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%1 / lambda is time for 1 / e fraction of tests to have been processed by that day
%1 / r is time for number of new real infections to increase by factor of e
% expectnewresultspoissonstest[i] assumes
    poisson chance of being tested on day i if infected on day j
% cc[i] is number of true cases on day i
% rr[i] is number of measured new cases on day i
% fracssymptomatic is fraction of people with covid - 19 who are symptomatic
% chancesymptomaticisstested is chance
    you get tested while symptomatic and havng covid - 19
% fracpositivetests is fraction of tests that comes back positive and
    may reflect fraction of people wth respiratory distress, fever,
    etc who have covid - 19 as opposed to some other illness like the flu,
    other coronavirus, strep, etc
% totalresultscases is sum total of all confirmed cases by day i
% testingcapacity is number of tests per day we currently process

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In[18]= lambda := 1 / 8
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In[19]= r := 1 / 8
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In[20]= testingcapacity := 150 000
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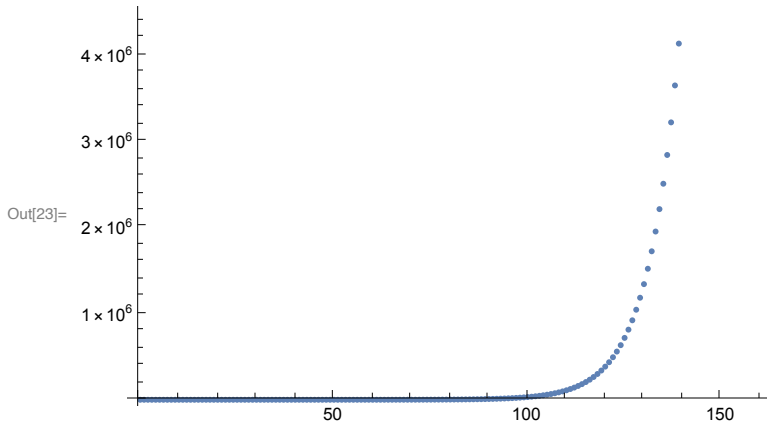
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In[21]= % expectnewresultspoissonstest[i_] :=
    Sum[(newtruecases[i - j]) * lambda * Exp[- lambda * j], {j, 1, i}]
```

 **SetDelayed:** Tag Times in Null expectnewresultspoissonstest[i_] is Protected.

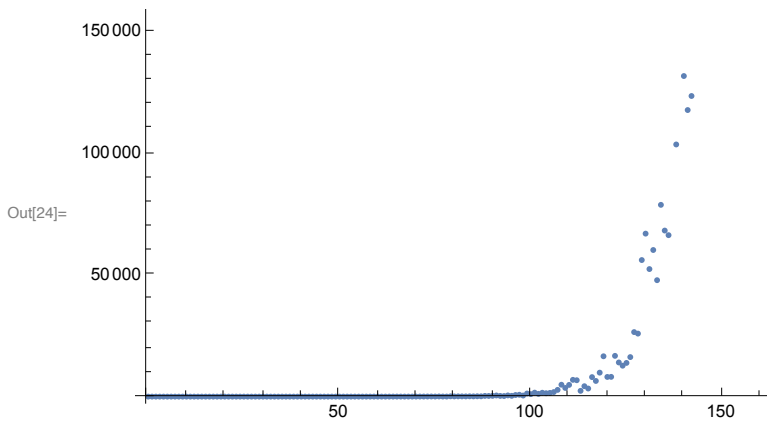
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Out[21]= $Failed
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In[22]= For[i = 1;
    cc[0] = 0;
    rr[0] = 0;
    newresultscases[0] = List[{0, rr[0]}];
    newtruecases[0] = 0;
    totalresultscases = List[{0, rr[0]}];
    truenewcases = List[{0, cc[0]}, i < 161,
    i++, fracssymptomatic = Random[Real, {0.1, 0.2}];
    chancesymptomaticisstested := Random[Real, {0.25, 0.75}]; cc[i] = N[Exp[r * i]];
    newtruecases[i] = cc[i] - cc[i - 1];
    truenewcases = Append[truenewcases, {i, newtruecases[i]}];
    rr[i] = N[fracssymptomatic * chancesymptomaticisstested *
        Sum[newtruecases[i - j] * lambda * Exp[- lambda * j], {j, 1, i}]];
    newresultscases[i] = Append[newresultscases[i - 1], {i, rr[i]}];
    tt[i] = Sum[rr[q], {q, 0, i}];
    totalresultscases = Append[totalresultscases, {i, tt[i]}]]
```

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In[23]:= ListPlot[{truenewcases}]
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In[24]:= ListPlot[newresultcases[160]]
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% exponential growth beyond testing capacity. Testing primarily from symptomatic (not randomly) who have constant positive testing rate. Min[] function enforces whether we are limited by numbers of covid - 19 positive people being tested or limited by testing capacity being maxed out and just getting random proportion of total symptomatic patients who may or may not have covid - 19. Effectvely this means that once tests are maxed out, your chance of getting tested has fallen greatly even if you ' re symptomatic.

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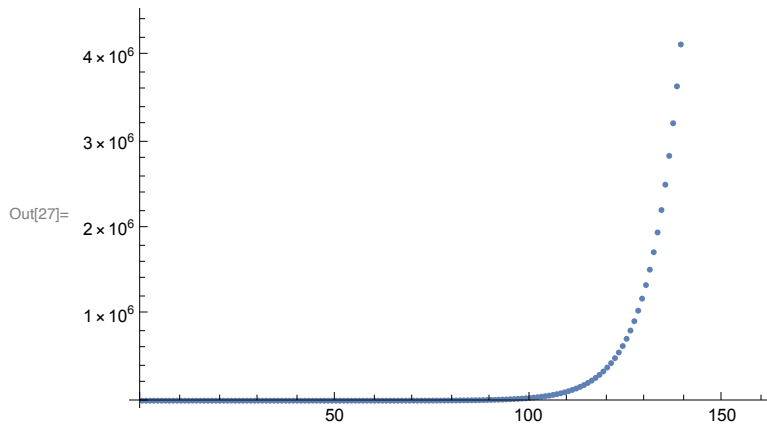
In[26]:= For[i = 1; cc[0] = 0; rr[0] = 0; newresultcases[0] = List[{0, rr[0]}];
  newtruecases[0] = 0;
  totalresultcases = List[{0, rr[0]}];
  trueneucases = List[{0, cc(0)}, i < 161,
  i++, fracstymptomatic = Random[Real, {0.1, 0.2}];
  chancesymptmoaticisstested := Random[Real, {0.25, 0.75}];
  fracpositivetests := Random[Real, {0.1, 0.3}]; cc[i] = N[Exp[r * i]];
  newtruecases[i] = cc[i] - cc[i - 1];
  trueneucases = Append[trueneucases, {i, newtruecases[i]}];
  rr[i] = Min[N[fracstymptomatic * chancesymptmoaticisstested * Sum[newtruecases[i - j] *
    lambda * Exp[-lambda * j], {j, 1, i}], fracpositivetests * testingcapacity];
  newresultcases[i] = Append[newresultcases[i - 1], {i, rr[i]}];
  tt[i] = Sum[rr[q], {q, 0, i}];
  totalresultcases = Append[totalresultcases, {i, tt[i]}]]

```

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In[27]:= ListPlot[{trueneucases}]

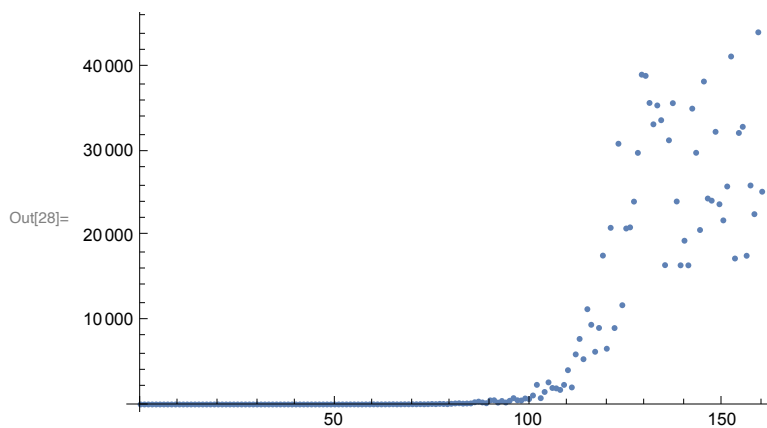
```



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In[28]:= ListPlot[{newresultcases[160]}]

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```

% xponential growth beyond testing capacity for first 125
  days and then flattend curve with random fluctuation around some mean
  for last 35 days. Still beyond testing capacity. Testing primarily
  from symptomatic (not randomly) who have constant positive testing
  rate. Min[] function enforces whether we are limited by numbers of covoid -
  19 positive people being tested or limited by testing capacity being maxed out and just
  getting random proportion of total symptomatic patients who may or may not have covid -
  19. Effectvelly this means that once tests are maxed out,
  your chance of getting tested has fallen greatly even if you ' re symptomatic.

% hard to tell difference between exponentially growing infections and flattened curve.
  % flatday is day the curve becomes flat

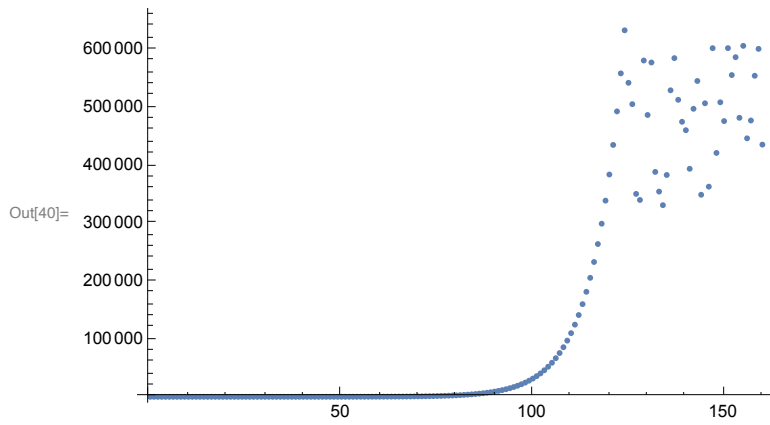
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In[29]:= flatday := 125
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In[39]:= For[i = 1;
  cc[0] = 0;
  rr[0] = 0;
  newtruecases[0] = 0;
  newresultcases[0] = List[{0, rr[0]}];
  totalresultcases = List[{0, rr[0]}];
  trueneucases = List[{0, cc(0)}, i < 161,
  i++, frac symptomatic = Random[Real, {0.1, 0.2}];
  chancesymptmoaticisstested := Random[Real, {0.25, 0.75}];
  fracpositivetests := Random[Real, {0.1, 0.3}];
  cc[i] = N[Exp[r * i]]; If[i < flatday, cc[i] = N[Exp[r * i]];
  newtruecases[i] = cc[i] - cc[i - 1],
  newtruecases[i] = N[newtruecases[flatday - 1] * Random[Real, {0.5, 1}]]];
  trueneucases = Append[trueneucases, {i, newtruecases[i]}];
  rr[i] = Min[N[frac symptomatic * chancesymptmoaticisstested * Sum[newtruecases[i - j] *
  lambda * Exp[-lambda * j], {j, 1, i}], fracpositivetests * testingcapacity];
  newresultcases[i] = Append[newresultcases[i - 1], {i, rr[i]}];
  tt[i] = Sum[rr[q], {q, 0, i}];
  totalresultcases = Append[totalresultcases, {i, tt[i]}]]

```

In[40]:= ListPlot[truenewcases]



In[38]:= ListPlot[newresultcases[160]]

