UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

PREDICTION OF POPULATION IN MALAYSIA BY USING NUMERICAL METHODS

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IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL

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ABSTRACT

This project is conducted for finding the best numerical method on calculating population in Malaysia. Starting from year 2011 until 2014, the method used is Euler's Method and Runge-Kutta Method. Before implementing both methods, the formulas have to derive in terms of population. The accuracy and minimum errors obtained for both methods, Since Euler's Method and Runge-Kutta Method is classified under numerical ordinary differential equation, the decision was made on differential equation for pursuing the calculation. Population data is collected which is secondary data from the website. Next, the project continued with decision on method. Forward Euler's Method and Runge-Kutta method was chosen and necessary for the data. The data collected was divided into population for both genders, population for males and females with it's population growth rate, k. The population growth rate, k is classified for three parts computation, which are constant value k, average value k and different value of k. All the calculation is generated by Maple Software including error analysis as a result for this project. As the result, Euler's Method is the best method as compared to the Runge-Kutta method since the precision of the data is closer to the actual data. The derivation of the Euler's Method Formula and Runge-Kutta formula, the prediction of the population using Euler's Method and Runge-Kutta Method and to determine the best method on predicting the population in Malaysia by calculating the error for both method is achieved.

1 INTRODUCTION

1.1 INTRODUCTION

Malaysia is a multi-racial country with more than 70 identified ethnic groups. According to Mahari (2011), the population of Malaysia in 2010 was 28.3 million with an annual population growth rate of 1.9 per cent. Bumiputera, the major ethnic constituted 60.3 per cent of the total population followed by Chinese and Indians at 22.9 and 6.8 per cent respectively. The population is estimated to reach 31.6 million in 2020. This project is conducted to predict population growth using Euler's Method and Runge-Kutta Method. This study shows that by manipulating explicit one can find ways to provide better approximations compared to the exact solution said Bui (2005). This method used on how the differential equation model for population to obtain the population in a certain year and growth rate for population in Malaysia.

The Malthusian growth model (Thomas Malthus, 1766-1834), similar to a compound interest model. Growth population model is based on the assumption that the population grows for a population of bacteria or animals under ideal conditions (unlimited environment, adequate nutrition, absence of predators and immunity from diseases) as mentioned by Stewart (2012). Here is the model used and it's variables :

$$\frac{dP}{dt} = kP \tag{1}$$

where t is time (independent variable) and P is the number of individuals in the population (dependent variable) and k is proportionally constant.

Euler's method is one of the best way to determine value of population with constant step size and growth rate. By reducing the step size, it will gives better approximation to exact solution. Forward Euler's method also known as an explicit method. In consequence, this