

```

Clear[S, Infe, R, N0, b0, b1, b, t, d, L, event, fun, fun2,
  main, list1, list2, list3, data, cc, SStar, IStar, result]
N0 = 500000;
b0 = 500;
b1 = 0.04;
d = 0.02;
L = 4;
(*list3={};*)
b[t_] := b0 * (1 + b1 * Cos[2 Pi t]);

fun2[] := Module[{N0 = 500000, b0 = 500, d = 0.02, L = 4},
  SStar = N0 / (b0 * d);
  IStar = (N0 - SStar) / (1 + L / d);
  {SStar, IStar}
]

fun[S0_, Infe0_, R0_, t0_] := Module[ {S = S0, Infe = Infe0, R = R0, t = t0},
  TransRate = b[t] * S * Infe / N0;
  RecoveryRate = Infe / d;
  ImmunityLoss = (N0 - S - Infe) / L;
  TotalRate = TransRate + RecoveryRate + ImmunityLoss;

  t = t + RandomReal[ExponentialDistribution[TotalRate]];
  event = RandomReal[UniformDistribution[]];

  If[event < TransRate / TotalRate,
    S = S - 1; Infe = Infe + 1,
    If[event < (TransRate + RecoveryRate) / TotalRate,
      Infe = Infe - 1; R = R + 1, R = R - 1; S = S + 1]];
  {S, Infe, R, t}
]

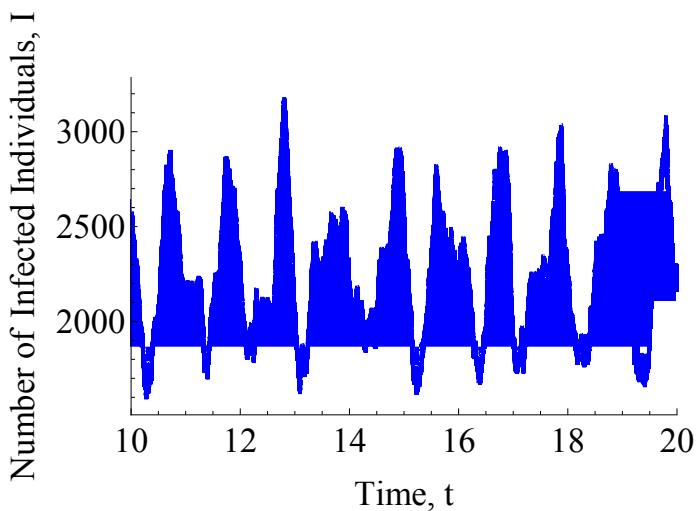
data[S0_, Infe0_, R0_, t0_] :=
  Reap[Module[{S = S0, Infe = Infe0, R = R0, t = t0}(*{S=499999,Infe=1,R=0,t=0}*) ,
    While[t < 20 && Infe > 0, {S, Infe, R, t} = fun[S, Infe, R, t];
    Sow[{t, Infe}]; (*as=Sow[b[t]]*)(*;AppendTo[list2,t]*)(*;
    Print["S=",S,"I=",Infe,"R=",R]*)(*AppendTo[list3,b[t]];*)]];
  (*data[First[fun2[]],Last[fun2[]],0,0];*)
  (*Last[Flatten[cc,1]];*)
  (*SortBy[Last[Flatten[data,1]],First]*)

  result = SortBy[Last[Flatten[data[First[fun2[]], Last[fun2[]], 0, 0], 1]], First]; // 
  AbsoluteTiming

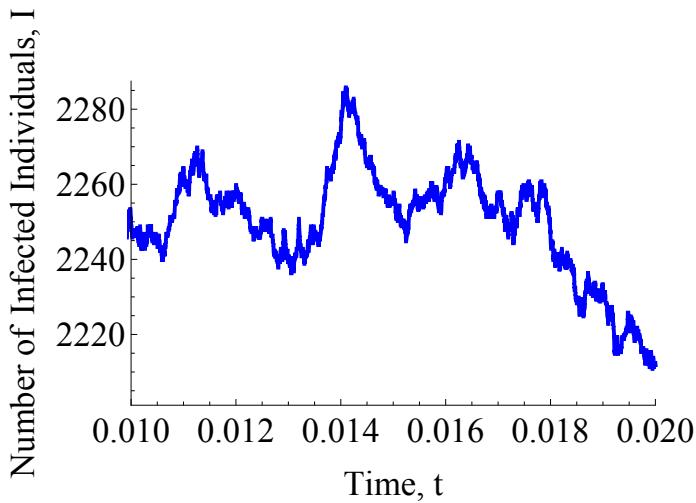
{935.053482, Null}

```

```
graph = ListPlot[result, Joined -> True,
  AxesLabel -> {"time", "Number of Infected Individuals"},
  BaseStyle -> {FontSize -> 18}, Frame -> {True, True, False, False},
  FrameLabel -> {"Time, t", "Number of Infected Individuals, I"},
  PlotStyle -> Directive[Thick, Blue, PointSize[Large]],
  PlotRange -> {{10, 20}, Automatic}]
```



```
Show[graph, PlotRange -> {{0.01, 0.02}, Automatic}]
```



```
(*Plot[b[t],{t,0,10}]*)
```

```
(*b[0.0100233]*)
```