



TRANSPORT SERVICE SYSTEM DESIGN USING MODIFIED APRIORI ALGORITHM

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ABSTRACT

This research is carried-out to evaluate the effectiveness of data mining in determining viability of routes, efficient scheduling and assigning of vehicles to commuters. The study was guided by the following objectives: modification of Apriori algorithm, implementation using C programming language, analyses and deductions from the results to determine if a given route is feasible. Data Mining (association rule) technique has been used to identify geographical locations where accidents have occurred and their characteristics, in road management to develop effective accident preventive measures, to determine estimated travel time and in market basket analysis applied in grocery stores. Data was collected from three transport companies for each route. The data was inputted into the program implemented using modified Apriori algorithm. The study findings revealed the volume of commuters per route and how vehicles can be assigned and scheduled. Using the above findings, effective transport service system is designed using routes viability.

Keywords: Apriori, scheduling, assigning, viability

INTRODUCTION

Apriori algorithm has been used to mine association rule among large dataset in market basket analysis to help in the arrangement of stocks (Akash and Mahendra 2019). Also in medical diagnosis, it assists physicians to cure patients (Akash and Mahendra 2017). The algorithm performs frequent item-set mining in a dataset to identify the items that often occur together. A set of item-set is frequent if it satisfies a minimum threshold value for support and confidence. Support depicts transaction with items bought together in a unit transaction while confidence shows transactions where the items are purchased one after the other. The frequent item-set technique considers only those transactions that meet minimum threshold support and confidence requirements. The algorithm generates (k+1) item-set from K-item-sets by joining each item with itself. It then performs a prune step. This prune step scans the unit of each item in the data pool. If the candidate item does not meet minimum support, then it is removed.

The Transport Service System Using Modified Apriori Algorithm is a modification and application of the apriori frequent set algorithm to solve a business problem. Transport business is a lucrative business with high return, but difficult to manage because of complexities in terms of number of buses assign to a route, number of commuters per route.

The research is geared toward estimating the volume of commuters that ply some designated routes in Nigeria and to determine how viable such routes are in terms of numbers of commuters proper scheduling of vehicles. This will also help to reduce transport service business failure.

Literature Review

The research works on land transportation focuses on risk and risk analysis using data mining techniques, but this work focuses on how to analyze transportation routes and identify viable routes ply to maximize profit. It is an application of apriori data mining algorithm. Xiaofeng in 2017, discussed on identification of accident prone areas and ways to help reduce frequent accident from occurring by putting measures based on its study. (Xiaofeng and Shu 2017). Although

Particle Swarm Optimization (PSO) can be used to analyze the correlation between accidents attributes and causes. (Xiao, et al., 2014). Researched on deep-level and predicted information that beneath the massive data is very important for traffic management agency to watch and control the road condition and traffic volume which takes a quick and specific measure to solve the traffic gridlock and to reduce the occurrence of traffic violation and accident. . (Shaw, et al., 2010). In analyzing the benefit using Geographic Information System (GIS) helps to retrieve important information for road analysis and to build a prototype which enhances the relationship between the transportation routes. (Marco 2017). Worked on fuzzy class association rule mining for traffic prediction applied genetic network programming techniques with multi-branch and full-paths. (Zhang and Rice 2003). Using a varying coefficients linear model, which varies as a smooth function of departure time, with past instantaneous travel time to predict future travel time. The Principal component analysis and nearest neighbor approach were investigated (Kwon and Petty 2018).

Also The Estimated travel time on a freeway uses flow and occupancy data obtained from loop detectors to predicted the future time steps using linear regression proposed by a variation based online travel time prediction approached using clustered neural networks.(Yin-Fu et al., 2020) (Fabrizi and Ragona 2016).

This research work modifies the apriori algorithm by applying the modulus operator on the volume of the commuters to identify the number of buses needed and the route viability.

RESEARCH METHODOLOGY

Data Collection

The data collection method applied is questionnaire. Data was collected from three leading transporting companies (Young Shall Grow Motors, Teile Motors and Peace Mass Transit (PMT) in Abuja.

The questionnaire was designed to have the name of the transport company, the name of route, the number of commuters per route. The data recorded was daily data for an entire week (starting from Monday to Sunday) for all the routes.

Modified Apriori Algorithm

In the **Modified Algorithm**, step 2 max and min are declared. The variable max stands for maximum carrying capacity of a bus. The max variable is assigned the value eighteen which is the highest number of commuters an eighteen seater bus can carry. The variable min stands for minimum number of commuters for a given route. The min variable is assigned the value nine which is fifty percent of the bus carrying capacity. The algorithm takes the average number of commuters for a given route per day from the three transport companies as input.

The input is processed, the remainder (the value from number of commuters in a given route variable max) and quotient (the result of the number of commuters in a given route divided by the variable max) are computed after successive division.

Then, the algorithm tests if the remainder of commuters in a given route is at least nine. If the test is true a bus is scheduled else it is not scheduled. The algorithm also test if the quotient is at least one, if the condition is true a bus is assigned else it is not assigned. After the initial assignment, subsequent assignment of buses to routes will be in an arithmetic progression (when quotient equal to one, one bus is assigned, when quotient equal to two, two buses are assigned...in that order).

The algorithm also test to identify a route that is viable (route with high volume of commuters). This is achieved by identifying routes that have at least four vehicles assigned at

a given period. Finally, the algorithm outputs the result for further analysis and deduction.

The Modified Algorithm

Step1. Start

Step2. Declare max and min

Step3. Declare routes

Step4. Declare commuters

Step5. Declare Remainder

Step 6. Declare Quotient

Step 7. Declare assign a bus

Step 8. Declare schedule a bus

Step 9. Declare no bus schedule

Step 10. Assign zero to schedule no bus

Step11. Set quotient counter to zero

Step12. Set assign a bus counter to one

Step 13. Assign values to min and max

Step14. Read the number of commuters for each route from the text file

Step15. Assign number of commuters to each route

Step16. Commuters < max & & commuters >= min

Step17. Schedule a bus

Step18. Remainder = number of commuters per route % max

Step19. Remainder >= min & & Remainder < max

Step20. Schedule a bus

Step 21. Quotient = number of commuter per route / max

Step22. Quotient >= 1 & & Quotient < 2

Step23. Assign a bus

Step24. Increment quotient counter

Step25. Increment assign a bus counter

Step 26. If Quotient >= 4

Step27. Route viable

Step 28. Else display results

Step 29. Stop

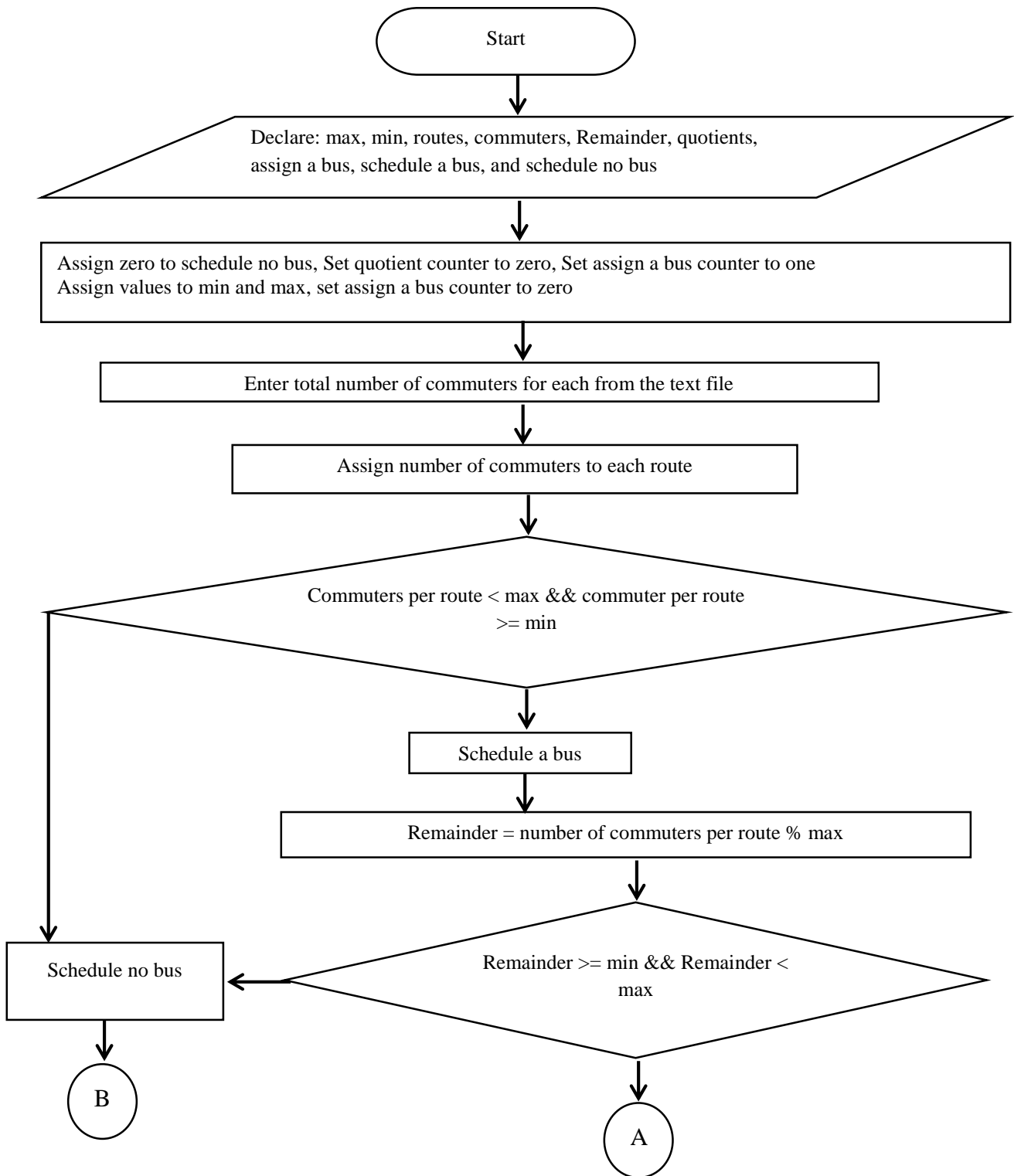


Figure 1a: Program Flowchart

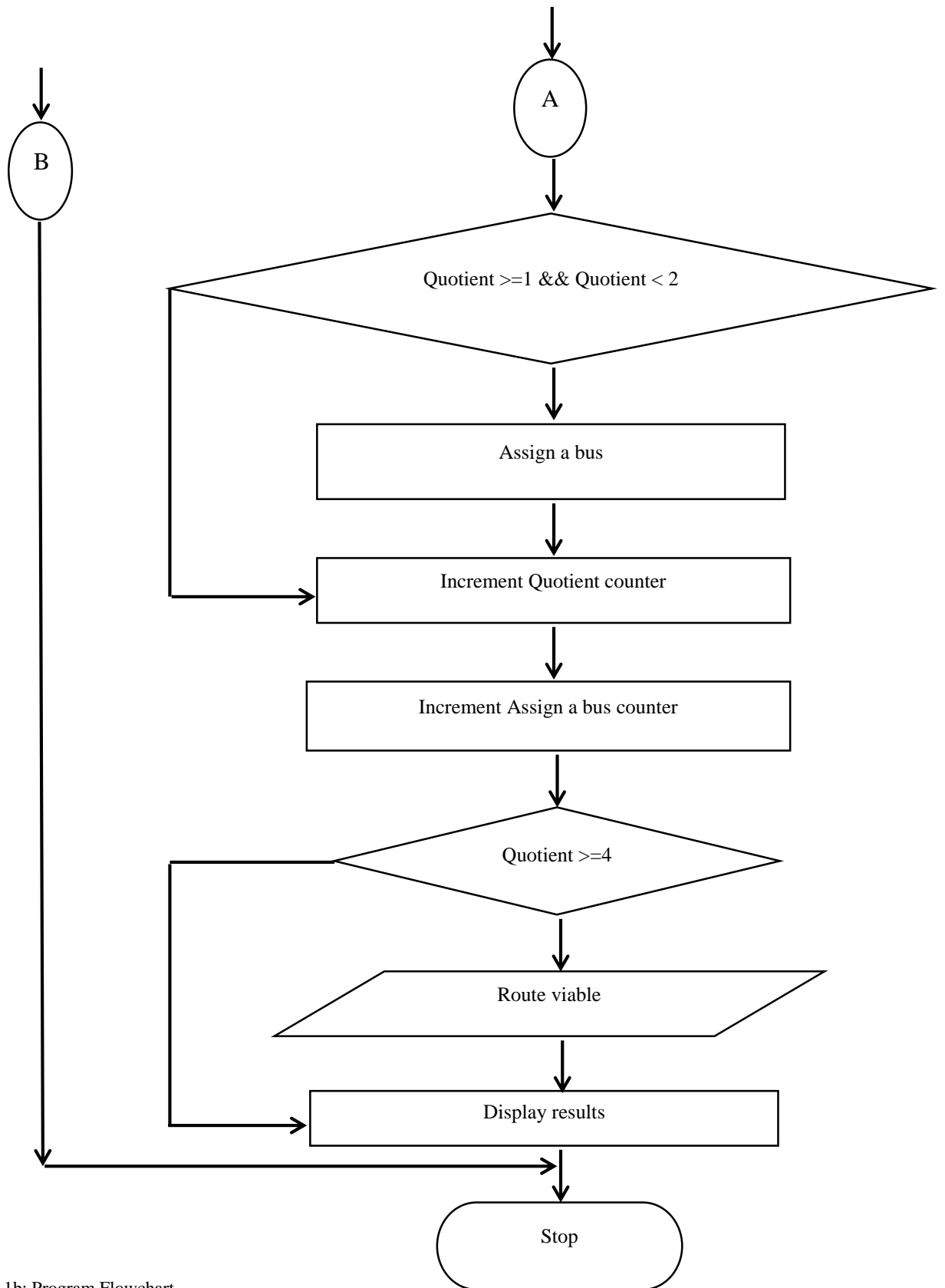


Figure 1b: Program Flowchart

RESULTS AND DISCUSSION

Graphical Analysis of Results

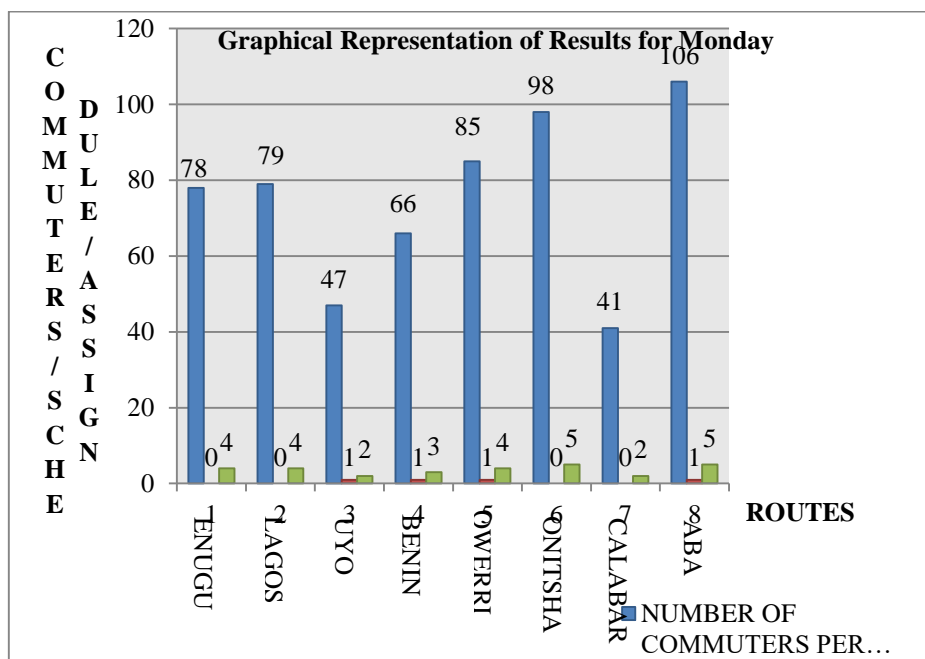


Figure 2: Graphical Representation of Results for Monday

The Figure 2 depicts that Enugu, Lagos, Owerri, Onitsha and Aba have very high volume of commuters, while Uyo and Calabar have low commuters. Enugu has a total of seventy-eight (78) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Enugu will be four (4) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity is nine passengers so no bus is scheduled.

Lagos has a total of seventy-nine (79) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Lagos will be four (4) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Uyo has a total of forty-seven (47) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Uyo will be two (2). The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Benin has a total of sixty-six (66) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Benin will be three (3) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is one (1) as shown in the graph. Owerri has a total of eighty-five (85) commuters. If the number of commuters are divided by

the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Owerri will be four (4) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1) as shown in the graph.

Onitsha has a total of ninety-eight (98) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Onitsha will be five (5). The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0) as shown in the graph. Calabar has a total of forty-one (41) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Calabar will be two (2) as shown in the graph.

The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0) as shown in the graph. Aba has a total of one hundred and one (101) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Aba will be five (5) as shown in figure 4.8. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent of the bus carrying capacity (nine passengers) and less than 100 percent of the bus carrying capacity (18 passengers) so “schedule a bus” is one as shown in the graph. The graph above shows that Lagos, Owerri, Onitsha and Aba have very high volume of commuters, while Lagos, Benin, Uyo and Calabar have low commuters.

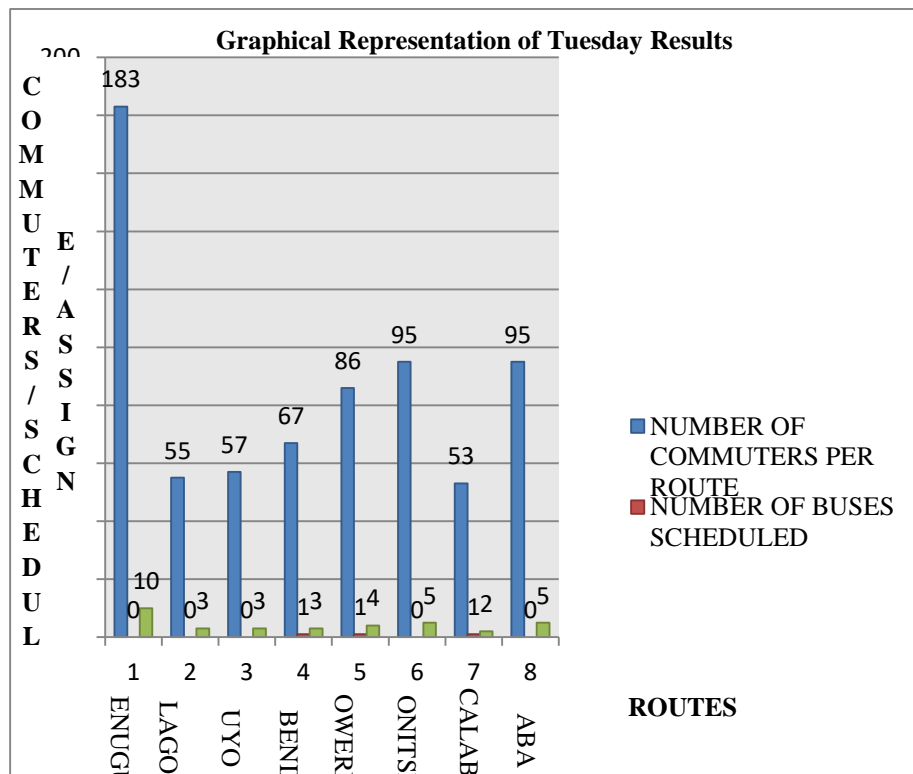


Figure 3: Graphical Representation of Results for Tuesday

In figure 3 Enugu has a total of one hundred and eighty-three (183) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Enugu will be ten (10) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Lagos has a total of fifty-five (55) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Lagos will be three (3) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Uyo has a total of fifty-seven (57) commuters. If the number of commuters are divided

by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Uyo will be three (3) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0) as shown in the graph. Benin has a total of sixty-seven (67) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Benin will be three (3) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1) as shown in the graph. Owerri has a total of eighty-six (86) commuters. If the

number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Owerri will be four (4) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Onitsha has a total of ninety-eight (98) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Onitsha will be five (5) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Calabar has a total of fifty-three (53) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Calabar will be two (2) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1) as shown in figure 4.9. Aba has a total of ninety-five (95) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Aba will be five (5) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

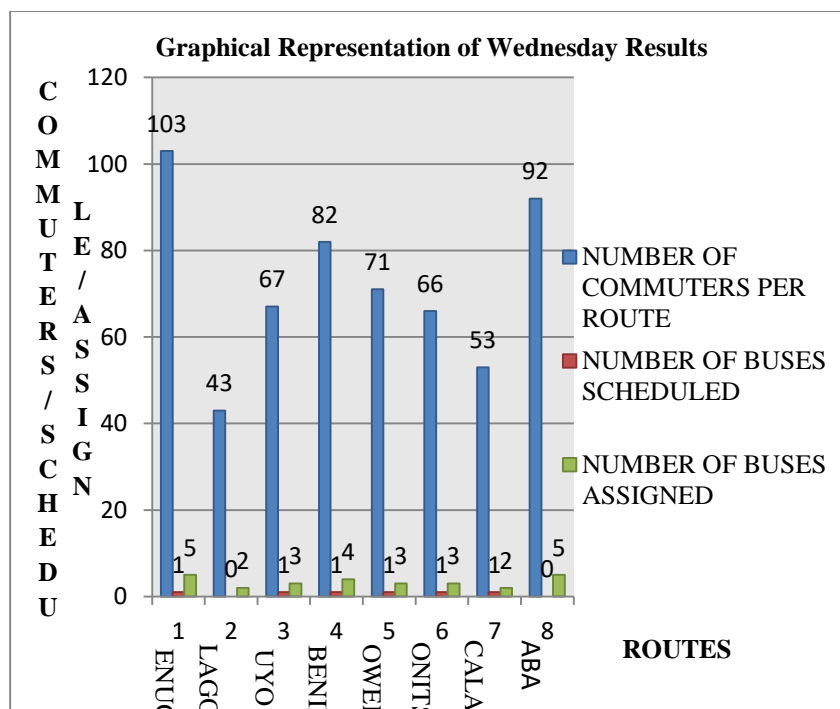


Figure 4: Graphical Representation of Results for Wednesday

The graph of Fig 4 shows that Enugu, Benin, and Aba have very high volume of commuters, while Lagos, Uyo, Owerri, onitsha and Calabar have low commuters.

Enugu has a total of one hundred and three (103) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Enugu will be five (5).

The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Lagos has a total of forty-three (43) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Lagos will be two (2) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Uyo has a total of sixty-seven (67) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Uyo will be three (3) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1) as shown in fig 4.

Benin has a total of eighty-two (82) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Benin will be four (4) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Owerri has a total of seventy-one (71) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Owerri will be three (3) as shown in figure 4.10. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Onitsha has a total of sixty-six (66) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Onitsha will be three (3) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1) as shown in the fig 4.

Calabar has a total of fifty-three (53) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Calabar will be two (2) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Aba has a total of ninety-two (92) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Aba will be five (5) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Figure 4.11, shows that Enugu and Owerri have very high volume of commuters, while Lagos, Uyo, Benin, Onitsha and Calabar and Aba have low commuters.

Enugu has a total of one ninety-six (96) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Enugu will be five (5) as shown in the

graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

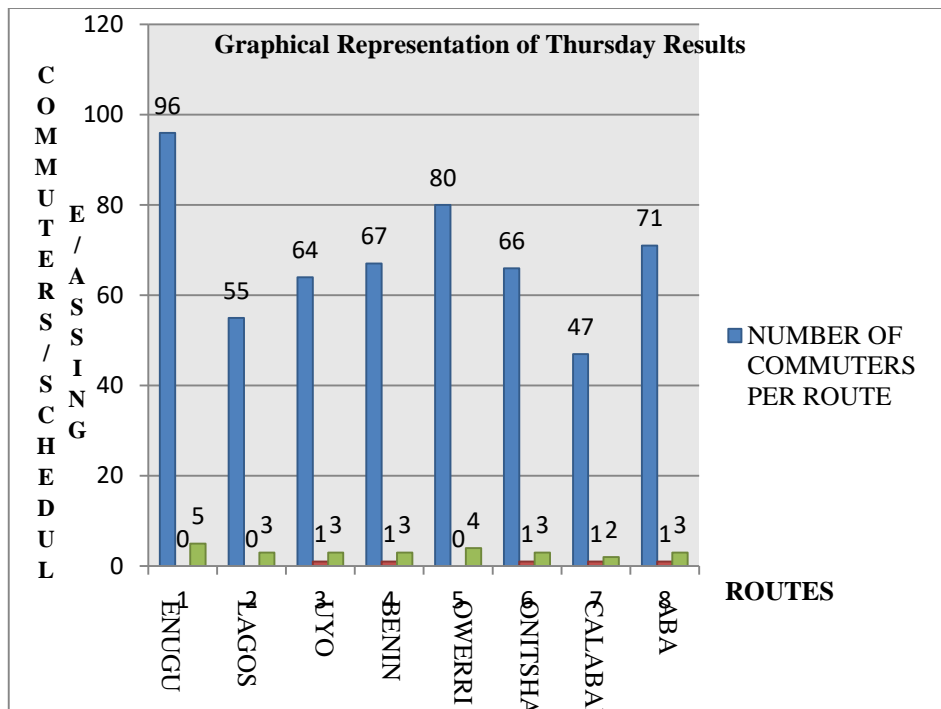


Figure 5: Graphical Representation of Results for Thursday

In figure 5 Lagos has a total of fifty-five (55) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Lagos will be three (3) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Uyo has a total of sixty-four (64) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Uyo will be three (3). The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1) as shown in the graph.

Benin has a total of sixty-seven (67) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Benin will be three (3) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Owerri has a total of eighty (80) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Owerri will be four (4) as shown in the graph. The remainder (spill over of commuters) after assigning is

less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Onitsha has a total of sixty-six (66) commuter. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Onitsha will be three (3) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Calabar has a total of fifty-three (53) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Calabar will be two (2) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Aba has a total of seventy-one (71) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Aba will be three (3) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

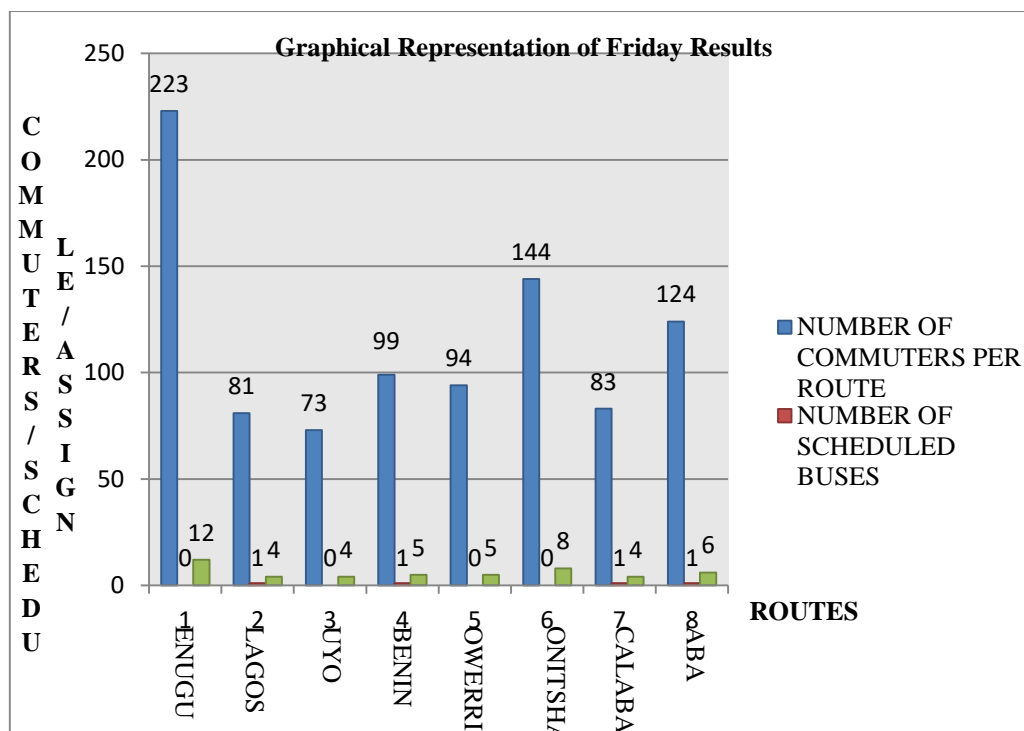


Figure 6: Graphical Representation of Results for Friday

Figure 6 shows that all the routes have very high volume of commuters. Enugu has a total of two hundred and fifty (250) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Enugu will be twelve (12) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Lagos has a total of eighty-one (81) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Lagos will be four (4) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Uyo has a total of seventy-three (73) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Uyo will be four (4) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Benin has a total of ninety-nine (99) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Benin will be five (5) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Owerri has a total of ninety-four (94) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Owerri will be five (5) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Onitsha has a total of one hundred and forty-four (144) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Onitsha will be eight (8) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Calabar has a total of eighty-three (83) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Calabar will be four (4) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Aba has a total of one hundred and twenty-four (124) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Aba will be six (6) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

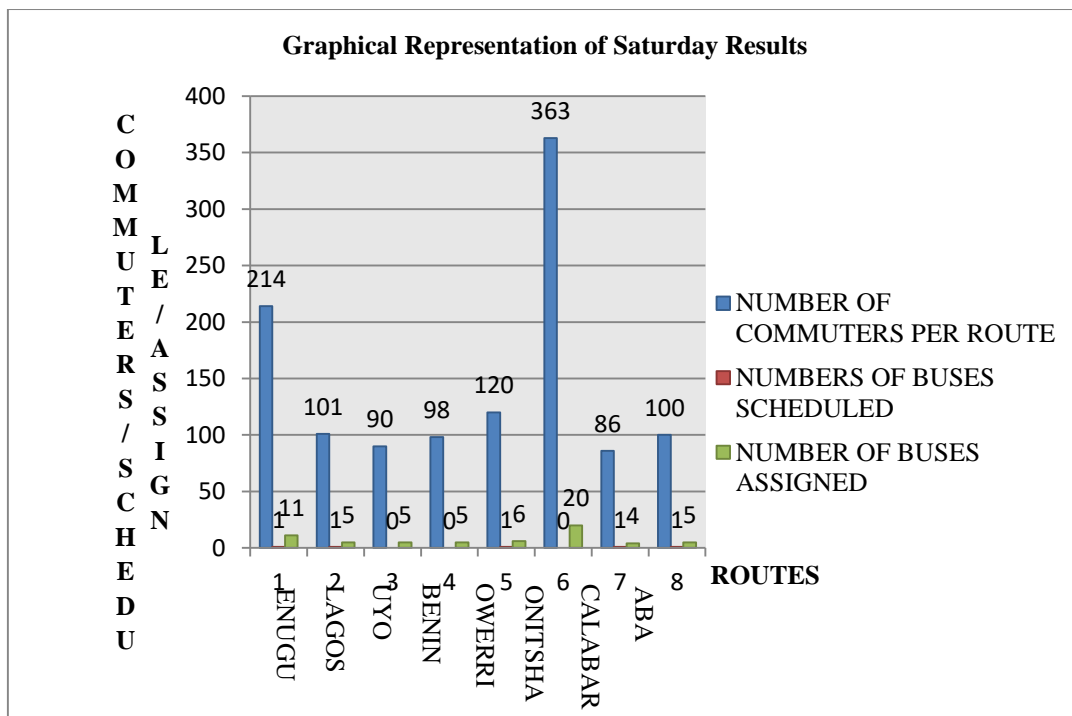


Figure 7: Graphical representation of results for Saturday

Figure 7 above shows that all the routes have very high volume of commuters. Enugu has a total of two hundred and fourteen (214) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Enugu will be eleven (11) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Lagos has a total of one hundred and one (101) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Lagos will be five (5) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Uyo has a total of ninety (90) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Uyo will be five (5) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Benin has a total of ninety-eight (98) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Benin will be five (5) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Owerri has a total of one hundred and twenty (120) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Owerri will be six (6) as

shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Onitsha has a total of three hundred and sixty-three (363) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Onitsha will be twenty (20) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Calabar has a total of eighty-six (86) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Calabar will be four (4) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Aba has a total of one hundred (100) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Aba will be five (5) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Figure 7 shows that only Aba has very high volume of commuters, while Enugu, Lagos, Uyo, Benin, Owerri, Onitsha and Calabar have low commuters. Enugu has a total of sixty-six (66) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Enugu will be three (3).

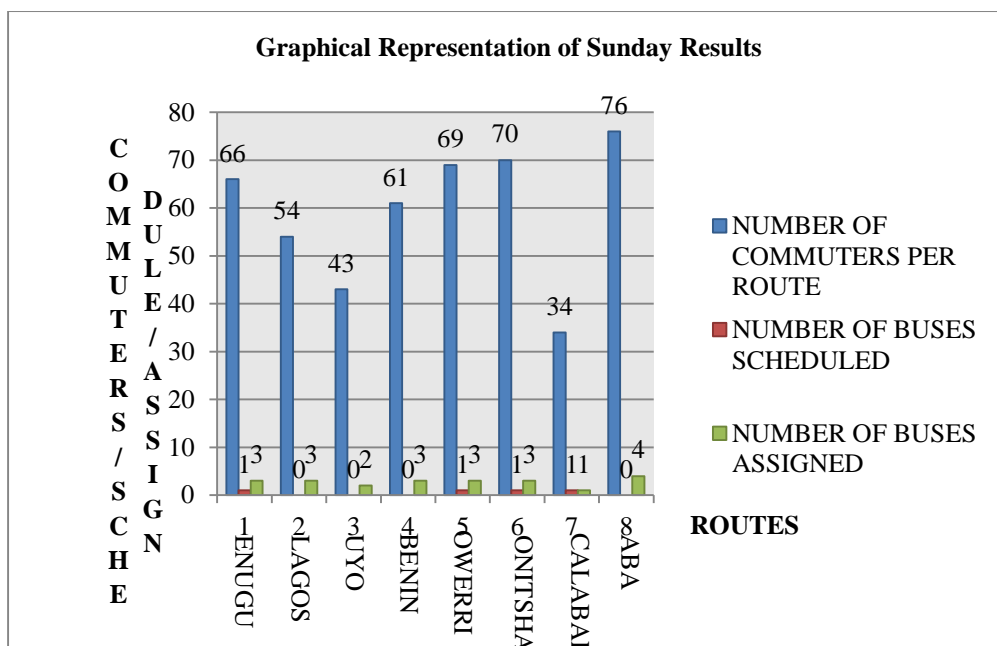


Figure 8: Graphical Representation of Results for Sunday

Figure 8 shows the remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Lagos has a total of fifty-four (54) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Lagos will be three (3) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Uyo has a total of forty-three (43) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Uyo will be two (2) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Benin has a total of sixty-one (61) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Benin will be three (3) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

Owerri has a total of sixty-nine (69) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Owerri will be three (3) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Onitsha has a total of seventy (70) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Onitsha will be three (3) as shown in the graph. The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying

capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Calabar has a total of thirty-four (34) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Calabar will be one (1). The remainder (spill over of commuters) after assigning is greater than or equal to fifty percent (50%) of the bus carrying capacity (nine passengers) and less than 100 percent (100%) of the bus carrying capacity (18 passengers) so “schedule a bus” is one (1).

Aba has a total of seventy-six (76) commuters. If the number of commuters are divided by the carrying capacity of the bus which is eighteen passengers, the total numbers of buses assigned for Aba will be four (4) as shown in the graph. The remainder (spill over of commuters) after assigning is less than fifty percent (50%) of the bus carrying capacity (nine passengers) so “schedule a bus” is zero (0).

CONCLUSION AND FUTURE WORK

The method gives a useful basis in the establishment of transport service system with minimal assumptions. Finally, the routes with high volume of commuters can be clearly seen, adequate number of vehicles can then be assigned and scheduled respectively. Future can be on computation of route distances and their economic implications on the transport companies in Nigeria.

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