THE FEDERAL UNIVERSITY OF TECHNOLOGY, AKURE

SCHOOL OF PHYSICAL SCIENCES

DEPARTMENT OF MATHEMATICAL SCIENCE

TOPIC:

DYNAMICS OF POPULATION GROWTH IN SOUTH KOREA USING LOGISTIC MODEL ANALYSIS

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SUBMITTED

TO

DEPARTMENT OF MATHEMATICAL SCIENCE

LECTURER IN CHARGE: PROF. T.T. YUSUF

IN PARTIAL FULFILMENT OF CONTINUOUS ASSESMENT

FOR

INTRO. TO MATHEMATICAL MODELLING MTS 307

APRIL 2024

1.0 Introduction

Population growth and its implications have been subjects of interest for scholars and policymakers worldwide. Understanding the dynamics of population growth is crucial for effective planning and policy formulation.

In this write up, we will focus on **South Korea**, a country known for its rich culture, entertainment and vibrant cities.

We aim to **analyse** the population dynamics of South Korea over the past **Twenty years (2004 - 2023)** using the logistics population model. By estimating key parameters such as the **growth rate** and **carrying capacity**, we aim to estimate the **country's growth rate** and **carrying capacity**, and subsequently **predict** its population for the years **2030**, **2040**, and **2050**.

We chose South Korea as the subject for our population prediction project due to its intriguing population trends over the years. We observed a consistent increase in population followed by a recent slight decrease. This observation prompted us to go deeper into understanding the factors driving these population changes.

- **Natural Increase:** South Korea historically had a relatively high birth rate, contributing significantly to population growth through natural increase.
- **Improved Healthcare:** Advances in healthcare, such as better access to medical services, improved sanitation, and lower infant mortality rates, have increased life expectancy and overall population growth.
- **Economic Development:** Rapid economic development since the mid-20th century has led to improved living standards, influencing fertility rates and contributing to population growth.
- **Migration:** While not as significant as natural increase, immigration has played a role in population growth, with people moving to South Korea for employment opportunities and family reunification.

Recent Population Trends and Decision to Predict: We observed a recent decrease in population and decided to investigate further. Our analysis led us to explore why the population increased over time and then decreased. Understanding these trends motivated us to predict future population changes.

So, using the Logistic Population model helps predict if the population will increase, stabilize or decrease in the future.

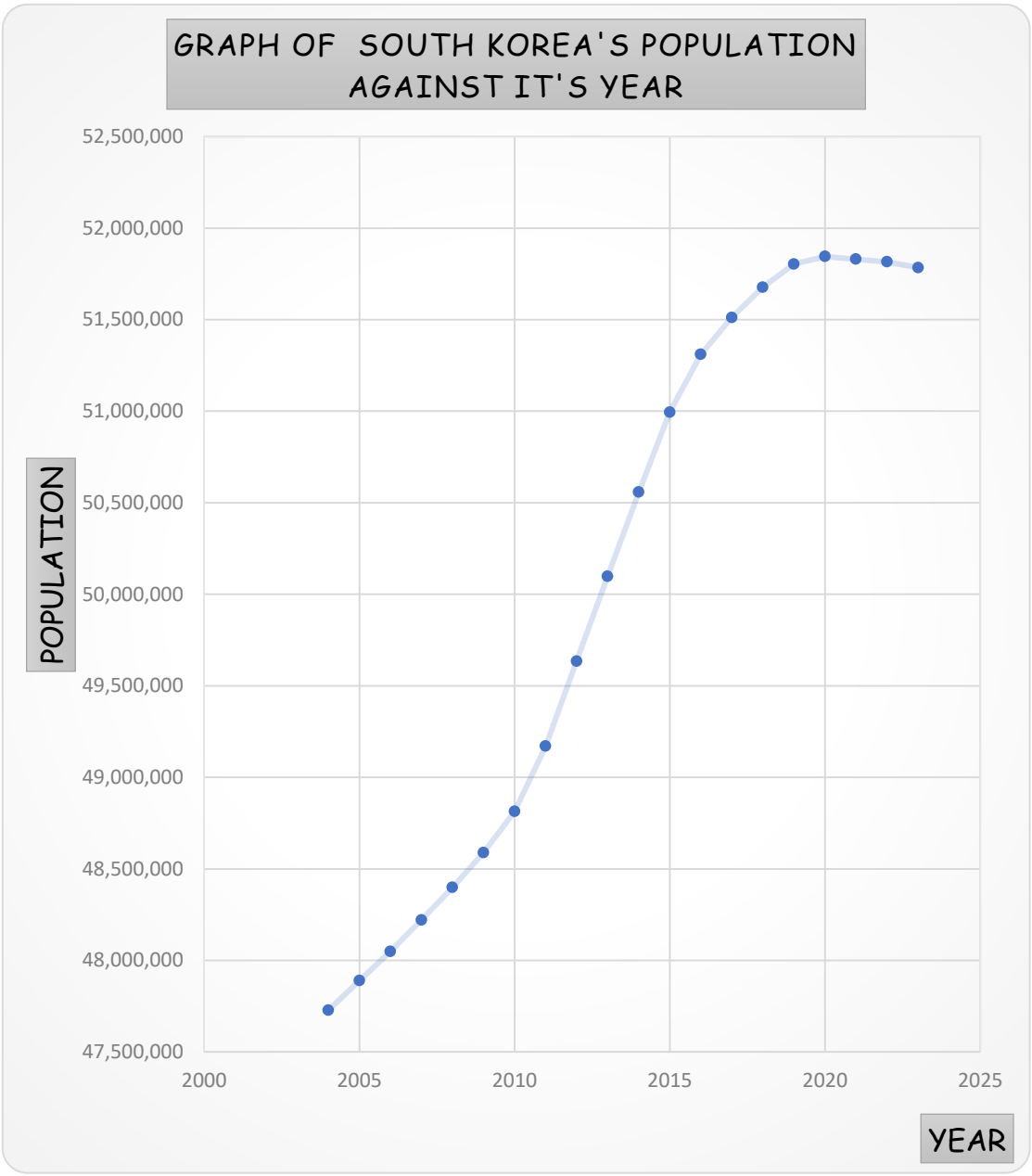
2.0 Literature Review

In our lecture on population modelling, we see how population dynamics have employed various mathematical models to analyse population growth patterns. One such model is the logistics population model, which accounts for both exponential growth and environmental constraints. The logistics model has been widely used in ecology, biology, and demography to study population dynamics. In the context of human populations, the logistics model provides valuable insights into the factors influencing population growth and sustainability.

3.0 Data Collection

Population data for **South Korea** over past 20 years were obtained from the World Bank open data. The table below includes annual population counts with the growth rate from 2004 to 2023.

YEAR	POPULATION	GROWTH RATE (%)	LOGARITHM OF POPULATION
2004	**47,727,285**	**0.39**	**7.6788**
2005	**47,889,573**	**0.34**	**7.6802**
2006	**48,049,347**	**0.33**	**7.6817**
2007	**48,220,601**	**0.36**	**7.6832**
2008	**48,398,626**	**0.37**	**7.6848**
2009	**48,588,019**	**0.39**	**7.6865**
2010	**48,813,042**	**0.46**	**7.6885**
2011	**49,169,878**	**0.73**	**7.6917**
2012	**49,634,185**	**0.94**	**7.6958**
2013	**50,098,229**	**0.93**	**7.6998**
2014	**50,558,043**	**0.92**	**7.7038**
2015	**50,994,401**	**0.86**	**7.7075**
2016	**51,309,984**	**0.62**	**7.7102**
2017	**51,511,639**	**0.39**	**7.7119**
2018	**51,676,900**	**0.32**	**7.7133**
2019	**51,803,829**	**0.25**	**7.7144**
2020	**51,844,690**	**0.08**	**7.7147**
2021	**51,830,139**	**-0.03**	**7.7146**
2022	**51,815,810**	**-0.03**	**7.7145**
2023	**51,784,059**	**-0.06**	**7.7142**



Logistic Model Formula: $P(t) = MP_0 / P_o + (M - P_o)\, e^{-kt}$

Growth Rate Formula: $dp/dt = KP(M-P)$

From the growth rate formula we were able to estimate the key parameters **K** and **M**, where ;

K = growth rate constant
M = carrying capacity

Below Are the Future Population Prediction Summary: Insights from the Logistic Model

Carrying capacity	48,965,315
Growth rate constant	6.6×10^{-15}
Estimated population at 2030	51,787,225
Estimated population at 2040	51,784,042
Estimated population at 2050	51,784,032

4.0. CONCLUSION

The predictions from the Logistic Population model suggest that South Korea's population is likely to stabilize in the coming decades. The estimates for 2030, 2040, and 2050 indicate minimal fluctuations in population size, closely aligning with the carrying capacity suggested by the model.

From our research, factors such as birth rates, mortality rates, economic shifts, and governmental policies can significantly influence future population trends.

References

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