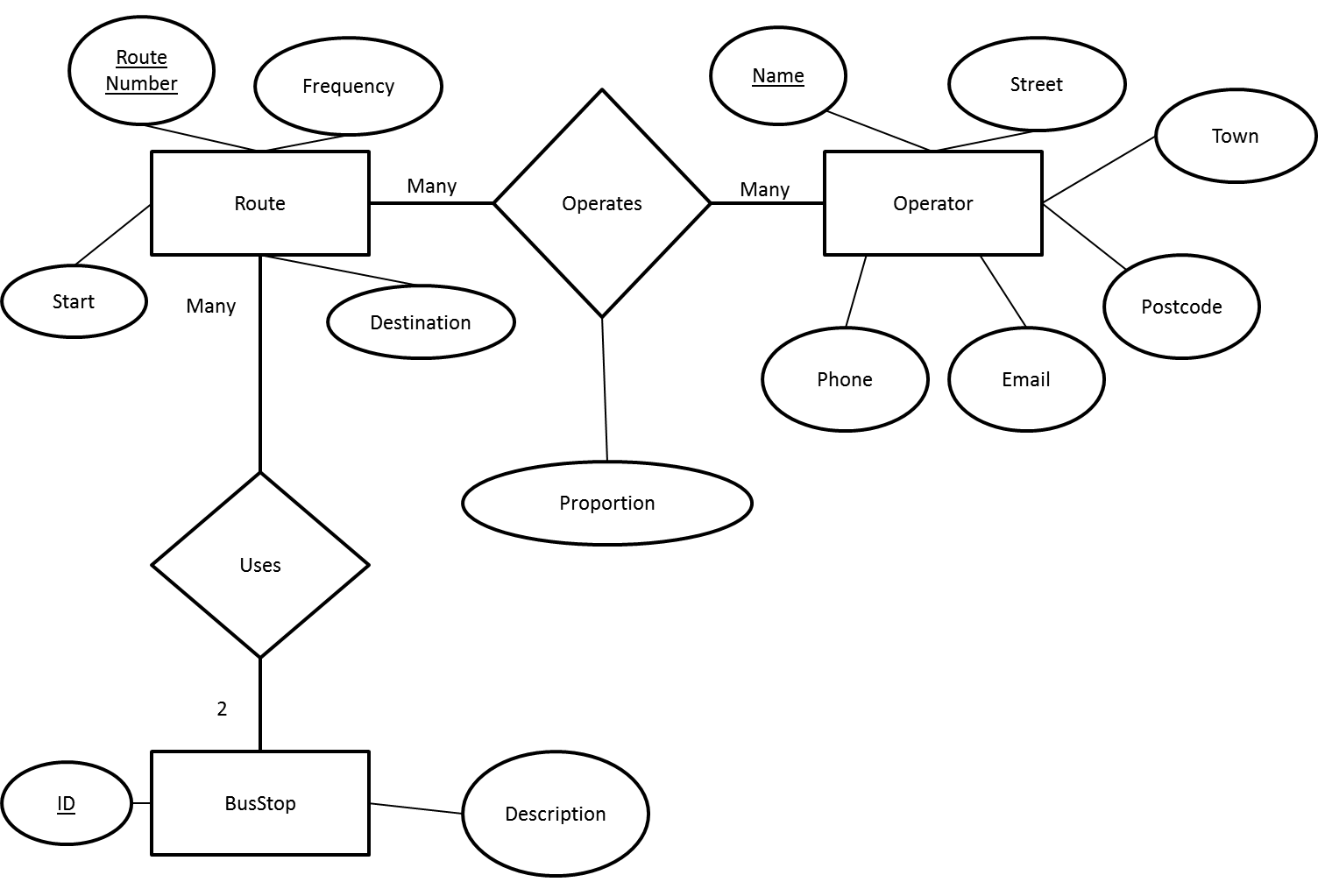
**Tasks**

i) **Complete the diagram so that it correctly represents the scenario described above.**



ii) **Decide on the database tables you will need to implement the database, using the E-R diagram to help you. Create ALL of these tables in MySQL. In your answer document, you MUST show the CREATE TABLE statements you use. Populate your database with the sample data given at the end of this assignment.**

CREATE TABLE `Operator` (

`Name` varchar(25) NOT NULL,

`Street` varchar(20) NOT NULL,

`Town` varchar(15) NOT NULL,

`Postcode` varchar(9) NOT NULL,

`email` varchar(35) NOT NULL,

`Phone` varchar(13) NOT NULL,

PRIMARY KEY (`Name`)

) ENGINE=InnoDB DEFAULT CHARSET=latin1$$

CREATE TABLE `Route` (

`RouteNumber` varchar(11) NOT NULL,

`Start` varchar(4) NOT NULL,

`Destination` varchar(4) NOT NULL,

`Frequency` int(11) NOT NULL,

PRIMARY KEY (`RouteNumber`),

KEY `Start` (`Start`),

KEY `Destination` (`Destination`),

CONSTRAINT `Start` FOREIGN KEY (`Start`) REFERENCES `BusStop` (`ID`) ON DELETE NO ACTION ON UPDATE NO ACTION,

CONSTRAINT `Destination` FOREIGN KEY (`Destination`) REFERENCES `BusStop` (`ID`) ON DELETE NO ACTION ON UPDATE NO ACTION

) ENGINE=InnoDB DEFAULT CHARSET=latin1$$

CREATE TABLE `BusStop` (

`ID` varchar(4) NOT NULL,

`Description` varchar(25) NOT NULL,

PRIMARY KEY (`ID`)

) ENGINE=InnoDB DEFAULT CHARSET=latin1$$

CREATE TABLE `Operates` (

`RouteNumber` varchar(11) NOT NULL,

`Operator` varchar(25) NOT NULL,

`Proportion` int(11) NOT NULL,

PRIMARY KEY (`RouteNumber`,`Operator`),

KEY `Operator` (`Operator`),

KEY `Route\_Number` (`RouteNumber`),

CONSTRAINT `Route\_Number` FOREIGN KEY (`RouteNumber`) REFERENCES `Route` (`RouteNumber`) ON DELETE NO ACTION ON UPDATE NO ACTION,

CONSTRAINT `Operator` FOREIGN KEY (`Operator`) REFERENCES `Operator` (`Name`) ON DELETE NO ACTION ON UPDATE NO ACTION

) ENGINE=InnoDB DEFAULT CHARSET=latin1$$

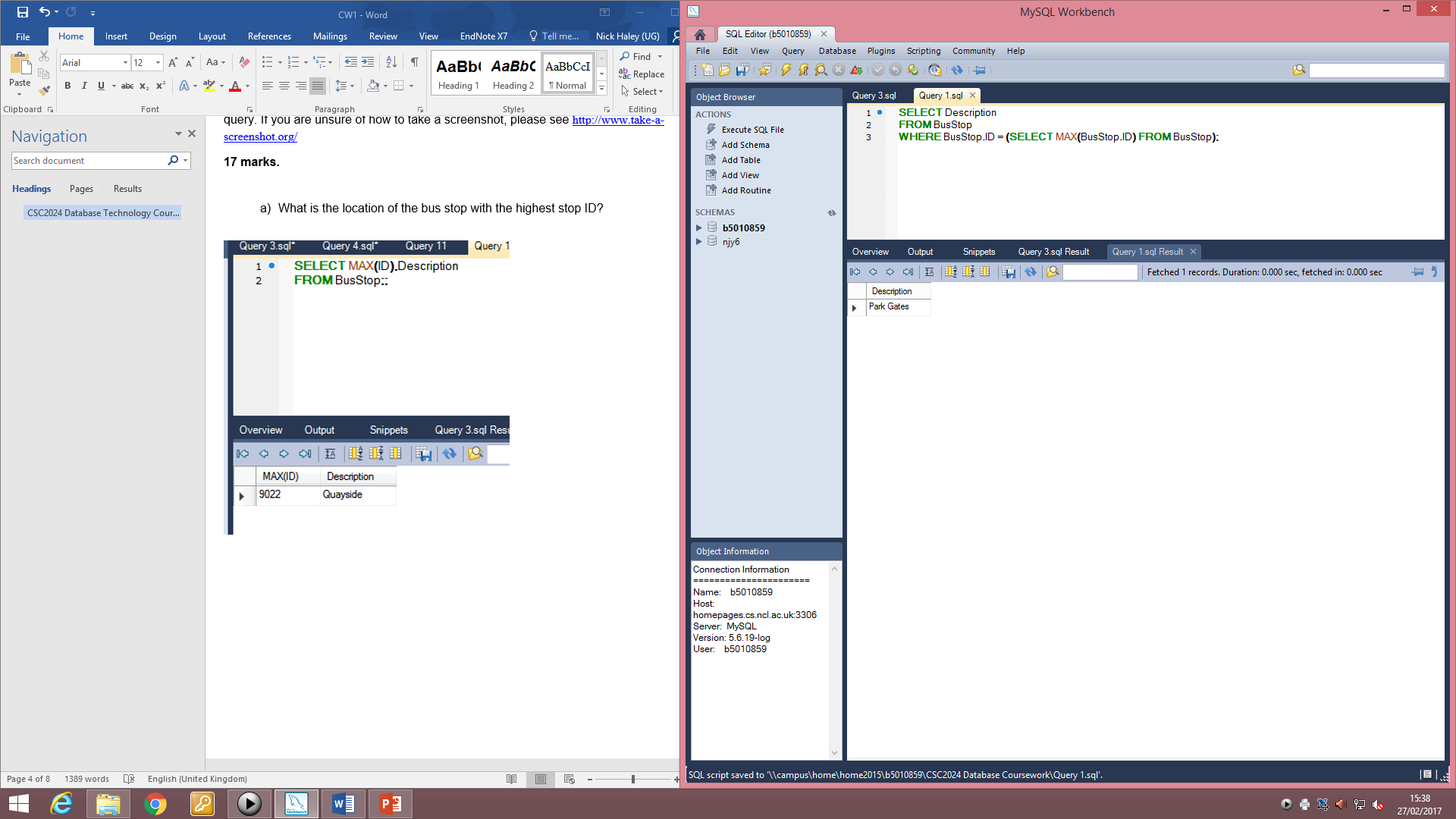
iii) **Give the SQL for the following and show screenshots of the results for each query.**

1. **What is the location of the bus stop with the highest stop ID?**

SELECT Description

FROM BusStop

WHERE BusStop.ID = (SELECT MAX(BusStop.ID) FROM BusStop);

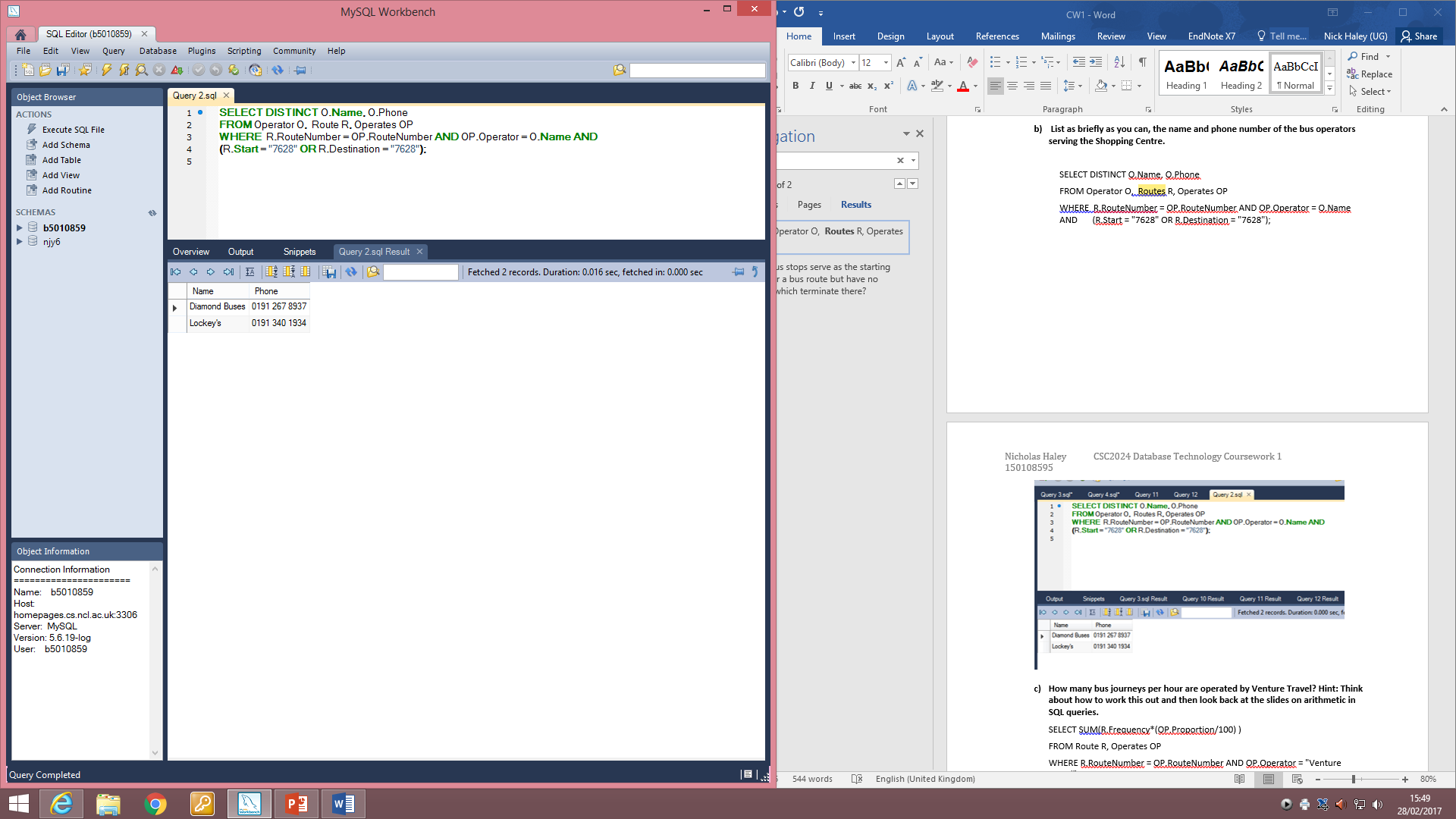


1. **List as briefly as you can, the name and phone number of the bus operators serving the Shopping Centre.**

SELECT DISTINCT O.Name, O.Phone

FROM Operator O, Route R, Operates OP

WHERE R.RouteNumber = OP.RouteNumber AND OP.Operator = O.Name AND (R.Start = "7628" OR R.Destination = "7628");

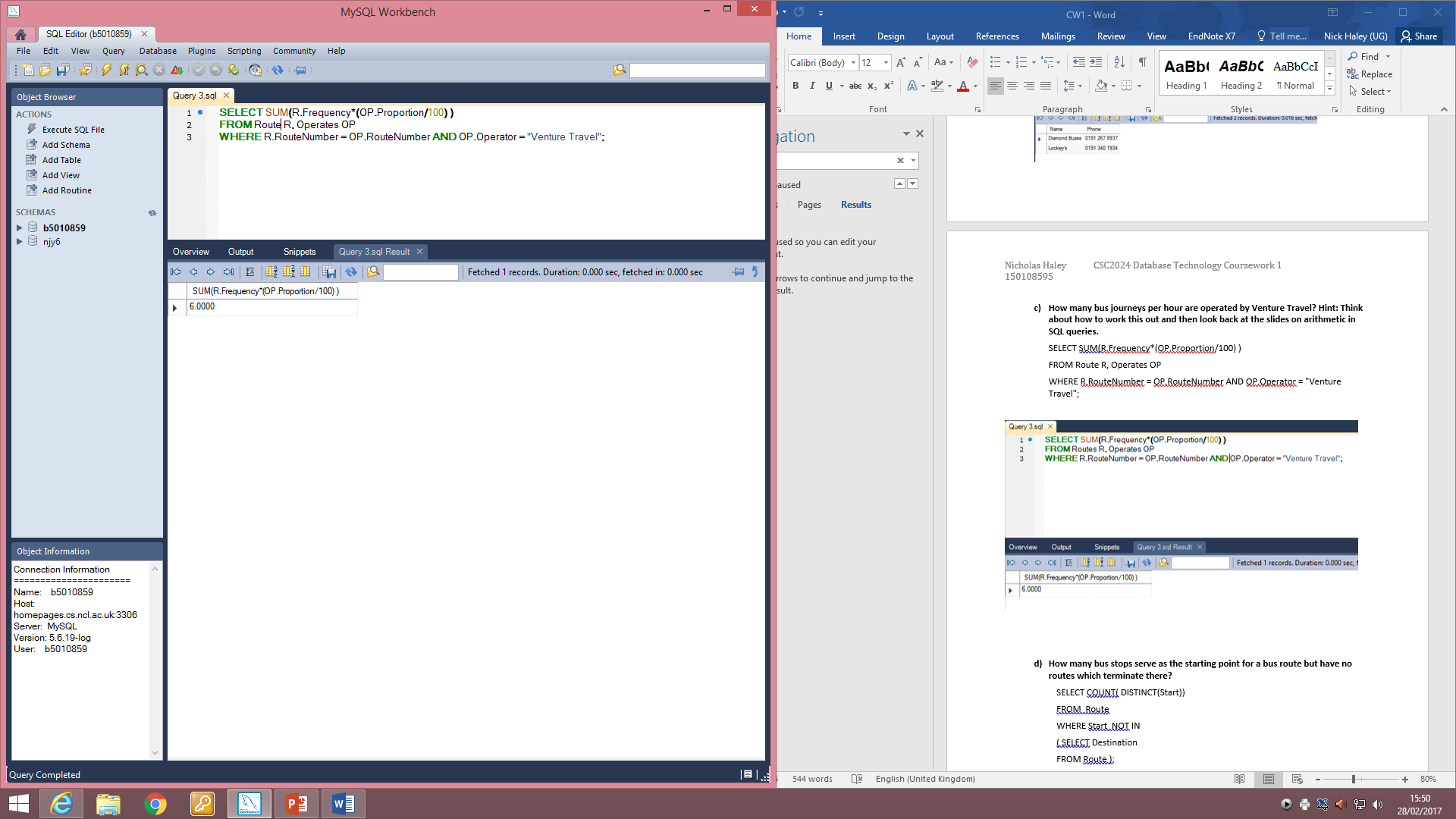


1. **How many bus journeys per hour are operated by Venture Travel? Hint: Think about how to work this out and then look back at the slides on arithmetic in SQL queries.**

SELECT SUM(R.Frequency\*(OP.Proportion/100) )

FROM Route R, Operates OP

WHERE R.RouteNumber = OP.RouteNumber AND OP.Operator = "Venture Travel";



1. **How many bus stops serve as the starting point for a bus route but have no routes which terminate there?**

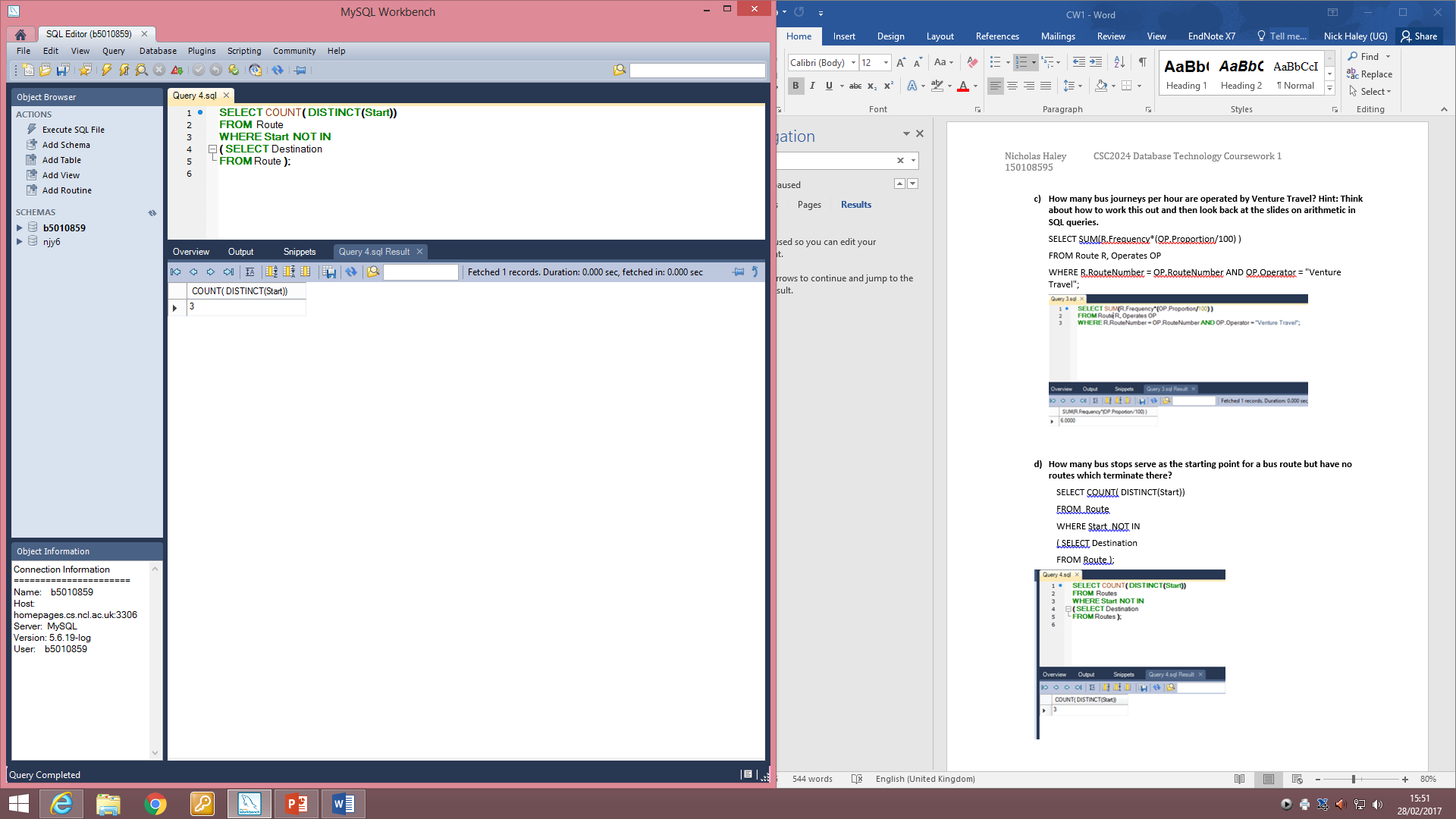
SELECT COUNT( DISTINCT(Start))

FROM Route

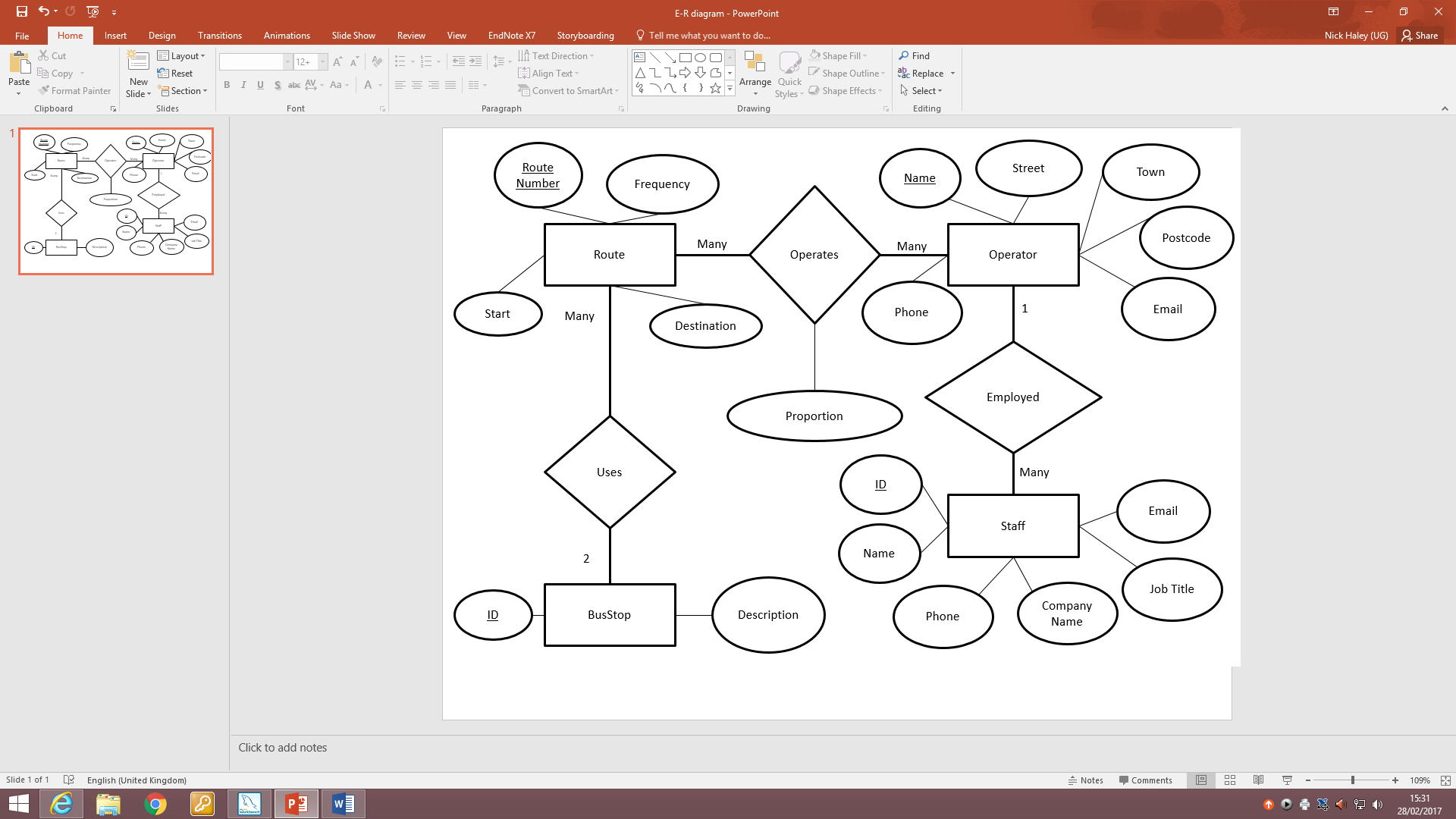
WHERE Start NOT IN

( SELECT Destination

FROM Route );



iv) **Modify the entity-relationship diagram to include this extension.**



v) List the changes you would need to make to the E-R diagram and the database if this approach was to be used.

* Remove start and destination columns from Route table
* BusStop to Route relationship becomes many to many cardinality as there is now an unlimited number of bus stops in a route.
* A new mapping table of the Uses relationship will need to be created. The table will include a column with route id and another for BusStop, both as foreign keys, so that many bus stops can be assigned to a route and start and destination is not taken into account.
* A single primary key will not be sufficient for the Uses table as they will not be unique. Therefore a composite or compound key of both Route id and bus stop id will be needed to make a unique key.