# 1 Introduction

COVID-19 is an infectious disease caused by a novel coronavirus known as SARS-CoV-2, first identified in Wuhan, China, on December 31, 2019. This coronavirus, or COVID-19, can result in mild respiratory problems, infections, severe lung diseases, or even death [1]. The number of recorded COVID-19 cases in Indonesia continues to increase daily; as of January 10, 2023, there have been 6,724,281 cases, with a death rate of 2.38 percent [2]. Bekasi City is one part of West Java with a relatively high rate of COVID-19 transmission, totaling 200,729 cases as of January 10, 2023 [3]. This research is significant considering Bekasi City's high population mobility, with many residents commuting to and from Jakarta, Karawang, or Cikarang for work. Therefore, understanding and constructing a model related to the dynamics of the spread of COVID-19 infection in Bekasi City is crucial.

This phenomenon underscores the necessity of a mathematical model to estimate the spread of COVID-19 in Bekasi City. In this COVID-19 analysis, the SIR (Susceptible-Infectious-Recovered) model is tested to understand and analyze the spread of COVID-19. This model aims to simulate the temporal evolution of several compartments divided into three categories: Susceptibles (individuals not yet affected by the virus and susceptible to infection), Infected (individuals whom the virus has infected) and Recovered (individuals who have recovered post-infection) [4].

Using the SIR model, the Runge-Kutta method is employed to calculate differentiation values within the SIR model to obtain values that are challenging to solve analytically or manually [5]. The Runge-Kutta method utilizes the fourth-order Runge-Kutta (RK4) to obtain accurate values, as the data the authors will analyze is solely from Bekasi City. Hence, RK4 is deemed appropriate for addressing this issue.

The SIR model is also chosen because it accurately analyzes values based on data compared to using models that tend to be more complex [6]. In a study discussing the "Effectiveness of Large-Scale Social Restrictions (PSBB) in Bekasi City in Combating COVID-19 with the Susceptible-Infected-Recovered (SIR) Model," it was estimated that the COVID-19 outbreak would cease after the implementation of PSBB in June [7]. However, this estimate contradicts the fact that the outbreak continued to spread until January 10, 2023 [2, 3]. Limited data available at that time resulted in a gap analysis. If previous research used datasets from the initial period of COVID-19 in Bekasi City with a limited time range, this could create significant gaps in knowledge and understanding.

Based on these considerations, this research is expected to depict the results of COVID-19 spread in Bekasi City with higher performance levels by utilizing a more comprehensive dataset distribution using the SIR model and Runge-Kutta method. This research is also expected to serve as a step towards preparedness if the COVID-19 outbreak resurges in Bekasi City.