**CHAPTER FOUR**

DATA ANALYSIS

Descriptive analysis:

To perform any analysis, we first describe the data. To perform this we conduct the descriptive analysis as follows:

**Descriptive Statistics: No. of Arrival, No. of cars served**

Variable N Mean SE Mean StDev Minimum Median Maximum

No. of Arrival 50 90.76 1.40 9.87 68.00 91.00 109.00

No. of cars served 50 83.14 1.49 10.56 60.00 88.50 100.00

***Fig.1***

Graphically:



***Fig. 2***



***Fig. 3***

The analysis in figure 1,2 and 3, shows that the number of cars that arrives at the fuel station seems to be more than the cars that are being served.

Queuing-Theorem Analysis:

As required in the chapter one of this study, we obtain the arrival rate and service rate as follows:

Arrival rate (λ) =

=4538/50 =90.76 customers per hour.

hence, λ = =1.5127 customers per minute.

Service rate(=

= 4157/50 = 83.14 customers per hour.

hence, customers per minute.

Also, we perform a goodness of fit test to check if the arrival rate follows a Poisson distribution or not. The hypothesis is given as:

Ho: The arrival rate follows a Poisson distribution with mean rate λ.

H1: The arrival rate does not follow the Poisson distribution with mean rate λ.

The result output (obtained by using minitab16) is then giving as follows:

**Goodness-of-Fit Test for Poisson Distribution**

Data column: No. of Arrival

Poisson mean for No. of Arrival = 90.76

No. of Poisson Contribution

Arrival Observed Probability Expected to Chi-Sq

<=74 5 0.040591 2.02957 4.34745

75 - 78 2 0.056262 2.81310 0.23502

79 - 82 5 0.097241 4.86204 0.00391

83 - 86 2 0.138388 6.91940 3.49749

87 - 90 6 0.163617 8.18083 0.58136

91 - 94 11 0.162016 8.10080 1.03760

95 - 98 8 0.135368 6.76838 0.22411

99 - 102 6 0.096087 4.80433 0.29757

103 - 106 3 0.058309 2.91546 0.00245

>=107 2 0.052122 2.60609 0.14095

N N\* DF Chi-Sq P-Value

50 0 8 10.3679 0.240

*Fig. 1*

the figure one above shows that, at 5% level of significant, we accept the null hypothesis (since p-value=0.24 > 0.05) and conclude that the arrival rate follows a Poisson distribution with mean rate λ.

Following this method, we can also test for the second hypothesis which is given as follows:

H0: The distribution of service time fits an exponential distribution.

H1: The distribution of service time does not fit an exponential distribution

Hence, from the result obtained in minitab16, we obtain the P-value =0.06 (greater than the level of significant (0.05)), which shows that the distribution of service time fits an exponential distribution.

Finally, we can obtain the values for the queuing parameters (using Ms-Excel) as follows:

|  |  |
| --- | --- |
| **Queue Station** | BOVAS |
| Arrival Rate | 1.512699962 |
| Service Rate/Channel | 1.385699987 |
| Number of Servers | 6 |
| Max. Number in System | \*\*\* |
| Number in Population | \*\*\* |
| Type | M/M/6 |
| Mean Number at Station(L) | 1.091864824 |
| Mean Time at Station(W) | 0.721798718 |
| Mean Number in Queue(L\_q) | 0.000214497 |
| Mean Time in Queue(W\_q) | 0.000141797 |
| Mean Number in Service | 1.091650367 |
| Mean Time in Service | 0.721656919 |
| Throughput Rate | 1.512699962 |
| Efficiency | 0.181941748 |
| Probability All Servers Idle (P0) | 0.335650802 |
| Prob. All Servers Busy (PW) | 0.000964434 |
| Prob. System Full | 0 |
| Critical Wait Time | 1 |
| P(Wait >= Critical Wait) | 1.07255E-06 |

1. The fraction of time each server is busy (utilization factor):

= 0.182 = 18.2%

1. The Probability that there are Zero patients in the system:

P0= 0.3357

1. The average number of patients in the system :

Ls = 1.0919 patients

1. The average time a patients spends in the waiting line and being served:

Ws = 0.7218

1. The average number of patients on the queue, waiting to be served at any time:

Lq = 0.0002145

1. The average time a patient spends in the queue waiting for service:

Wq = 0.0001418

CHAPTER FIVE

**SUMMARY, CONCLUSION AND RECOMMENDATIONS**

**5.1 Summary**

This research work deals with determining the amount of average time customers spend on a queue and actual time of service delivery. It was analyzed using a multi-server queuing model, waiting and service costs.

The method of data collection in this work is the secondary data and this was collected at the Bovas filling station Ado, Ekiti. The data covers a period of period of 5days (10hours per day).

Goodness of fit test was conducted (using the minitab16 for the chi-square poisson test) to carry out the research question and reach out to some conclusions. Finally, we then obtain the queuing parameters of the model by using the Ms-Excel Add ins (queues).

**5.2 Conclusion**

From the descriptive analysis conducted in the chapter 4 of this work, we can then conclude that that the number of cars that arrived Bovas seems to be more than the numbers of cars being served, hence the queue.

Also, the result obtained by the queue analysis shows that, the arrival rate follows a Poisson distribution and the service rate follows an exponential distribution respectively.

The parameter output also shows that, at the petrol station the servers seems to be busy than being idle.

**5.3 Recommendations**

From the summary and conclusion made by the researcher, it will then be advisable for the manager of the filling station to build more fuel pumps and create spaces for car parks so as to reduce the strength of queue around the area.

The manager should also employ more staffs to attend to customers patronizing the Bovas filing station.