ISIT219 Assignment 2 Report

Ontologies

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Team Members - 27th May 2017

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Using the metadata of the Supermarket excel file, develop the ontology model of the Supermarket and implement it in Fluent Editor.

Task 2:

Creation of a Rail Transport System Ontology Model with associated questions.

Questions:

1. *What are the information sources that you have gathered to obtain the required knowledge? The information sources can be collected from the rail transport websites, academic resources (journal papers and books) or other online pages. You have to collect at least 4 different sources, 2 of which must be in text format and others can be figures or in other formats.*
2. *Were there any inconsistencies in the gathered knowledge? How did you reconcile the information of various sources?*
3. *Explain the process of using the gathered knowledge to develop the ontology model. You have to use a systematic method for developing the ontology. The method can be simple, but it has to be clearly explained.*
4. *Provide a list of concepts of your ontology model and their properties.*
5. *Implement the ontology model in Fluent Editor.*
6. *Who will benefit from this ontology model? How can this conceptual model be useful?*
7. *Write an example scenario that explains how this model can be applied in the real world.*
8. *Write 10 reasoning questions which you know the answers. Then use these questions to validate your ontology model. (The provided answers by the tool should be the same as what you expect). List the questions and the answers given by the software.*

Task 1 – Response

Using the metadata of the Supermarket excel file, develop the ontology model of the Supermarket and implement it in Fluent Editor.
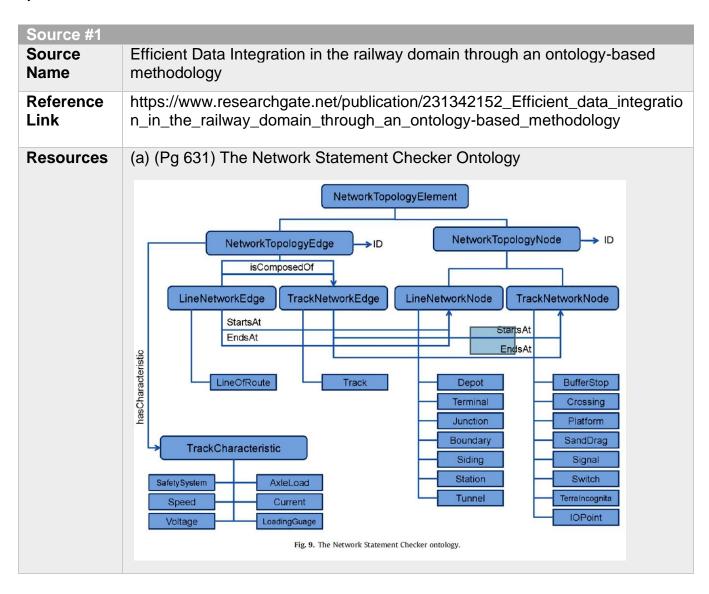
See File Part1 - Supermarket Data.encnl

Task 2 - Response

Question 1:

What are the information sources that you have gathered to obtain the required knowledge?

We have gathered information from various sources including research papers, articles and conference journals**.**

Source #1	
Source Name	Efficient Data Integration in the railway domain through an ontology-based methodology
Reference Link	https://www.researchgate.net/publication/231342152_Efficient_data_integration_in_the_railway_domain_through_an_ontology-based_methodology
Resources	(a) (Pg 631) The Network Statement Checker Ontology **Fig. 9.** The Network Statement Checker ontology.

Source #2	
Source Name	Sydney Lines
Reference Link	http://www.nswrail.net/lines/sydney-lines.php
Resources	(a) Sydney Lines:

Sydney Lines

Passenger Lines	Freight Lines	Coal Lines
■ Airport Line	■ Abattoirs Branch	■ Glenlee Colliery Branch
■ Bankstown Line	■ Botany Goods Line	
■ Camden Branch	■ Campsie - Flemington Goods Line	
■ Carlingford Line	■ Chullora - Sefton Goods Line	
■ City Circle	■ Prospect Quarry Branch	
■ Cronulla Line	■ Rozelle - Darling Harbour Goods Line	
■ East Hills Line	■ Sandown Line	
■ Eastern Suburbs Line	■ Widemere Quarry Line	

(b) Airport Line:

Airport Line

| Description | History |

Originally known as the New Southern Railway, this line links the international and domestic terminals of Sydney's Kingsford Smith airport to the city.

It is a new line extending from Central extending south the the airport and then to a new station on the Main South line at Wolli Creek. The construction costs were partly funded by private companies, and as a result the stations on this line are privately owned. After 30 years these will be transferred to the government. Apart from a small section near Central, this line is entirely underground.

In effect this line has become an extension of the East Hills line. Most East Hills services now run via the Airport Line.

An article on this line appeared in the July 2000 issue of Railway Digest.

Name	Facility	Status	Opened	Closed	km	📷	Links
Central	Station	In Use	26-Sep-1855	-		29	
Green Square	Station	In Use	21-May-2000	-	2.600		
Mascot	Station	In Use	21-May-2000	-	5.100	1	
Domestic Terminal	Station	In Use	21-May-2000	-	6.600		
International Terminal	Station	In Use	21-May-2000	-	8.100	6	
Wolli Creek	Station	In Use	21-May-2000	-	7.300	4	

(c) Central Station:

Central Station

| Description | Photographs |

Main facility:	Station (In Use)
Lines:	Main South Line Airport Line City Circle
Location:	(151.2067°, -33.8828°) [exact] GDA94
Distance:	unknown km from Sydney
History:	26-Sep-1855 Opened 5-Aug-1906 Moved site
Photos:	1931, 1967, 1970, 1978, circa 2000, 2002, 2003, 2005, 2006
Description:	
Current status:	

Source #3	
Source Name	Data notation and modelling
Reference Link	http://www.capacity4rail.eu/IMG/pdf/c4r_-_d341_-_data_notation_and_modelling_-_public.pdf
Resources	(a) (pg 81) Public transport ontology Figure 3-48 Public transport ontology (Excerpt) (Keller, Brunk, & Schlegel, 2014)

Source #4	
Source Name	Sydney Trains Annual Report 2014
Reference Link	https://www.transport.nsw.gov.au/sites/default/files/b2b/publications/annual_reports/sydney-trains-annual-report-2013-14.pdf
Resources	(a) (pg 3) The Sydney Trains Network (b) (Pg 13) Number of Employees **Number of Employees** <table><tr><th>Categories</th><th>Sydney Trains Employees</th></tr><tr><td>Train Operations</td><td>537</td></tr><tr><td>Train Crew</td><td>2447</td></tr><tr><td>Station Staff</td><td>1918</td></tr><tr><td>Asset Management – Trades</td><td>2341</td></tr><tr><td>Asset Management – Engineering</td><td>569</td></tr><tr><td>Corporate</td><td>789</td></tr><tr><td>Professional</td><td>640</td></tr><tr><td>Senior Service[1]</td><td>406</td></tr><tr><td>Other</td><td>181</td></tr><tr><td>Total[2]</td><td>9828</td></tr></table>

Source #5	
Source Name	Our Fleet
Reference Link	http://www.sydneytrains.info/about/fleet/
Resources	(a) Rolling Stock Components (b) Waratah Fleet

Source #6	
Source Name	An Ontology based Data Model for Railways
Reference Link	http://www.serialsjournals.com/serialjournalmanager/pdf/1490771302.pdf
Resources	(a) (Pg 227) Station Timetable in a Train Timetable Figure 2: Image showing list of Station Timetableina Train Timetable Figure 2 shows the relationship between **TrainTimetable** and **StationTimetable**. The 'PPTA CDG Express' has a **TrainTimetable**which has multiple **StationTimetable**. (b) 7.3.2 Datatype Properties: "arrivalTime" "departureTime" "sourceStation" "destinationStation"

Source #7	
Source Name	Public Transport Visualisation- Train Patronage – Train Performance and Analytics | Tableau Public
Reference Link	https://public.tableau.com/profile/bureau.of.transport.statistics#!/vizhome/PTVisualisation-Train-2_7_3-Nov16/Welcome
Resources	(a) Card Type

Source #8	
Source Name	Electronic ticketing systems as a mechanism for travel behaviour change? Evidence from Sydney's Opal Card
Reference Link	http://sydney.edu.au/business/__data/assets/pdf_file/0005/283973/ITLS-WP-16-16_003.pdf
Resources	(a) (pg 2) 2.2.1 Fare Structure "One unique element of the Opal fare structure is that after eight "journeys" during a week, all remaining trips are at 50% discount."

Source #9	
Source Name	ATE 15 facetsheet: Transport in Sydney
Reference Link	http://www.destinationnsw.com.au/wp-content/uploads/2012/05/fs-transport-sydney.pdf
Resources	(a) (pg 1) Opal Card "Purchase an Opal card once and add value to it by topping up online or at retailers around Sydney. Simply tap on a card reader at the start of each trip and tap off at the end. The Opal system will automatically deduct the correct fare from the card."

Source #10	
Source Name	Opal card stored information from Opal App and Card
Reference Link	none (first hand experience)
Resources	(a) Opal card stored information from Opal App and Card

Source #11	
Source Name	Rail Infrastructure | Infrabel : Belgian railway infrastructure manager
Reference Link	https://www.infrabel.be/en/about/rail-network/rail-infrastructure
Resources	(a) Signalling Systems "Signal Boards" "Light Signals" "Signal Boxes" "Cab Signalling"

Source #12	
Source Name	Controlling rail traffic | Infrabel : Belgian railway infrastructure manager
Reference Link	https://www.infrabel.be/en/about/safety/controlling-rail-traffic
Resources	(a) 3. Signals and Signs along the tracks "There are also different signs along the tracks which give the train driver additional "fixed" instructions about his journey." "Light Signals" - "a red light means that the train must stop" "a signal with a double yellow light warns the train driver that the next signal may be red and he should slow down." (b) Traffic Control Coordinates Rail Traffic at National Level "The signal box then provides modified routes for the trains affected. They set the points in the correct direction and control the signals." (c) Cab Signalling "The train driver receives all relevant information on a display inside the train."

Question 2:

Were there any inconsistencies in the gathered knowledge? How did you reconcile the information of various sources?

While the information and knowledge (hereby referred to as 'data') gathered from the sources cover different aspects of a Rail Transport System (hereby referred to as 'RTS'), we noticed that due to different conditions and circumstances, there was slight inconsistencies in the overlapping data that was obtained.

Our method for merging the acquired data was by identifying the subsystems and components of the RTS data and choosing a model among the sources to become our base model to which we could extend and build upon, slowly fleshing it out. Most inconsistencies that arose were solved by comparing the conflicting knowledge with our base source, SydneyTrains and making an informed decision based upon what we felt best matched.

For the inconsistencies that were not clearly specified by our primary source, we compared the data from our other sources and made a decision based on what seemed most appropriate. This left some things subject to our knowledge, as we didn't have access to a domain expert our decisions were influenced by our personal experiences and what we thought was best.

Question 3:

Explain the process of using the gathered knowledge to develop the ontology model. You have to use a systematic method for developing the ontology.

The systematic process for developing our ontology model is as follows:
1. Identify and Understand Domain of the Ontology Model
2. Identify and Define the Scope
3. Gather and Analyse Sources
4. Extract and Reuse Existing Concepts
5. Define Taxonomy and Properties
6. Define Instances

Identify and Understand the Domain of the Ontology Model

The first step of the process is to identify the target domain of our ontology model, which is a Rail Transport System. The RTS is a complex system with many subsystems and operations that requires us to undergo further study on the system to develop an understanding that will allow us to develop an ontology model that is accurate and correct.

We found our sources of information by firstly visiting Wikipedia to get a brief overview and understanding of an RTS ontology model. From here, we further investigated the referenced sources on Wikipedia to gather additional information. Once these references were exhausted, we branched out to existing RTS systems and gathered data on their infrastructures and services to give us a well-rounded supply of information to analyse.

Identify and Define the Scope

Next, we identified and defined the purpose and scope of our ontology mode. The main purpose is to provide an overview regarding the relationship between system components (the network, the people, the vehicles) as well as the systems and operations that make up and support the RTS.

The scope of the ontology model covers the basis of system components (network, people, vehicles, etc), all the subsystems associated with the system components and all the different support operations (staff, maintenance, etc) that makes up an RTS. As we implemented more of the ontology model, we would further extend subsystems as required to further model the relationship between components, subsystems are supporting operations.

Gather and Analyse Sources

After defining our scope, we distributed the task among group members to find sources relevant to our domain and scope. We gathered sources from organization websites, annual reports, and documents that describe the use of ontology from different perspectives of a RTS.

Extract and Reuse Existing Concepts

From the sources provided above, we reused the existing concepts (e.g. network topology model) as a starting point, and extracted relevant concepts (e.g. nodes and edges) to which we added in additional data from our other sources where we thought it seemed fitting.

The table below describes the sources and the concept extracted from the respective sources:

Source Name	Source Part	Extracted Concepts
Source #1	a	1. Concepts in the diagram are derived from the NetworkTopologyElement concept. 2. Network edge and network node are network topology elements. 3. Line network edge and track network edge are network edges. 4. Line network node and track network node are network nodes. 5. LineOfRoute is a line network edge 6. Track is a track network edge. 7. Station, and Depot are examples of line network node 8. Crossing, signal, and switch are examples of track network node. 9. Line network edge is composed of track network edge. 10. Line network edge starts and ends at line network node 11. Track network edge starts and ends at track network node. 12. Network edges have track characteristics, such as safety system, axle load, loading gauge, speed, current, voltage.
Source #2	a, b, c	1. Sydney lines consists of passenger lines, freight lines, and coal lines. 2. In each line, there are multiple stations (line network nodes) 3. Each line node have characteristics such as facility name, current-status, open-date, close-date, distance from city, location, and description.
Source #3	a	1. Location has address that consists of street address, postal code, and locality. 2. Stop points on a network (network node) all have a location.
Source #4	a, b	1. SydneyTrains is a railway organization. 2. SydneyTrains owns the Sydney Trains Network. 3. SydneyTrains has employed railway employees.

		4. Station staff, train crew, train operations, asset management, corporate, professional and senior service staff are all Sydney Trains staff.
Source #5	a, b	1. Each rolling stock (train) consists of multiple carriages as rolling stock components, such as: trailer driving carriage, control trailer carriage, trailer carriage, control motor, motor carriage, and non-control motor. 2. Each carriage has characteristics, such as seating capacity, builder, into service number, build number, weight, length, width, and height.
Source #6	a, b	1. Each train (e.g. PPTA CDG Express) has a train timetable. 2. Each train timetable has multiple station timetable. 3. Each timetable has a timetable unit with properties such as arrival time, departure time, source station and destination station.
Source #7	a	1. Tickets used in the opal system are Adult, Child/Youth, Concession, Employee, Free Travel, School Student, Senior/Pensioner, Single Trip Rail Adult, and Single Trip Rail Child/Youth.
Source #8	a	1. Opal cards have a property that keeps track of number of journeys in a week.
Source #9	a	1. Process of ticketing system involves purchasing an opal card, topping up balance at retailers, tapping card on and off from a card reader. 2. Card fare (balance) will be deducted automatically by the ticketing system.
Source #10	a	1. Opal card details include a card number, status activity, last tap node and time, number of journeys in current week, name of owner, and current balance.
Source #11	a	1. Components that make up a signalling system includes signal boards, light signals, signal boxes, and cab signalling.
Source #12	a, b, c	1. Signal boards provide fixed instructions to train crew. 2. Light signals provide stop instruction to train crew.

		3. Light signals provide slow down instruction to train crew.
		4. Signal boxes control light signals.
		5. Signal boxes provide modified routes to train crew.
		6. Cab signalling provide operation information to train crew.

Define Taxonomy and Properties

After extracting the relevant concepts, we then defined the overarching taxonomy that organizes all components into a hierarchy, and the properties that are defined for the class and all its subclasses.

Define Instances

Lastly, we defined instances to populate the ontology to present and test the extracted concepts for the Rail Transport System with the built-in reasoner used with Fluent Editor by Cognitum.

Provide a list of concepts of your ontology model and their properties.

Section : Infrastructure	
Concepts	Network Node and Network Edge are Network Elements. Line Node and Track Node are Network Nodes. Line Edge and Track Edge are Network Edges. Line of Route is a Line Edge. Track is a Track Edge. Depot, Train Station, and Sub-Station are Line Nodes. Level-Crossing, Signal, and Switch-and-Crossing are Track Nodes. Line Edge is composed of many Track Edges, and Track Edges make up a Line Edge. Line Edge starts and ends at a Line Node, and Line Node is connected by Line Edges. Track Edge starts and ends at a Track Node, and Track Node is connected by Track Edges. Network Line is composed of multiple line nodes (e.g. Train Stations) connected together. Passenger Line, Freight Line, and Coal Line are all Network Lines.
Properties	Network edges have the following properties: ● Safety System ● Axle Load ● Loading Gauge ● Speed ● Current ● Voltage Network nodes have the following properties: ● Locality ● Postal code ● Street address ● X-coordinate ● Y-coordinate Line nodes have the following properties: ● Description ● Km distance from city ● Current Status ● Open Date ● Close Date
Section : Entity (Person and Organization)	

Concepts	Person and Organization are entities. Commuter and Staff are Person. Rail Organization and Retailer Organization are Organization. Railway Staff and Retailer Staff are Staff. Station Staff, Train Crew Staff, Train Operations Staff, Asset Management Staff, and Corporate Staff are all Railway Staff. Rail Organization owns Network Lines. Rail Organization hires Railway Staff employees, whereas Retailer Organization hires Retailer Staff employees.
Properties	Person has age.

Section : Vehicles (Rolling Stock)

Concepts	Rolling Stock is a vehicle. Rolling Stock is made up of Rolling Stock Components (e.g. Carriages) Trailer Driving Carriage, Control Trailer Carriage, Trailer Carriage, Control Motor, Motor Carriage, and Non-Control Motor are all Rolling Stock Components. Rolling Stock runs on a Network Line.
Properties	Rolling Stock Components (e.g. Carriages) have the follow properties: ● Seating Capacity ● Weight ● Length ● Width ● Height ● Builder ● Vehicle Number (Identifier)

Section : Ticketing System and Card

Concepts	Ticketing System is a system that supports the Railway System. Ticketing System is made up of Ticketing System Components. Ticket Card, Ticket Dispenser, Card Reader are all Ticketing System Components. Single Trip Cards and Opal Cards are Ticket Cards. Child or Youth Single Trip Cards and Adult Single Trip Cards are Single Trip Cards, whereas Child or Youth Opal Cards, School Opal Cards, Adult Opal Cards, Concession Opal Cards, Senior Opal Cards, and Employee Opal Cards are Opal Cards. Railway Staff have Employee Opal Cards, whereas Commuters have Child or Youth Opal Cards, School Opal Cards, Adult Opal Cards, Concession Opal Cards, and Senior Opal Cards. Train Stations have Card Readers. Ticket Machines dispenses Single Trip Cards. Commuter purchases Single Trip Cards and Opal Cards. Retailer Staff tops up Opal Cards for Commuters.

	Commuters uses Opal Cards to tap on and tap off from Card Readers. Ticketing System deducts fare from the Opal Card.
Properties	Opal Cards have the following properties: ● Card Identifier ● Active Status ● Owner Name ● Balance ● Start Trip Node ● Start Trip Time ● Number of times used in week
Section : Timetable Planning System	
Concepts	Timetable Planning System is a system that supports the Railway System. Timetable Planning System is made up of Timetable Planning System Components. Timetable and Timetable Unit are Timetable Planning System Components. Station Timetable, Train Timetable, and Network Line Timetable are all Timetables. Station Timetable is made up of many Timetable Unit that describes the details properties as mentioned below. Network Line Timetable and Train Timetable is made up of many Station Timetable.
Properties	Timetable units that make up a timetable have the following properties: ● Train Departure Time ● Source Station ● Train Arrival Time ● Destination Station
Section : Signalling System	
Concepts	Signalling System is a system that supports the Railway System. Signalling System is made up of Signalling System Components. Signal Board, Color Light Signal, Signal Box, and Cab Signalling are all Signalling System Components. Signal Boards gives out fixed instructions to the Train Crew. Color Light Signal provide slow down signals to the Train Crew. Color Light Signal provide stopping signals to the Train Crew. Signal Box controls signals for Color Light Signal. Signal Box provide modified route to the Train Crew. Cab Signalling provide relevant operation information to the Train Crew.
Properties	N/A

Question 5:

Implement the ontology model in Fluent Editor.

<u>*See File Part2 - Rail Transport System.encnl*</u>

Question 6:

Who will benefit from this ontology model? How can this conceptual model be useful?

There are different groups of people that can benefit from this ontology model.

One group that will benefit from this model would be CEOs/business owners or any person who is in charge of managing a current or setting up a new transport system. The ontology represents a detailed model of a modern railway transport system in order to help them understand what components the system comprises of.

A second group would be investors of a particular railway system. The ontology model provides them with a comprehensive insight into the costs of building, setting up and running the transport system along with the potential complexities involved.

General staff can also benefit from this ontology model. As general staff, having well-formed knowledge about the system means that they can quickly and easily respond to potential threats, dangers and issues that arise. It can additionally allow further improvements to be planned easier with multiple point of views all aligning based on the same knowledge. For example, certain existing systems can implement opal card functionality with different card types for different customers, as this can encourage customers to use the system more often.

Another group of users who would benefit from this model would be researchers, who work in fields related to transport system. This model would be helpful in terms of developing further detailed railway systems or maybe to investigate existing systems for further analysis on how the current world set runs or for finding potential pitfalls.

Overall, this ontology model will provide benefits to various groups related to the system, ranging from directors and managers to engineers to support staff with the detailed objects-components structure that can minimise the risk of building an illogical system/component thus reducing the amount of effort they have to put in to fix any flaw in the future.

Question 7:

Write an example scenario that explains how this model can be applied in the real world.

Task: Opening a brand new train system in an area
Persona: Roger
User Group: Administrator

Background:
Our ontology model is written in OWL-RL+ using Fluent Editor that represents the model behind a real railway transport system.

Scenario:
Roger is a CEO of a transportation group in Australia. He decided to build a new system in another region. He then looked up on the internet for the railway framework in order to build his new RTS.

He came across our ontology model and opened it. At the first glance he can see all the components related to the railway system being separated into two different sections: the location of the system and the actual components that the system comprised of.

All physical components are constructed as the components themselves and break down to smaller subcomponents of themselves.

First, he wants to know about what type of infrastructure of the railway system should be built, so he looks at the infrastructure branch under the rail-transport-system-component. Looking at that he sees different types of infrastructures displayed comprehensively with two major types namely nodes - stands for a particular place (e.g. station) and edge which represents the route or line. This provides him with the understanding in order to build a logically suitable combination of routes and nodes.

After that he needs to know about the facilities that the stations will have. So he looks at the support-system branch where all other facilities beside infrastructure are located. The support-system has different smaller components such as timetable planning system, ticketing system and signaling system. Each of them has even smaller components, for example a ticketing system has a ticket machine, ticket card and card reader. The ticket card is then expanded to other smaller types such as single trip card or opal card. So the support system basically shows him everything of a railway system beside the infrastructure part.

The last physical components of the system he needs to know about is the vehicles used. He searches under the vehicle branch and finds the rolling-stock, and under rolling-stock there are other components called rolling-stock-components, which is specialised by different components such as trailer-carriage, etc.

Moving onto another "thing" in terms of entities that interact with the system, he finds two categories under the entities, which are organisations and people. Each category is expanded with a high level of detail that would help him understand how should he organise people in the system.

After finishing reading everything, he decided that he will use our model to build his new system as he finds our model to be comprehensive in terms of defining objects in a system and their relations.

Write 10 reasoning questions which you know the answers. Then use these questions to validate your ontology model.

No.	Questions	Reasoning Question		Expected Answer	Reasoner Answer
1	Which railway organization owns the Airport-Line?	**Who-Or-What**	owns-network nothing-but Airport-Line?	Sydney-Trains	Sydney-Trains
2	Which network nodes (e.g. X-Train-Station) belongs to Airport-Line?	**Who-Or-What**	is a network-node and is-part-of Airport-Line?	Mascot, Central, Green-Square, Domestic-Terminal, Wolli-Creek, International-Terminal	Mascot, Central, Green-Square, Domestic-Terminal, Wolli-Creek, International-Terminal
	Which trains are operating on the Airport Line?	**Who-Or-What**	runs-on nothing-but Airport-Line?	Millennium, C-Set, Waratah	Millennium, C-Set, Waratah
3	Which network nodes are in the area with postal code of 2522?	**Who-Or-What**	is a network-node that has-address-postal-code equal-to '2522'?	Central, Green-Square	Central, Green-Square
	Which network nodes are close to city (within 3km range)?	**Who-Or-What**	is a network-node that have-km-distance-from-city lower-or-equal-to 3.0?	Central, Green-Square	Central, Green-Square
4	Which carriages are part of the Waratah train?	**Who-Or-What**	is-part-of nothing-but Waratah?	Waratah-Carriage-156, Waratah-Carriage-158, Waratah-Carriage-312	Waratah-Carriage-156, Waratah-Carriage-158, Waratah-Carriage-312
	Which carriage on the Waratah train is a motor carriage?	**Who-Or-What**	is-part-of nothing-but Waratah and is a motor-carriage?	Waratah-Carriage-312	Waratah-Carriage-312

5	Which opal card did Joey purchase?	**Who-Or-What**	is an opal-card that is-purchased-by nothing-but Joey?	Adult-Opal-Card-1	Adult-Opal-Card-1
	Who has an adult-opal-card?	**Who-Or-What**	have adult-opal-card?	Joey	Joey
	Which opal card belongs to Joey?	**Who-Or-What**	is an opal-card that have-card-owner-name equal-to 'Joey'?	Adult-Opal-Card-1	Adult-Opal-Card-1
6	Which employee has experience in topping up opal cards?	**Who-Or-What**	tops-up nothing-but opal-card?	Aiden	Aiden
	Which organization provided the opportunity for the employee to top up opal cards for commuters?	**Who-Or-What**	is an organization that hires-employee nothing-but Aiden?	Uni-Store	Uni-Store
7	At which place that the Adult-Opal-Card-1 was tapped on from?	**Who-Or-What**	is a network-node that have card-reader that receive-card-tap-on nothing-but Adult-Opal-Card-1?	Central	Central
	At which place that the Adult-Opal-Card-1 was tapped off from?	**Who-Or-What**	is a network-node that have card-reader that receive-card-tap-off nothing-but Adult-Opal-Card-1?	Green-Square	Green-Square
8	Who is working at Sydney-Trains as a train crew?	**Who-Or-What**	is a train-crew-staff that works-at nothing-but Sydney-Trains?	Amy, Andrew, James, Jason, May	Amy, Andrew, James, Jason, May

| 9 | Which station have trains that are scheduled to arrive at Green Square? | **Who-Or-What** | has-station-timetable nothing-but station-timetable that is-composed-of timetable-unit that have-destination-station equal-to 'Green Square'? | Central | Central |
| 10 | Which signal box controlled the color light signal to provide slow down sign to Amy who have been employed as a train crew? | **Who-Or-What** | controls-signals-for color-light-signal that provide-slow-down-sign-to Amy? | Signal-Box-1 | Signal-Box-1 |