**Proving our database in either 3NF or BCNF:**

We will look at each table and relation one by one

A few things that we already established:

1. Every table cell in every single table in our database contains one attribute.
2. Every tuple in every table in unique because we have a unique key for each one.

For each table below, we will test for 3NF and if possible BCNF.

A table is in 3NF if and only if for each of its non-trivial FDs, at least one of the conditions below hold:

1. The left-hand side is a super key.
2. The right-hand side is a prime attribute.

A table to be in BCNF, if and only if it is in 3NF and for each non-trivial FD

**Person (A, B, C, D, E, F, G, H, I, J, K, L):**

FDs:

For each FD in Person, not all LHS is a key. There is also no transitive dependency from non-prime attributes that includes . includes registries from the US zip codes and Canadian postal codes. There are a few rare cases where a ZIP Code crosses state boundaries. Usually, it is due to access problems, such as being on a military base or due to constraints of the transportation network. So, it is not a violation of 3NF.

Hence, this table is in 3NF.

**Age group (A, B, C):**

FDs:

For the only FD in age group, LHS is a key. There is also no transitive dependency from non-prime attributes.

Hence, this table is in BCNF, which is also in 3NF.

**Province list (A):**

FDs:

This is a simple trivial table containing one column. It is in BCNF, which is also in 3NF.

**Eligibility (A, B):**

FDs:

For the only FD in vaccine group, LHS is a key. There is also no transitive dependency from non-prime attributes.

is subject to change at any times.

We have unique provinces in the country

Hence, this table is in BCNF, which is also in 3NF.

**Infection history (A, B, C):**

FDs:

For the only FD in infection history, LHS is a key. There is also no transitive dependency from non-prime attributes.

The same person can be infected more than once, but it is not possible to infected twice on the same day. Hence, the combo is a key.

Hence, this table is in BCNF, which is also in 3NF.

**Registered person (A, B, C, D):**

Registered Person is a Person, they have the same relations along with these new FDs:

Medicare number now acts as a key for registered person along with any keys in the hierarchy. from does not always give us the attributes of a registered person because not all them in the database are permanent Canadian residents.

For the FDs in registered person, LHS is a key. There is also no transitive dependency from non-prime attributes.

Hence, this table is in BCNF, which is also in 3NF.

**Unregistered person (A, B):**

Unregistered Person is a Person, they have the same relations along with these new FDs:

Passport number is unique and now acts as a key for unregistered person along with any keys in the hierarchy.

For the only FD in unregistered person, LHS is a key. There is also no transitive dependency from non-prime attributes.

Hence, this table is in BCNF, which is also in 3NF.

**Public healthcare worker (A, B, C):**

Public healthcare worker is a Registered Person which is a Person, they have the same relations along with these new FDs:

SIN is unique and now acts as a key for registered person along with any keys in the hierarchy.

For the only FD in public healthcare worker, LHS is a key. There is also no transitive dependency from non-prime attributes.

Hence, this table is in BCNF, which is also in 3NF.

**Works at (A, B, C, D, E, F, G):**

This relationship contains the shifts for all public healthcare employees including managers.

In this table, we cannot simply rely on and because that employee can work at different facilities and have those attributes registered with the facilities.

We can also combine the and to make another minimal candidate key to get information from each employee that is currently working at a specific facility at a specific time.

For the FDs in works at, LHS is a key. There is also no transitive dependency from non-prime attributes.

Hence, this table is in BCNF, which is also in 3NF.

**Manages (A, B, C, D, E, F, G):**

This relationship contains the employment history for all public healthcare employees that are managers only.

Employee cannot be unique if an employee takes a break between dates, even for managers. Combing all three attributes makes it a key.

In this table, we cannot simply rely on and because that employee can work at different facilities and have those attributes registered with the facilities.

We can also combine the and to make another minimal candidate key to get information from each employee that is currently working at a specific facility at a specific time.

For the FDs in manages, LHS is a key. There is also no transitive dependency from non-prime attributes.

Hence, this table is in BCNF, which is also in 3NF.

**Shifts (A, B, C, D, E, F, G, H):**

This relationship contains the weekly shift for all public healthcare at a one specific facility.

cannot be unique if an employee takes a break between dates. Combing all three attributes makes it a key.

are not unique either because one employee can have the same at a different facility.

We can also combine the , to make another minimal candidate key to get information from each employee that is currently working at a specific facility at a specific time.

For the FDs in works at, LHS is a key. There is also no transitive dependency from non-prime attributes.

Hence, this table is in BCNF, which is also in 3NF.

**Vaccine facility (A, B, C, D, E, F, G, H, I, J, K):**

FDs:

Vaccine facilities have many unique attributes and many of them can act as a key.

For the FDs in vaccine facility, LHS is a key. There is also no transitive dependency from non-prime attributes.

This is a rare instance where vaccination facilities are evenly spread out around Canada that the postal code may act as a minimal candidate key to retrieve the name of the facility and hence, the rest of the attributes.

Hence, this table is in BCNF, which is also in 3NF.

**Vaccine (A, B, C, D):**

FDs:

Vaccine type is unique, but their statuses and dates could be changed at any time.

For the FDs in vaccine, LHS is a key. There is also no transitive dependency from non-prime attributes.

Hence, this table is in BCNF, which is also in 3NF.

**Vaccine record (A, B, C, D, E, F, G, H):**

FDs:

A is not enough to make a key, a person can be vaccinated no more than twice. A nurse could vaccinate the same person twice. However, they cannot be vaccinated twice at the same day.

For the FDs in vaccine records, LHS is a key. There is also no transitive dependency from non-prime attributes.

Hence, this table is in BCNF, which is also in 3NF.

**Since Person is the only table not in BCNF, the entire database is at least 3NF.**