Lucky Lao

DSC-VI : Practical-04

Exponential Growth/Decay Model

x(t): population at time t
a: per capita death rate
b: per capita birth rate
initial condition: x(0) = x_0

1 Exponential Growth

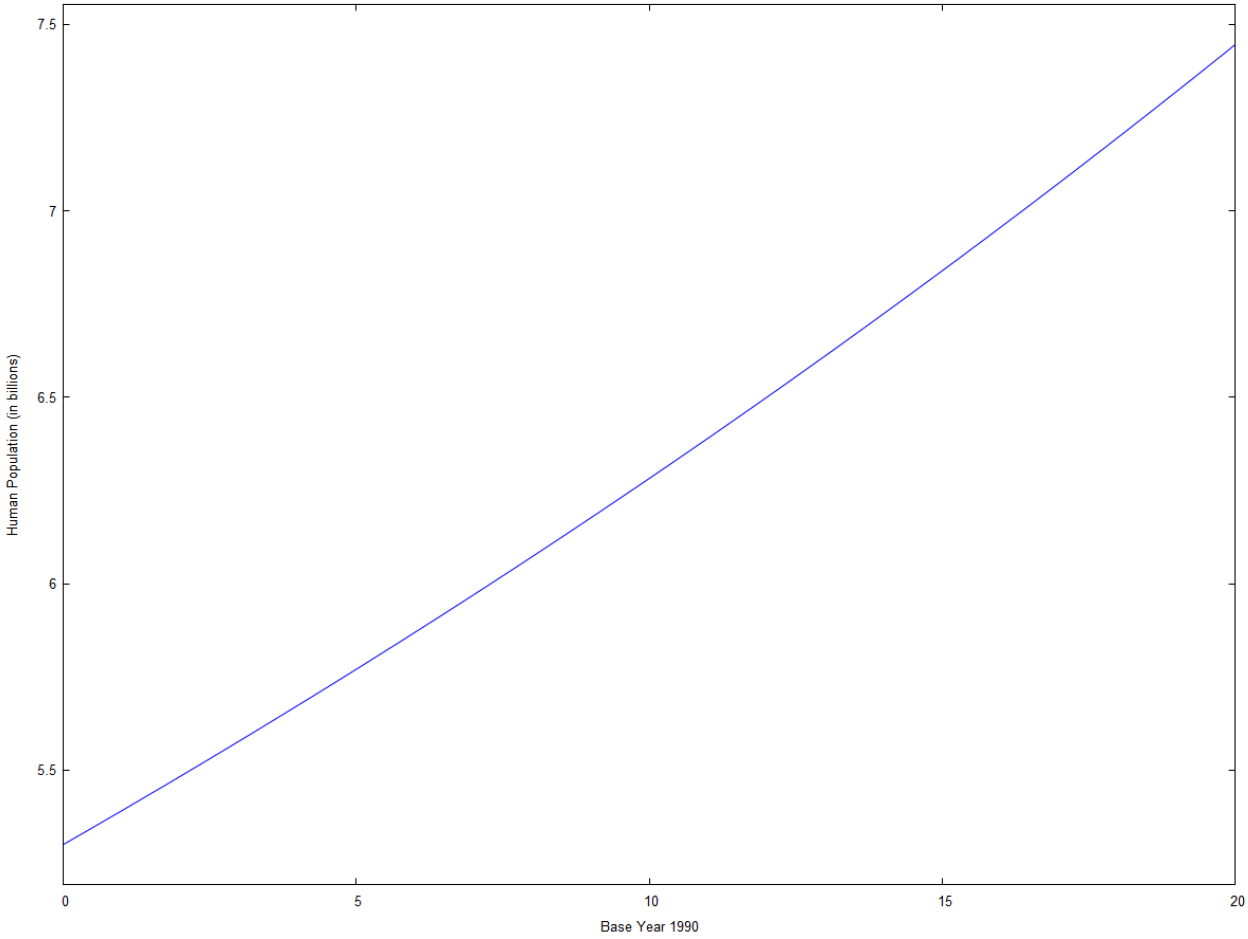
```
--> kill ( all ) $
    eqn : ' diff ( x , t ) = b · x − a · x ;
    sol : ode2 ( eqn , x , t ) ;
    fsol : ic1 ( sol , x = x_0 , t = 0 ) ;
    fsol1 : ev ( fsol , a = 0 . 010 , b = 0 . 027 , x_0 = 5 . 3 ) ;     /* b > a */
    wxplot2d ( rhs ( fsol1 ) ,
          [ t , 0 , 20 ] ,
          [ xlabel , "Base Year 1990" ] ,
          [ ylabel , "Human Population (in billions)" ] ) $
```

$$\frac{d}{dt}x = bx - ax$$

$$x = \%c\%e^{(b-a)t}$$

$$x = \%e^{bt-at}x_0$$

$$x = 5.3\%e^{0.017t}$$



2 Exponential Decay

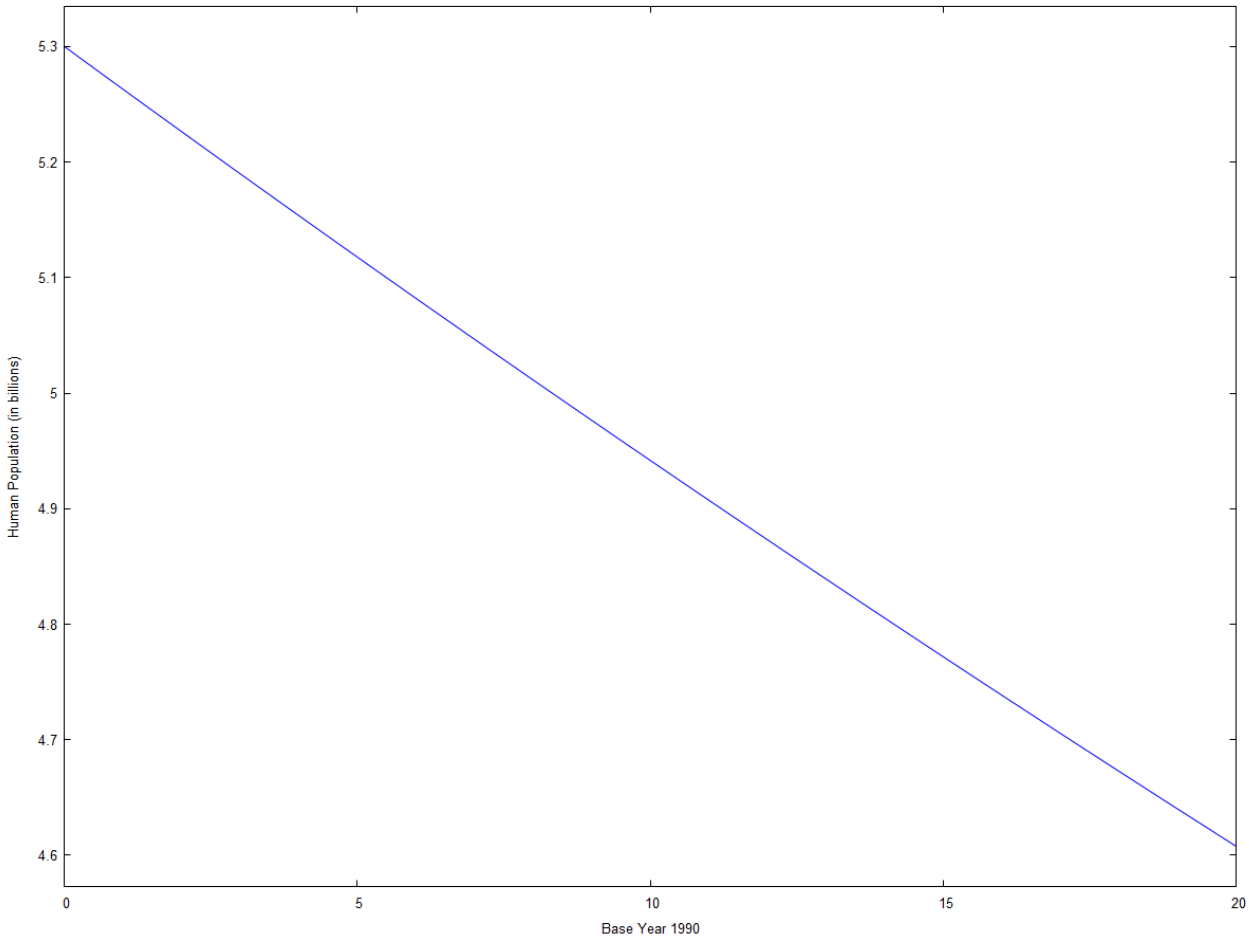
```
--> kill ( all ) $
    eqn : ' diff ( x , t ) = b · x − a · x ;
    sol : ode2 ( eqn , x , t ) ;
    fsol : ic1 ( sol , x = x_0 , t = 0 ) ;
    fsol1 : ev ( fsol , a = 0 . 027 , b = 0 . 020 , x_0 = 5 . 3 ) ;     /* b > a */
    wxplot2d ( rhs ( fsol1 ) ,
          [ t , 0 , 20 ] ,
          [ xlabel , "Base Year 1990" ] ,
          [ ylabel , "Human Population (in billions)" ] ) $
```

$$\frac{d}{dt}x = bx - ax$$

$$x = \%c\%e^{(b-a)t}$$

$$x = \%e^{bt-at}x_0$$

$$x = 5.3\%e^{-0.006999999999999999t}$$



Created with wxMaxima.
The source of this Maxima session can be downloaded here.