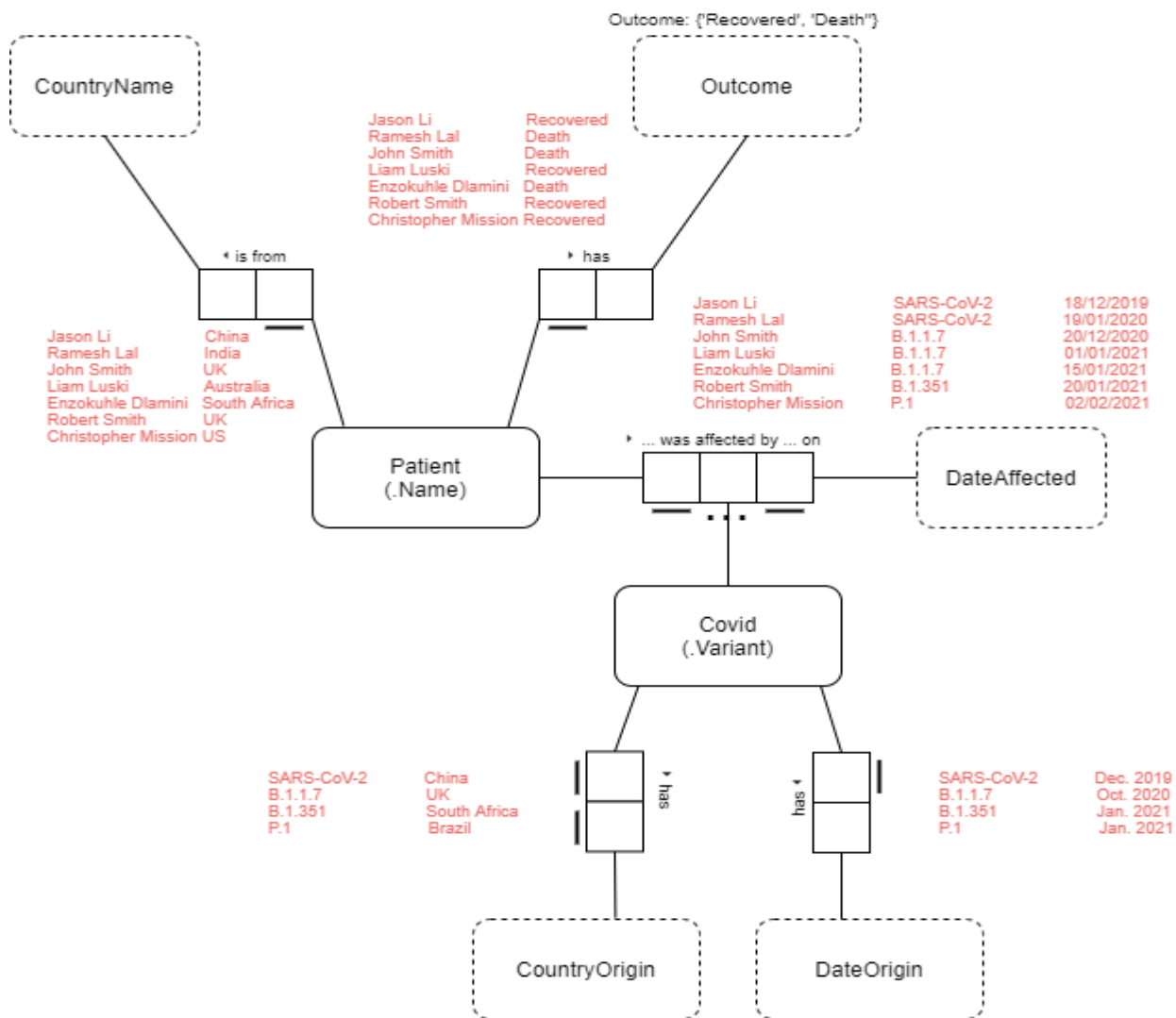
As can be seen in the above model, 'Outcome' is a possible combination of the entities/attributes 'Recovered' and 'Death' as they can be meaningfully compared and both entail the 'outcome' of a patient from a Covid variant. It is also a primitive value type which is partitioned into mutually exclusive types, in particular either 'Recovered' or 'Death'. As a patient cannot both recover and die from a Covid Variant, we must enforce a constraint in further steps to ensure that this will not happen within the conceptual schema if we decide to derive 'Outcome' in this way.

Furthermore, in the ORM model at its current stage, no arithmetic derivations can be made.

Such a combination would result in the following schema:



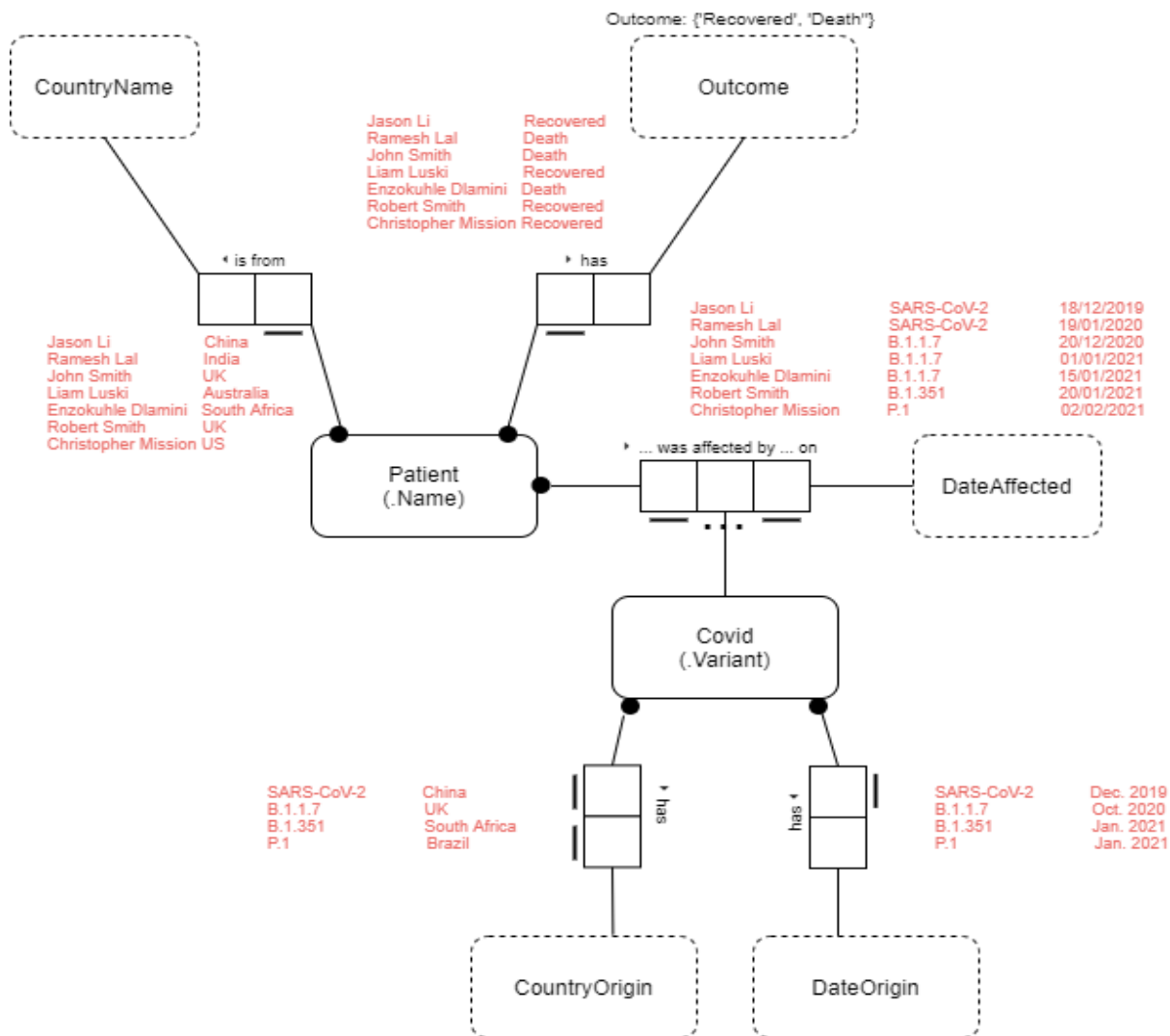
Step 4: Add uniqueness constraints and check the arity (length) of fact types.



Explanations for identified uniqueness constraints:

- Each patient has come from one CountryName, but one CountryName can be related to multiple patients. Thus, a many-to-one mapping or uniqueness constraint.
- Each patient has one 'Outcome' from being affected by a Covid variant, but an 'Outcome', in this scenario either 'recovered' or 'death' can be related to multiple patients. Thus, a many-to-one mapping or uniqueness constraint.
- Each patient has at most one DateAffected. In this scenario, while not realistic, each DateAffected has at most one Patient. A CovidVariant can have many Patients and many DateAffecteds. Thus, following the n-1 uniqueness constraint rule, there is a one-to-one mapping between Patient and DateAffected.
- In this scenario, while not realistic, each CovidVariant has at most one CountryOrigin, and one CountryOrigin has at most one CovidVariant. Thus, one-to-one mapping.
- Each CovidVariant has at most one DateOrigin, but one DateOrigin can have multiple CovidVariants. Thus, many-to-one mapping.

Step 5: Add mandatory role constraints and check for logical derivations.



Explanations for identified mandatory constraints:

- Each patient must have an outcome whether it be recovered or death. Therefore, patient is mandatory on outcome.
- Each patient must come from a CountryName. Therefore, patient is mandatory on CountryName.
- Each patient must have been affected by a CovidVariant on a certain DateAffected. Therefore, patient is mandatory on CovidVariant on certain DateAffected.
- Each covid variant must have a country of origin. Therefore, CovidVariant is mandatory on CountryOrigin.
- Each covid variant must have a date of origin. Therefore, CovidVariant is mandatory on DateOrigin.

In this scenario, no significant logical derivations can be found.

TASK 2.

Relational Schema

Seat(Seat_name_{PK}, State_code, Party_code, NrOnRoll, PercentVotesCounted, NrInformalVotes, NrFormalVotes, Politician_name)

Politician(Politician_name_{PK}, NrFormalVotes, Party_code, Seat_name)

Party(Party_code, Seat_name, Politician_name, PartyTitle, NrFormalVotes)

State(State_code, Seat_name)