School of Civil Engineering
The University of Queensland

To be submitted through BlackBoard
100 Marks total; points for each question as marked

Due: 4:00pm Friday 21 April 2023

Within the Queensland Department of Transport and Main Roads, Translink is the division responsible for the funding and oversight of all public transport services in Queensland. For this project, we will be exploring the available public transport services, and the demand for these services, across South East Queensland (SEQ). For the purposes of this project, we define SEQ using the local government areas as far west as Toowoomba, as far south as the Gold Coast, and as far north as the Sunshine Coast.

In this project we will examine the distribution of public transport services as they vary across space in South East Queensland. The critical question for this project is: **What is the demand for public transport service? How might it vary in space, and what are the critical variables describing that demand?**

We will use as a dependent variable the total journeys made to work by public transport, found in the 2016 Census, collected by the Australian Bureau of Statistics (ABS). We have as potential dependent variables the characteristics of population and employment by Statistical Area 1 (SA1). Also, there are several possible measures that we can use to measure "access" to public transport services. In last year's class, we generated a metric called the "Public Transport Accessibility Level", or PTAL. The PTAL metric was originally developed by Transport for London to capture the average time spent walking to, and waiting for, bus and train service in greater London. The PTAL metric captures this accessibility at a fairly fine level of spatial detail. A report on the method used to calculate PTAL is included on Blackboard with this project.

Other measures of service could include the location of stops within an SA1, the number of routes passing through an SA1, and other relevant variables associated with peak-hour services from Translink across SEQ.

Geographies (shapefiles) for SA1 as defined by the Australian Bureau of Statistics (ABS) are included in the data online; these have already been processed to include only those shapes within the SEQ region.

Finally, selected data from the Australian Bureau of Statistics (ABS) at the level of Spatial Area 1 (SA1) for Queensland is also given. As examples, you may consider Tables G02 and G07, recorded at the SA1 level. Descriptive information on these two tables is show at the end of this project statement.

A short summary of the data files available in Blackboard is provided on the next page.

Task 1 (10 marks)

From the Journey to Work data, identify the total number of persons in each SA1 that use public transport as their main travel mode to work. This can generally be found in Table G59 in the ABS data by SA1. Again, this will be your dependent variable. Illustrate these data on a suitable map of SEQ by SA1.

Task 2 (30 marks)

Determine the following metrics using the SEQ stops and routes shapefiles. ***Also***, display these data on a map of your choosing, illustrating the variability of these measures across SEQ.

1. The PTAL value for each SA1 (provided with the original data on Blackboard).
2. The percentage of each SA1 area within 960 m of a train station ***or*** within 640 m of a bus stop.
3. The number of bus stops and train stations within the SA1.
4. The number of bus routes and train routes travelling through the SA1.

You can also consider any other metric you think might capture some measure of "access" to public transport services during peak hours on weekdays.

Task 3 (30 marks)

Conduct a linear regression of the public transport trips for each SA1 as a function of demographic data from the ABS, and at least one of the access variables identified in Task 2. [You may also consider transformations of variables, e.g. square roots, squared values, logarithms, etc.]

From this regression, determine if there is spatial correlation among the residuals, by checking both Moran's I across the full set of SA1 in SEQ, and the Getis-Ord Gi* for each SA1 area.

Include the output of the regression, the value of Moran's I, a map of SEQ with the values of the Getis-Ord Gi* for each SA1 area, and a CSV file with the SA1 code and the Getis-Ord Gi*.

Also include a 1-page interpretation of the output values in the regression, of Moran's I, and of the Getis-Ord Gi*.

Task 4 (30 marks)

Assuming that there is some spatial correlation in the residuals from Task 3, conduct a Geographically Weighted Regression (GWR). You can use the same variables from Task 3, or you can consider additional / other variables in your GWR.

In your output, include the output of the regression, the value of Moran's I, a map of SEQ with the values of the Getis-Ord Gi* for each SA1 area, and a CSV file with the SA1 code and the Getis-Ord Gi*.

Also include a 1-page interpretation of the output values in the GWR, of Moran's I from the residuals after running the GWR, and of the Getis-Ord Gi* again after running the GWR.

Data table descriptions appear on the next page.

Data provided

File name	Relevant contents
SEQ SA1 region.shp	The geography (shape file) for Statistical Area 1 zones located in South East Queensland. The SA1 aggregates mesh blocks and provides the lowest level of detail of population statistics collected in the Census by the ABS.
2016Census_G02_QLD_SA1.csv	From the ABS data of the 2016 Census, Table G02 has median values of income by person, by family, and by household, as well as median rent, median mortgage, and average household size. These data apply at the SA1 level.
2016Census_G07_QLD_SA1.csv	From the ABS data of the 2016 Census, Table G07 has the total number of persons of Indigenous and non-Indigenous heritage living in an SA1, by age and gender.
2016Census_G59_QLD_SA1.csv	From the ABS data of the 2016 Census, Table G59 has the total number of trips to work originating in a given SA1. These are broken out by mode of travel.
stops.txt	This comma-delimited file has the identification number, name, and location (latitude and longitude) of every stop in Translink's network for South East Queensland. This file is taken from the General Transit Feed Specification (GTFS) for South East Queensland.
shapes.txt	This comma-delimited file has the information for the shapes describing routes across SEQ, essentially for every bus, train, and ferry in South East Queensland. The primary identifiers are the route, the service (scheduled trip by a bus, train or ferry). Also, the service is identified by weekday, Saturday, and Sunday.
trips.txt	This comma-delimited file has the information of each vehicle trip operating in South East Queensland. The primary identifiers are the trip (service), the route, the headsign, and the direction. It also connects to a shape that is used to describe the route in space.

Additional data from the ABS can be found among the Census Data Pack, General Community Profile (GCP) for 2016, for SA1. This is also included in Blackboard and is available on-line at:

https://www.abs.gov.au/census/find-census-data/datapacks?release=2016&product=GCP&geography=SA1&header=S