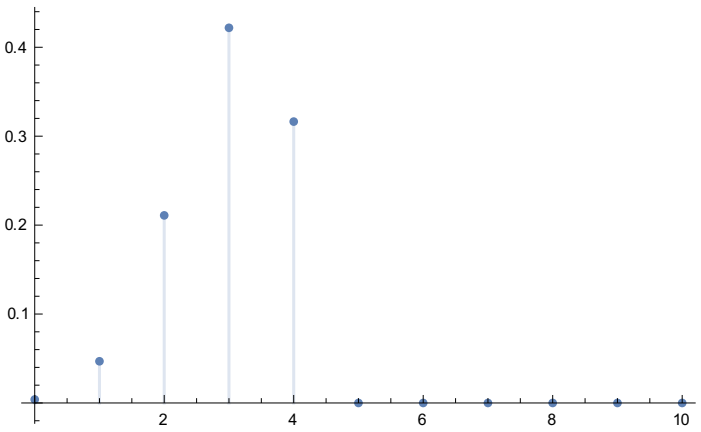
- Q1 b

In[461]:=
```
DiscretePlot[Binomial[4, y] * 0.75^y * 0.25^(4 - y), {y, 0, 10, 1}]
```

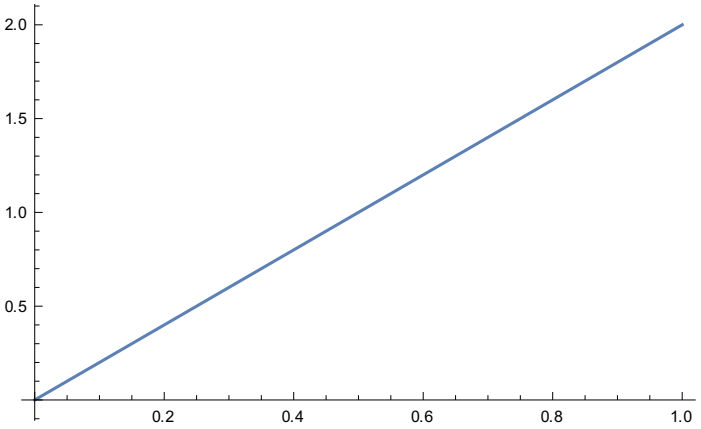
Out[461]=



- Q1 c n=1,y=1

In[462]:=
```
Plot[
 Piecewise[{{2 * Binomial[1, 1] * θ^1 * (1 - θ)^0, θ < 1}, {2 * Binomial[1, 1] * θ^1, θ == 1}}], {θ, 0, 1}]
```

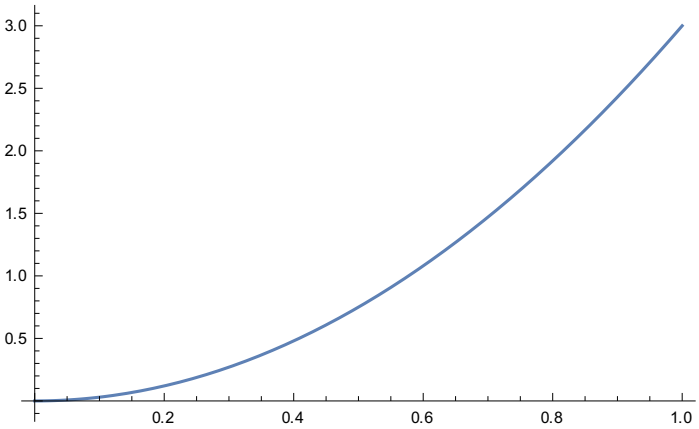
Out[462]=



- Q1c n=2, y=2

In[463]:=
```
Plot[
 Piecewise[{{3 * Binomial[2, 2] * θ ^ 2 * (1 - θ) ^ 0, θ < 1}, {3 * Binomial[2, 2] * θ ^ 2, θ == 1}}], {θ, 0, 1}]
```

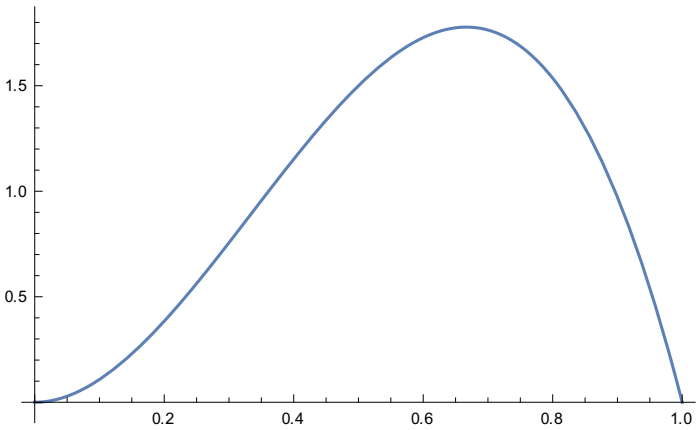
Out[463]=



- Q1 c n=3,y=2

In[464]:=
```
Plot[{4 * Binomial[3, 2] * θ ^ 2 * (1 - θ) ^ 1}, {θ, 0, 1}]
```

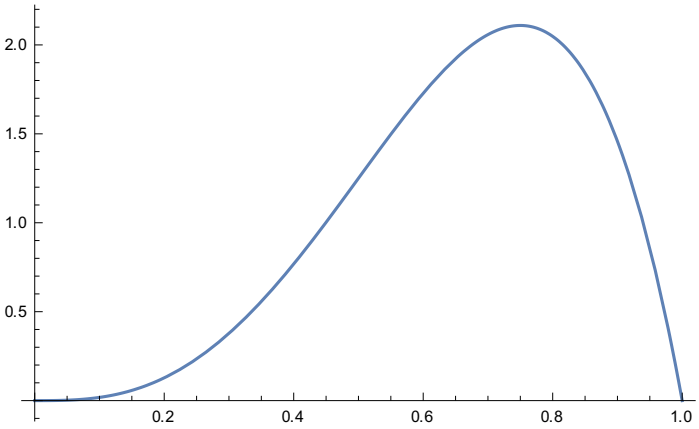
Out[464]=



- Q1 c n=4, y=3

In[465]:=
```
Plot[{5 * Binomial[4, 3] * θ ^ 3 * (1 - θ) ^ 1}, {θ, 0, 1}]
```

Out[465]=



- Q2 a h1,P(h1) = 0.1

Red line indicates h1, blue line indicates h2, green line indicates h3, purple line indicates h4, yellow line indicates h5.

- For some graphs, only 4 lines are shown since red line and yellow line are totally the same.
- When evaluating graphs for P(dN+1 = lime|d1,...,dN) in Mathematica, if it is totally different from my graph in this document, just repeat evaluating the cell. (I don't know why, but the weird things happened several times.)

In[32]:=

```
binaryData1 = RandomChoice[{1, 0} → {0, 1}, 100]
myData11 = Array[f11, 10]
myData12 = Array[f12, 10]
myData13 = Array[f13, 10]
myData14 = Array[f14, 10]
myData15 = Array[f15, 10]
mySum = Array[s1, 10]

For[i = 1, i ≤ 10, i++, f11[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData1[[j]] == 0, f11[i] = f11[i] * 1, f11[i] = f11[i] * 0]];
 f11[i] = f11[i] * 0.1]
For[i = 1, i ≤ 10, i++, f12[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData1[[j]] == 0, f12[i] = f12[i] * 0.75, f12[i] = f12[i] * 0.25]];
 f12[i] = f12[i] * 0.2]
For[i = 1, i ≤ 10, i++, f13[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData1[[j]] == 0, f13[i] = f13[i] * 0.5, f13[i] = f13[i] * 0.5]];
 f13[i] = f13[i] * 0.4]
For[i = 1, i ≤ 10, i++, f14[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData1[[j]] == 0, f14[i] = f14[i] * 0.25, f14[i] = f14[i] * 0.75]];
 f14[i] = f14[i] * 0.2]
For[i = 1, i ≤ 10, i++, f15[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData1[[j]] == 0, f15[i] = f15[i] * 0, f15[i] = f15[i] * 1]];
 f15[i] = f15[i] * 0.1]

For[i = 1, i ≤ 10, i++, s1[i] = 0; s1[i] = s1[i] + f11[i] + f12[i] + f13[i] + f14[i] + f15[i]]
For[i = 1, i ≤ 10, i++, f11[i] = f11[i] / s1[i];
 f12[i] = f12[i] / s1[i];
 f13[i] = f13[i] / s1[i];
 f14[i] = f14[i] / s1[i];
 f15[i] = f15[i] / s1[i]]
myData11 = Prepend[myData11, 0.1]
myData12 = Prepend[myData12, 0.2]
myData13 = Prepend[myData13, 0.4]
myData14 = Prepend[myData14, 0.2]
myData15 = Prepend[myData15, 0.1]
```

```
Show[ListLinePlot[myData11, PlotStyle → Red, PlotRange → {{1, 11}, {0, 1}},
  Frame → True, FrameLabel → {"Number of samples in d", "Posterior probability"},
  FrameTicks → {{Automatic, None},
   {{{1, 0}, {2, 10}, {3, 20},
    {4, 30}, {5, 40}, {6, 50}, {7, 60}, {8, 70}, {9, 80}, {10, 90}, {11, 100}}, None}}],
 ListLinePlot[myData12, PlotRange → {{1, 11}, {0, 1}}],
 ListLinePlot[myData13, PlotRange → {{1, 11}, {0, 1}}, PlotStyle → Green],
 ListLinePlot[myData14, PlotRange → {{1, 11}, {0, 1}}, PlotStyle → Purple],
 ListLinePlot[myData15, PlotRange → {{1, 11}, {0, 1}}, PlotStyle → Yellow]]
```

Out[32]= {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0}

Out[33]= {0.895628, 0.993694, 0.999643, 0.99998, 0.999999, 1., 1., 1., 1., 1.}

Out[34]= {0.100872, 0.00630243, 0.000357037, 0.0000201128, 1.13264×10^{-6},
6.37831×10^{-8}, 3.59185×10^{-9}, 2.0227×10^{-10}, 1.13905×10^{-11}, 6.4144×10^{-13}}

Out[35]= {0.00349855, 3.79064×10^{-6}, 3.72396×10^{-9}, 3.63791×10^{-12}, 3.55271×10^{-15},
3.46945×10^{-18}, 3.38813×10^{-21}, 3.30872×10^{-24}, 3.23117×10^{-27}, 3.15544×10^{-30}}

Out[36]= {1.70827×10^{-6}, 1.80752×10^{-12}, 1.7341×10^{-18}, 1.65433×10^{-24}, 1.57772×10^{-30},
1.50463×10^{-36}, 1.43493×10^{-42}, 1.36846×10^{-48}, 1.30506×10^{-54}, 1.2446×10^{-60}}

Out[37]= {0., 0., 0., 0., 0., 0., 0., 0., 0., 0.}

Out[38]= {0.111654, 0.100635, 0.100036, 0.100002, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1}

Out[46]= {0.1, 0.895628, 0.993694, 0.999643, 0.99998, 0.999999, 1., 1., 1., 1., 1.}

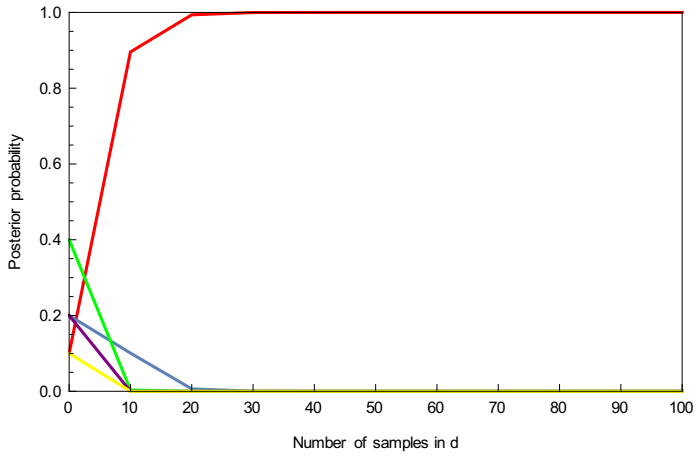
Out[47]= {0.2, 0.100872, 0.00630243, 0.000357037, 0.0000201128, 1.13264×10^{-6},
6.37831×10^{-8}, 3.59185×10^{-9}, 2.0227×10^{-10}, 1.13905×10^{-11}, 6.4144×10^{-13}}

Out[48]= {0.4, 0.00349855, 3.79064×10^{-6}, 3.72396×10^{-9}, 3.63791×10^{-12}, 3.55271×10^{-15},
3.46945×10^{-18}, 3.38813×10^{-21}, 3.30872×10^{-24}, 3.23117×10^{-27}, 3.15544×10^{-30}}

Out[49]= {0.2, 1.70827×10^{-6}, 1.80752×10^{-12}, 1.7341×10^{-18}, 1.65433×10^{-24}, 1.57772×10^{-30},
1.50463×10^{-36}, 1.43493×10^{-42}, 1.36846×10^{-48}, 1.30506×10^{-54}, 1.2446×10^{-60}}

Out[50]= {0.1, 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.}

Out[51]=

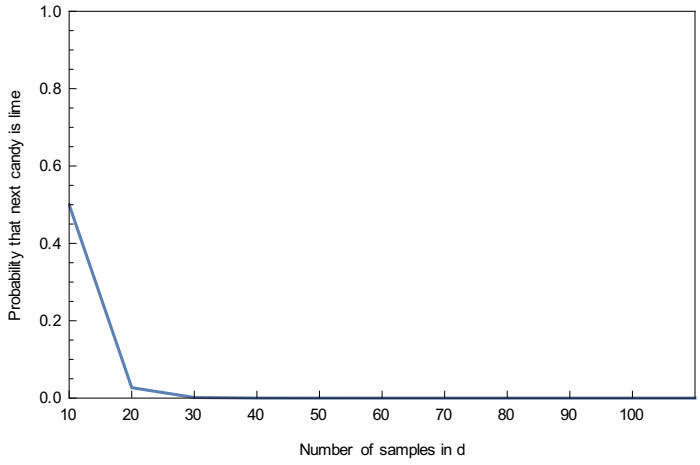


In[56]:=
```
myPredict1 = Array[f1, 10]
For[i = 1, i ≤ 10, i++, f1[i] = 0;
 f1[i] = f1[i] + 0 * f11[i] + 0.25 * f12[i] + 0.5 * f13[i] + 0.75 * f14[i] + 1 * f15[i]]
myPredict1 = Prepend[myPredict1, 0.5]
ListLinePlot[myPredict1 , PlotRange → {{1, 11}, {0, 1}}, Frame → True,
 FrameLabel → {"Number of samples in d", "Probability that next candy is lime"},
 FrameTicks → {{Automatic, None},
   {{{1, 10}, {2, 20}, {3, 30},
    {4, 40}, {5, 50}, {6, 60}, {7, 70}, {8, 80}, {9, 90}, {10, 100}}, None}}]
```

Out[56]= $\{0.0269685, 0.0015775, 0.000089261, 5.02819 \times 10^{-6}, 2.83161 \times 10^{-7}, 1.59458 \times 10^{-8}, 8.97963 \times 10^{-10}, 5.05675 \times 10^{-11}, 2.84763 \times 10^{-12}, 1.6036 \times 10^{-13}\}$

Out[58]= $\{0.5, 0.0269685, 0.0015775, 0.000089261, 5.02819 \times 10^{-6}, 2.83161 \times 10^{-7}, 1.59458 \times 10^{-8}, 8.97963 \times 10^{-10}, 5.05675 \times 10^{-11}, 2.84763 \times 10^{-12}, 1.6036 \times 10^{-13}\}$

Out[59]=



- Q2 a h2,P(h2) = 0.2

In[80]:=
```
binaryData2 = RandomChoice[{0.75, 0.25} → {0, 1}, 100]
myData21 = Array[f21, 10]
```

```
myData22 = Array[f22, 10]
myData23 = Array[f23, 10]
myData24 = Array[f24, 10]
myData25 = Array[f25, 10]
mySum2 = Array[s2, 10]

For[i = 1, i ≤ 10, i++, f21[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData2[[j]] == 0, f21[i] = f21[i] * 1, f21[i] = f21[i] * 0]];
 f21[i] = f21[i] * 0.1]
For[i = 1, i ≤ 10, i++, f22[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData2[[j]] == 0, f22[i] = f22[i] * 0.75, f22[i] = f22[i] * 0.25]];
 f22[i] = f22[i] * 0.2]
For[i = 1, i ≤ 10, i++, f23[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData2[[j]] == 0, f23[i] = f23[i] * 0.5, f23[i] = f23[i] * 0.5]];
 f23[i] = f23[i] * 0.4]
For[i = 1, i ≤ 10, i++, f24[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData2[[j]] == 0, f24[i] = f24[i] * 0.25, f24[i] = f24[i] * 0.75]];
 f24[i] = f24[i] * 0.2]
For[i = 1, i ≤ 10, i++, f25[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData2[[j]] == 0, f25[i] = f25[i] * 0, f25[i] = f25[i] * 1]];
 f25[i] = f25[i] * 0.1]

For[i = 1, i ≤ 10, i++, s2[i] = 0; s2[i] = s2[i] + f21[i] + f22[i] + f23[i] + f24[i] + f25[i]]
For[i = 1, i ≤ 10, i++, f21[i] = f21[i] / s2[i];
 f22[i] = f22[i] / s2[i];
 f23[i] = f23[i] / s2[i];
 f24[i] = f24[i] / s2[i];
 f25[i] = f25[i] / s2[i]]
myData21 = Prepend[myData21, 0.1]
myData22 = Prepend[myData22, 0.2]
myData23 = Prepend[myData23, 0.4]
myData24 = Prepend[myData24, 0.2]
myData25 = Prepend[myData25, 0.1]

Show[ListLinePlot[myData21, PlotStyle → {Red, Thickness[0.01]}, PlotRange → {{1, 11}, {0, 1}},
   Frame → True, FrameLabel → {"Number of samples in d", "Posterior probability"},
   FrameTicks → {{Automatic, None},
    {{{1, 0}, {2, 10}, {3, 20},
     {4, 30}, {5, 40}, {6, 50}, {7, 60}, {8, 70}, {9, 80}, {10, 90}, {11, 100}}, None}}],
 ListLinePlot[myData22, PlotRange → {{1, 11}, {0, 1}}],
 ListLinePlot[myData23, PlotRange → {{1, 11}, {0, 1}}, PlotStyle → Green],
 ListLinePlot[myData24, PlotRange → {{1, 11}, {0, 1}}, PlotStyle → Purple],
 ListLinePlot[myData25, PlotRange → {{1, 11}, {0, 1}}, PlotStyle → Yellow]]
```

Out[80]= {0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1, 1, 0, 0, 1, 0,
1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 1, 1, 1, 0, 1, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0,
0, 0, 0, 1, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0}

Out[81]= {0., 0., 0., 0., 0., 0., 0., 0., 0., 0.}

Out[82]= {0.761314, 0.431637, 0.618847, 0.776172,
0.88104, 0.993024, 0.990229, 0.98633, 0.999279, 0.998988}

Out[83]= {0.237642, 0.56777, 0.381143, 0.223828, 0.11896,
0.00697551, 0.00977066, 0.0136704, 0.000720537, 0.00101182}

Out[84]= $\{0.00104433, 0.000592095, 0.0000104802, 1.62278 \times 10^{-7}, 2.27412 \times 10^{-9},$
$3.90668 \times 10^{-13}, 4.32853 \times 10^{-14}, 4.79054 \times 10^{-15}, 7.3974 \times 10^{-19}, 8.21694 \times 10^{-20}\}$

Out[85]= {0., 0., 0., 0., 0., 0., 0., 0., 0., 0.}

Out[86]= $\{0.00164375, 6.71873 \times 10^{-7}, 9.774 \times 10^{-10}, 1.62535 \times 10^{-12}, 2.98647 \times 10^{-15},$
$4.97376 \times 10^{-17}, 3.46766 \times 10^{-20}, 2.42035 \times 10^{-23}, 4.4844 \times 10^{-25}, 3.11859 \times 10^{-28}\}$

Out[94]= {0.1, 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.}

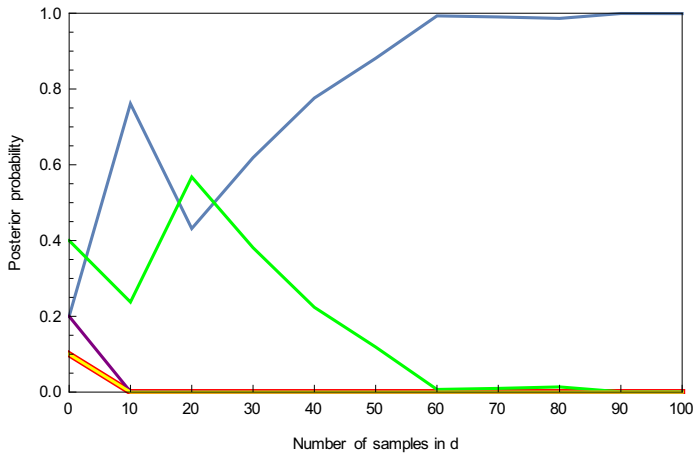
Out[95]= {0.2, 0.761314, 0.431637, 0.618847, 0.776172,
0.88104, 0.993024, 0.990229, 0.98633, 0.999279, 0.998988}

Out[96]= {0.4, 0.237642, 0.56777, 0.381143, 0.223828, 0.11896,
0.00697551, 0.00977066, 0.0136704, 0.000720537, 0.00101182}

Out[97]= $\{0.2, 0.00104433, 0.000592095, 0.0000104802, 1.62278 \times 10^{-7}, 2.27412 \times 10^{-9},$
$3.90668 \times 10^{-13}, 4.32853 \times 10^{-14}, 4.79054 \times 10^{-15}, 7.3974 \times 10^{-19}, 8.21694 \times 10^{-20}\}$

Out[98]= {0.1, 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.}

Out[99]=

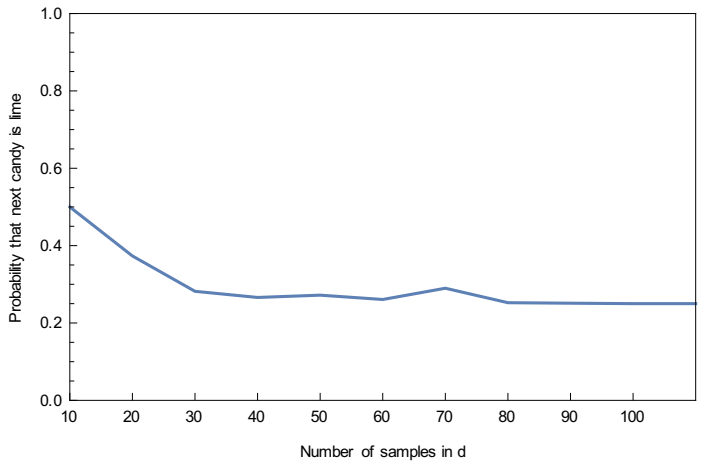


In[104]:=
```
myPredict2 = Array[f2, 10]
For[i = 1, i ≤ 10, i++, f2[i] = 0;
 f2[i] = f2[i] + 0 * f21[i] + 0.25 * f22[i] + 0.5 * f23[i] + 0.75 * f24[i] + 1 * f25[i]]
myPredict2 = Prepend[myPredict2, 0.5]
ListLinePlot[myPredict2 , PlotRange → {{1, 11}, {0, 1}}, Frame → True,
 FrameLabel → {"Number of samples in d", "Probability that next candy is lime"},
 FrameTicks → {{Automatic, None},
   {{{1, 10}, {2, 20}, {3, 30},
    {4, 40}, {5, 50}, {6, 60}, {7, 70}, {8, 80}, {9, 90}, {10, 100}}, None}}]
```

Out[104]=
```
{0.373299, 0.281886, 0.266012, 0.271924,
 0.260767, 0.289856, 0.252443, 0.25115, 0.25002, 0.250009}
```

Out[106]=
```
{0.5, 0.373299, 0.281886, 0.266012, 0.271924,
 0.260767, 0.289856, 0.252443, 0.25115, 0.25002, 0.250009}
```

Out[107]=



- Q2 a h3,P(h3) = 0.4

In[228]:=
```
binaryData3 = RandomChoice[{0.5, 0.5} → {0, 1}, 100]
myData31 = Array[f31, 10]
myData32 = Array[f32, 10]
myData33 = Array[f33, 10]
myData34 = Array[f34, 10]
myData35 = Array[f35, 10]
mySum3 = Array[s3, 10]

For[i = 1, i ≤ 10, i++, f31[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData3[[j]] == 0, f31[i] = f31[i] * 1, f31[i] = f31[i] * 0]];
 f31[i] = f31[i] * 0.1]
For[i = 1, i ≤ 10, i++, f32[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData3[[j]] == 0, f32[i] = f32[i] * 0.75, f32[i] = f32[i] * 0.25]];
 f32[i] = f32[i] * 0.2]
```

```
For[i = 1, i ≤ 10, i++, f33[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData3[[j]] == 0, f33[i] = f33[i] * 0.5, f33[i] = f33[i] * 0.5]];
 f33[i] = f33[i] * 0.4]
For[i = 1, i ≤ 10, i++, f34[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData3[[j]] == 0, f34[i] = f34[i] * 0.25, f34[i] = f34[i] * 0.75]];
 f34[i] = f34[i] * 0.2]
For[i = 1, i ≤ 10, i++, f35[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData3[[j]] == 0, f35[i] = f35[i] * 0, f35[i] = f35[i] * 1]];
 f35[i] = f35[i] * 0.1]

For[i = 1, i ≤ 10, i++, s3[i] = 0; s3[i] = s3[i] + f31[i] + f32[i] + f33[i] + f34[i] + f35[i]]
For[i = 1, i ≤ 10, i++, f31[i] = f31[i] / s3[i];
 f32[i] = f32[i] / s3[i];
 f33[i] = f33[i] / s3[i];
 f34[i] = f34[i] / s3[i];
 f35[i] = f35[i] / s3[i]]
myData31 = Prepend[myData31, 0.1]
myData32 = Prepend[myData32, 0.2]
myData33 = Prepend[myData33, 0.4]
myData34 = Prepend[myData34, 0.2]
myData35 = Prepend[myData35, 0.1]

Show[ListLinePlot[myData31, PlotStyle → {Red, Thickness[0.01]}, PlotRange → {{1, 11}, {0, 1}},
   Frame → True, FrameLabel → {"Number of samples in d", "Posterior probability"},
   FrameTicks → {{Automatic, None},
    {{{1, 0}, {2, 10}, {3, 20},
    {4, 30}, {5, 40}, {6, 50}, {7, 60}, {8, 70}, {9, 80}, {10, 90}, {11, 100}}, None}}],
 ListLinePlot[myData32, PlotRange → {{1, 11}, {0, 1}}],
 ListLinePlot[myData33, PlotRange → {{1, 11}, {0, 1}}, PlotStyle → Green],
 ListLinePlot[myData34, PlotRange → {{1, 11}, {0, 1}}, PlotStyle → Purple],
 ListLinePlot[myData35, PlotRange → {{1, 11}, {0, 1}}, PlotStyle → Yellow]]
```

Out[228]= {1, 0, 1, 1, 0, 1, 0, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 0, 0, 0, 1, 1, 1, 1, 0, 0, 0, 0, 1, 0, 1, 1, 1, 0, 0,
0, 1, 0, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 0, 1, 1, 0, 1, 0, 0, 1, 0, 0, 1, 1, 1, 1, 1, 0,
0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 0, 1, 1, 0, 1, 0, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 0, 1, 0, 1, 0, 0}

Out[229]= {0., 0., 0., 0., 0., 0., 0., 0., 0., 0.}

Out[230]= {0.00633505, 0.000105946, 0.000209605, 0.00017367, 0.0000416651,
3.29911×10^{-6}, 7.84335×10^{-7}, 1.86208×10^{-7}, 4.41926×10^{-8}, 3.14622×10^{-8}}

Out[231]= {0.480526, 0.304781, 0.846988, 0.985759,
0.996583, 0.997592, 0.999427, 0.999864, 0.999968, 0.999997}

Out[232]= {0.513139, 0.695113, 0.152802, 0.0140672, 0.00337488,
0.00240505, 0.00057178, 0.000135745, 0.0000322164, 2.54844×10^{-6}}

Out[233]= {0., 0., 0., 0., 0., 0., 0., 0., 0., 0.}

Out[234]= $\{0.000812912, 1.25162 \times 10^{-6}, 4.39828 \times 10^{-10}, 3.69054 \times 10^{-13}, 3.56489 \times 10^{-16},$
$3.47782 \times 10^{-19}, 3.39007 \times 10^{-22}, 3.30917 \times 10^{-25}, 3.23128 \times 10^{-28}, 3.15545 \times 10^{-31}\}$

Out[242]= {0.1, 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.}

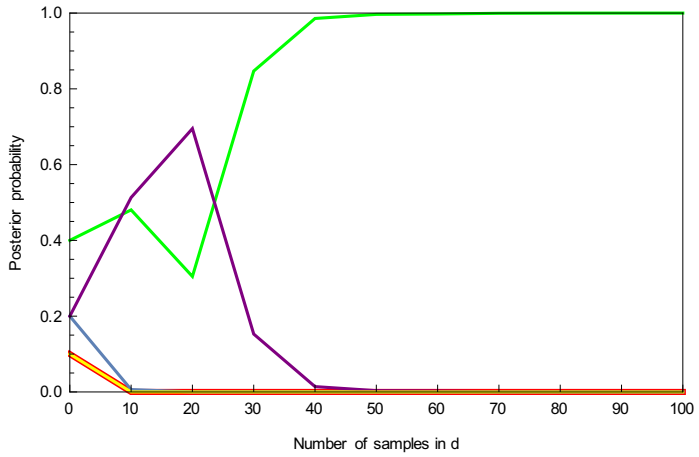
Out[243]= {0.2, 0.00633505, 0.000105946, 0.000209605, 0.00017367, 0.0000416651,
3.29911×10^{-6}, 7.84335×10^{-7}, 1.86208×10^{-7}, 4.41926×10^{-8}, 3.14622×10^{-8}}

Out[244]= {0.4, 0.480526, 0.304781, 0.846988, 0.985759,
0.996583, 0.997592, 0.999427, 0.999864, 0.999968, 0.999997}

Out[245]= {0.2, 0.513139, 0.695113, 0.152802, 0.0140672, 0.00337488,
0.00240505, 0.00057178, 0.000135745, 0.0000322164, 2.54844×10^{-6}}

Out[246]= {0.1, 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.}

Out[247]=

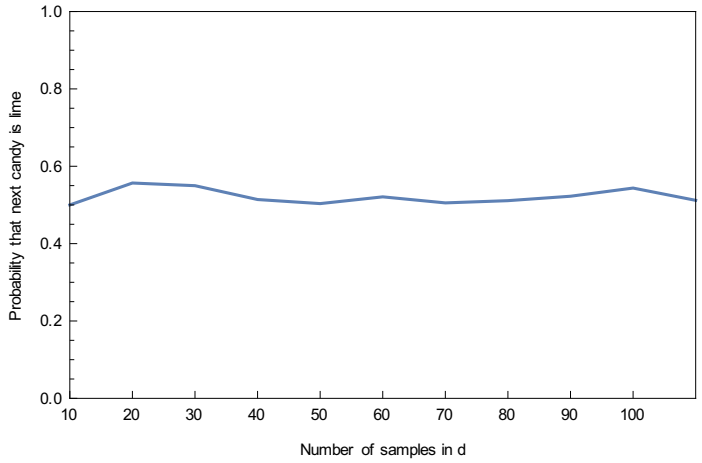


In[252]:=
```
myPredict3 = Array[f3, 10]
For[i = 1, i ≤ 10, i++, f3[i] = 0;
 f3[i] = f3[i] + 0 * f31[i] + 0.25 * f32[i] + 0.5 * f33[i] + 0.75 * f34[i] + 1 * f35[i]]
myPredict3 = Prepend[myPredict3, 0.5]
ListLinePlot[myPredict3 , PlotRange → {{1, 11}, {0, 1}}, Frame → True,
 FrameLabel → {"Number of samples in d", "Probability that next candy is lime"},
 FrameTicks → {{Automatic, None},
   {{{1, 10}, {2, 20}, {3, 30},
    {4, 40}, {5, 50}, {6, 60}, {7, 70}, {8, 80}, {9, 90}, {10, 100}}, None}}]
```

Out[252]=
```
{0.556683, 0.549796, 0.513996, 0.503473,
 0.520943, 0.505309, 0.511072, 0.522515, 0.543624, 0.511941}
```

Out[254]=
```
{0.5, 0.556683, 0.549796, 0.513996, 0.503473,
 0.520943, 0.505309, 0.511072, 0.522515, 0.543624, 0.511941}
```

Out[255]=



In[538]:=

- Q2 a h4,P(h4) = 0.2

In[368]:=
```
binaryData4 = RandomChoice[{0.25, 0.75} → {0, 1}, 100]
myData41 = Array[f41, 10]
myData42 = Array[f42, 10]
myData43 = Array[f43, 10]
myData44 = Array[f44, 10]
myData45 = Array[f45, 10]
mySum4 = Array[s4, 10]

For[i = 1, i ≤ 10, i++, f41[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData4[[j]] == 0, f41[i] = f41[i] * 1, f41[i] = f41[i] * 0]];
 f41[i] = f41[i] * 0.1]
For[i = 1, i ≤ 10, i++, f42[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData4[[j]] == 0, f42[i] = f42[i] * 0.75, f42[i] = f42[i] * 0.25]];
```

```
 f42[i] = f42[i]* 0.2]
For[i = 1, i ≤ 10, i++, f43[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData4[[j]] == 0, f43[i] = f43[i]* 0.5, f43[i] = f43[i]* 0.5]];
 f43[i] = f43[i]* 0.4]
For[i = 1, i ≤ 10, i++, f44[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData4[[j]] == 0, f44[i] = f44[i]* 0.25, f44[i] = f44[i]* 0.75]];
 f44[i] = f44[i]* 0.2]
For[i = 1, i ≤ 10, i++, f45[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData4[[j]] == 0, f45[i] = f45[i]* 0, f45[i] = f45[i]* 1]];
 f45[i] = f45[i]* 0.1]

For[i = 1, i ≤ 10, i++, s4[i] = 0; s4[i] = s4[i] + f41[i] + f42[i] + f43[i] + f44[i] + f45[i]]
For[i = 1, i ≤ 10, i++, f41[i] = f41[i] / s4[i];
 f42[i] = f42[i] / s4[i];
 f43[i] = f43[i] / s4[i];
 f44[i] = f44[i] / s4[i];
 f45[i] = f45[i] / s4[i]]
myData41 = Prepend[myData41, 0.1]
myData42 = Prepend[myData42, 0.2]
myData43 = Prepend[myData43, 0.4]
myData44 = Prepend[myData44, 0.2]
myData45 = Prepend[myData45, 0.1]

Show[ListLinePlot[myData41, PlotStyle → {Red, Thickness[0.01]}, PlotRange → {{1, 11}, {0, 1}},
  Frame → True, FrameLabel → {"Number of samples in d", "Posterior probability"},
  FrameTicks → {{Automatic, None},
   {{{1, 0}, {2, 10}, {3, 20},
    {4, 30}, {5, 40}, {6, 50}, {7, 60}, {8, 70}, {9, 80}, {10, 90}, {11, 100}}, None}}],
 ListLinePlot[myData42, PlotRange → {{1, 11}, {0, 1}}],
 ListLinePlot[myData43, PlotRange → {{1, 11}, {0, 1}}, PlotStyle → Green],
 ListLinePlot[myData44, PlotRange → {{1, 11}, {0, 1}}, PlotStyle → Purple],
 ListLinePlot[myData45, PlotRange → {{1, 11}, {0, 1}}, PlotStyle → Yellow]]
```

Out[368]= {0, 1, 1, 1, 1, 1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 0, 0, 1, 0, 1, 1, 0, 1, 1,
 1, 1, 1, 1, 0, 1, 0, 1, 1, 1, 1, 1, 0, 0, 1, 1, 0, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1,
 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 0, 1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1}

Out[369]= {0., 0., 0., 0., 0., 0., 0., 0., 0., 0.}

Out[370]= $\{0.00104433, 0.0000147754, 2.86072 \times 10^{-10}, 4.37067 \times 10^{-14}, 4.85604 \times 10^{-15},$
 $6.66227 \times 10^{-18}, 1.12829 \times 10^{-22}, 1.54773 \times 10^{-25}, 1.91078 \times 10^{-27}, 2.62109 \times 10^{-30}\}$

Out[371]= {0.237642, 0.127515, 0.00252813, 0.000131841, 0.000185182, 0.0000289066, 5.01299×10^{-7}, 7.82396×10^{-8}, 3.66335×10^{-8}, 5.71752×10^{-9}}

Out[372]= {0.761314, 0.87247, 0.997472, 0.999868, 0.999815, 0.999971, 0.999999, 1., 1., 1.}

Out[373]= {0., 0., 0., 0., 0., 0., 0., 0., 0., 0.}

Out[374]= $\{0.00164375, 2.99156 \times 10^{-6}, 1.47354 \times 10^{-7}, 2.75937 \times 10^{-9}, 1.9185 \times 10^{-12}, 1.20023 \times 10^{-14}, 6.75871 \times 10^{-16}, 4.22896 \times 10^{-18}, 8.82028 \times 10^{-21}, 5.5189 \times 10^{-23}\}$

Out[382]= {0.1, 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.}

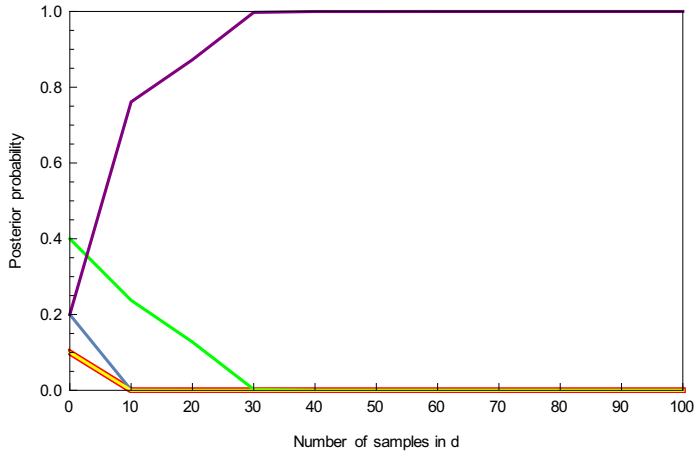
Out[383]= $\{0.2, 0.00104433, 0.0000147754, 2.86072 \times 10^{-10}, 4.37067 \times 10^{-14}, 4.85604 \times 10^{-15}, 6.66227 \times 10^{-18}, 1.12829 \times 10^{-22}, 1.54773 \times 10^{-25}, 1.91078 \times 10^{-27}, 2.62109 \times 10^{-30}\}$

Out[384]= {0.4, 0.237642, 0.127515, 0.00252813, 0.000131841, 0.000185182, 0.0000289066, 5.01299×10^{-7}, 7.82396×10^{-8}, 3.66335×10^{-8}, 5.71752×10^{-9}}

Out[385]= {0.2, 0.761314, 0.87247, 0.997472, 0.999868, 0.999815, 0.999971, 0.999999, 1., 1., 1.}

Out[386]= {0.1, 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.}

Out[387]=

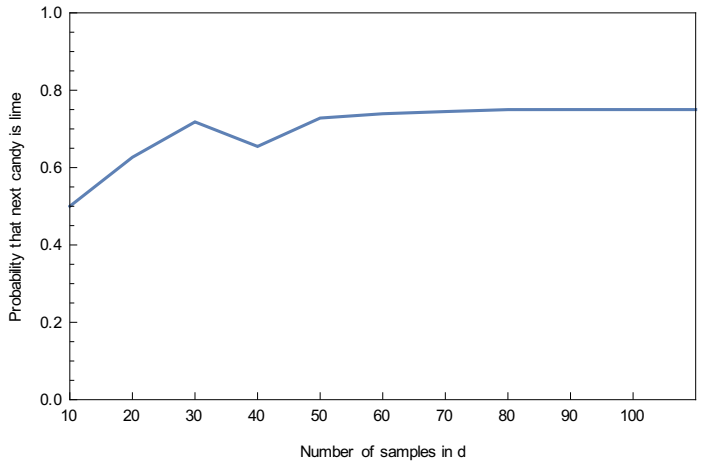


In[392]:=
```
myPredict4 = Array[f4, 10]
For[i = 1, i ≤ 10, i++, f4[i] = 0;
 f4[i] = f4[i] + 0 * f41[i] + 0.25 * f42[i] + 0.5 * f43[i] + 0.75 * f44[i] + 1 * f45[i]]
myPredict4 = Prepend[myPredict4, 0.5]
ListLinePlot[myPredict4 , PlotRange → {{1, 11}, {0, 1}}, Frame → True,
 FrameLabel → {"Number of samples in d", "Probability that next candy is lime"},
 FrameTicks → {{Automatic, None},
   {{{1, 10}, {2, 20}, {3, 30},
    {4, 40}, {5, 50}, {6, 60}, {7, 70}, {8, 80}, {9, 90}, {10, 100}}, None}}]
```

Out[392]= {0.626701, 0.718114, 0.654709, 0.728076, 0.739233, 0.74484, 0.749909, 0.749995, 0.749998, 0.75}

Out[394]= {0.5, 0.626701, 0.718114, 0.654709, 0.728076,
 0.739233, 0.74484, 0.749909, 0.749995, 0.749998, 0.75}

Out[395]=



- Q2 a h5,P(h5) = 0.1

In[416]:=
```
binaryData5 = RandomChoice[{0, 1} → {0, 1}, 100]
myData51 = Array[f51, 10]
myData52 = Array[f52, 10]
myData53 = Array[f53, 10]
myData54 = Array[f54, 10]
myData55 = Array[f55, 10]
mySum5 = Array[s5, 10]

For[i = 1, i ≤ 10, i++, f51[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData5[[j]] == 0, f51[i] = f51[i] * 1, f51[i] = f51[i] * 0]];
 f51[i] = f51[i] * 0.1]
For[i = 1, i ≤ 10, i++, f52[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData5[[j]] == 0, f52[i] = f52[i] * 0.75, f52[i] = f52[i] * 0.25]];
 f52[i] = f52[i] * 0.2]
For[i = 1, i ≤ 10, i++, f53[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData5[[j]] == 0, f53[i] = f53[i] * 0.5, f53[i] = f53[i] * 0.5]];
```

```
 f53[i] = f53[i] * 0.4]
For[i = 1, i ≤ 10, i++, f54[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData5[[j]] == 0, f54[i] = f54[i] * 0.25, f54[i] = f54[i] * 0.75]];
 f54[i] = f54[i] * 0.2]
For[i = 1, i ≤ 10, i++, f55[i] = 1;
 For[j = 1, j ≤ i * 10, j++, If[binaryData5[[j]] == 0, f55[i] = f55[i] * 0, f55[i] = f55[i] * 1]];
 f55[i] = f55[i] * 0.1]

For[i = 1, i ≤ 10, i++, s5[i] = 0; s5[i] = s5[i] + f51[i] + f52[i] + f53[i] + f54[i] + f55[i]]
For[i = 1, i ≤ 10, i++, f51[i] = f51[i] / s5[i];
 f52[i] = f52[i] / s5[i];
 f53[i] = f53[i] / s5[i];
 f54[i] = f54[i] / s5[i];
 f55[i] = f55[i] / s5[i]]
myData51 = Prepend[myData51, 0.1]
myData52 = Prepend[myData52, 0.2]
myData53 = Prepend[myData53, 0.4]
myData54 = Prepend[myData54, 0.2]
myData55 = Prepend[myData55, 0.1]

Show[ListLinePlot[myData51, PlotStyle → Red, PlotRange → {{1, 11}, {0, 1}},
   Frame → True, FrameLabel → {"Number of samples in d", "Posterior probability"},
   FrameTicks → {{Automatic, None},
    {{{1, 0}, {2, 10}, {3, 20},
     {4, 30}, {5, 40}, {6, 50}, {7, 60}, {8, 70}, {9, 80}, {10, 90}, {11, 100}}, None}}],
 ListLinePlot[myData52, PlotRange → {{1, 11}, {0, 1}}],
 ListLinePlot[myData53, PlotRange → {{1, 11}, {0, 1}}, PlotStyle → Green],
 ListLinePlot[myData54, PlotRange → {{1, 11}, {0, 1}}, PlotStyle → Purple],
 ListLinePlot[myData55, PlotRange → {{1, 11}, {0, 1}}, PlotStyle → Yellow]]
```

Out[416]= {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1}

Out[417]= {0., 0., 0., 0., 0., 0., 0., 0., 0., 0.}

Out[418]= $\{1.70827 \times 10^{-6}, 1.80752 \times 10^{-12}, 1.7341 \times 10^{-18}, 1.65433 \times 10^{-24}, 1.57772 \times 10^{-30}, 1.50463 \times 10^{-36}, 1.43493 \times 10^{-42}, 1.36846 \times 10^{-48}, 1.30506 \times 10^{-54}, 1.2446 \times 10^{-60}\}$

Out[419]= $\{0.00349855, 3.79064 \times 10^{-6}, 3.72396 \times 10^{-9}, 3.63791 \times 10^{-12}, 3.55271 \times 10^{-15}, 3.46945 \times 10^{-18}, 3.38813 \times 10^{-21}, 3.30872 \times 10^{-24}, 3.23117 \times 10^{-27}, 3.15544 \times 10^{-30}\}$

Out[420]= $\{0.100872, 0.00630243, 0.000357037, 0.0000201128, 1.13264 \times 10^{-6}, 6.37831 \times 10^{-8}, 3.59185 \times 10^{-9}, 2.0227 \times 10^{-10}, 1.13905 \times 10^{-11}, 6.4144 \times 10^{-13}\}$

Out[421]= {0.895628, 0.993694, 0.999643, 0.99998, 0.999999, 1., 1., 1., 1., 1.}

Out[422]= {0.111654, 0.100635, 0.100036, 0.100002, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1}

Out[430]= {0.1, 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.}

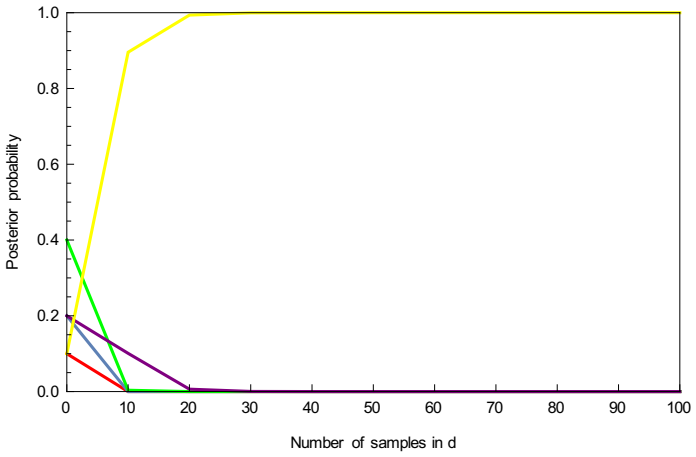
Out[431]= $\{0.2, 1.70827 \times 10^{-6}, 1.80752 \times 10^{-12}, 1.7341 \times 10^{-18}, 1.65433 \times 10^{-24}, 1.57772 \times 10^{-30},$
$1.50463 \times 10^{-36}, 1.43493 \times 10^{-42}, 1.36846 \times 10^{-48}, 1.30506 \times 10^{-54}, 1.2446 \times 10^{-60}\}$

Out[432]= $\{0.4, 0.00349855, 3.79064 \times 10^{-6}, 3.72396 \times 10^{-9}, 3.63791 \times 10^{-12}, 3.55271 \times 10^{-15},$
$3.46945 \times 10^{-18}, 3.38813 \times 10^{-21}, 3.30872 \times 10^{-24}, 3.23117 \times 10^{-27}, 3.15544 \times 10^{-30}\}$

Out[433]= $\{0.2, 0.100872, 0.00630243, 0.000357037, 0.0000201128, 1.13264 \times 10^{-6},$
$6.37831 \times 10^{-8}, 3.59185 \times 10^{-9}, 2.0227 \times 10^{-10}, 1.13905 \times 10^{-11}, 6.4144 \times 10^{-13}\}$

Out[434]= {0.1, 0.895628, 0.993694, 0.999643, 0.99998, 0.999999, 1., 1., 1., 1., 1.}

Out[435]=

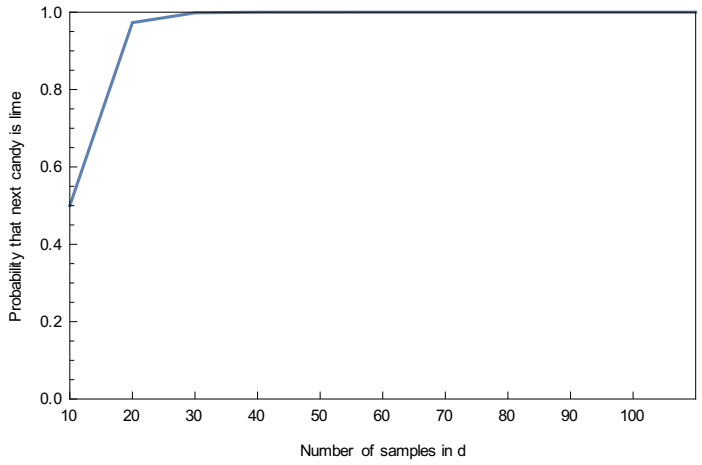


In[440]:=
```
myPredict5 = Array[f5, 10]
For[i = 1, i ≤ 10, i++, f5[i] = 0;
 f5[i] = f5[i] + 0 * f51[i] + 0.25 * f52[i] + 0.5 * f53[i] + 0.75 * f54[i] + 1 * f55[i]]
myPredict5 = Prepend[myPredict5, 0.5]
ListLinePlot[myPredict5 , PlotRange → {{1, 11}, {0, 1}}, Frame → True,
 FrameLabel → {"Number of samples in d", "Probability that next candy is lime"},
 FrameTicks → {{Automatic, None},
   {{{1, 10}, {2, 20}, {3, 30},
    {4, 40}, {5, 50}, {6, 60}, {7, 70}, {8, 80}, {9, 90}, {10, 100}}, None}}]
```

Out[440]= {0.973031, 0.998422, 0.999911, 0.999995, 1., 1., 1., 1., 1., 1.}

Out[442]= {0.5, 0.973031, 0.998422, 0.999911, 0.999995, 1., 1., 1., 1., 1., 1.}

Out[443]=



- Q3 c

Red line indicates h1, blue line indicates h2, green line indicates h3, purple line indicates h4, yellow line indicates h5.

In[537]:=
```
myReduction1 = Array[r1, 11]
myReduction2 = Array[r2, 11]
myReduction3 = Array[r3, 11]
myReduction4 = Array[r4, 11]
myReduction5 = Array[r5, 11]

For[i = 1, i ≤ 11, i++,
 r1[i] = (myData11[[i]] + myData21[[i]] + myData31[[i]] + myData41[[i]] + myData51[[i]]) / 5]
For[i = 1, i ≤ 11, i++,
 r2[i] = (myData12[[i]] + myData22[[i]] + myData32[[i]] + myData42[[i]] + myData52[[i]]) / 5]
For[i = 1, i ≤ 11, i++,
 r3[i] = (myData13[[i]] + myData23[[i]] + myData33[[i]] + myData43[[i]] + myData53[[i]]) / 5]
For[i = 1, i ≤ 11, i++,
 r4[i] = (myData14[[i]] + myData24[[i]] + myData34[[i]] + myData44[[i]] + myData54[[i]]) / 5]
For[i = 1, i ≤ 11, i++,
 r5[i] = (myData15[[i]] + myData25[[i]] + myData35[[i]] + myData45[[i]] + myData55[[i]]) / 5]

myData55[[11]]
Show[ListLinePlot[myReduction1, PlotStyle → {Red, Thickness[0.01]}, PlotRange → {{1, 11}, {0, 1}},
  Frame → True, FrameLabel → {"Number of samples in d", "Posterior probability"},
  FrameTicks → {{Automatic, None},
   {{{1, 0}, {2, 10}, {3, 20},
    {4, 30}, {5, 40}, {6, 50}, {7, 60}, {8, 70}, {9, 80}, {10, 90}, {11, 100}}, None}}],
 ListLinePlot[myReduction2, PlotRange → {{1, 11}, {0, 1}}],
 ListLinePlot[myReduction3, PlotStyle → Green, PlotRange → {{1, 11}, {0, 1}}],
 ListLinePlot[myReduction4, PlotStyle → Purple, PlotRange → {{1, 11}, {0, 1}}],
 ListLinePlot[myReduction5, PlotStyle → Yellow, PlotRange → {{1, 11}, {0, 1}}]]
```

Out[537]= {0.1, 0.179126, 0.198739, 0.199929, 0.199996, 0.2, 0.2, 0.2, 0.2, 0.2, 0.2}

Out[538]= {0.2, 0.173913, 0.0876121, 0.123883, 0.155273,
 0.176216, 0.198606, 0.198046, 0.197266, 0.199856, 0.199798}

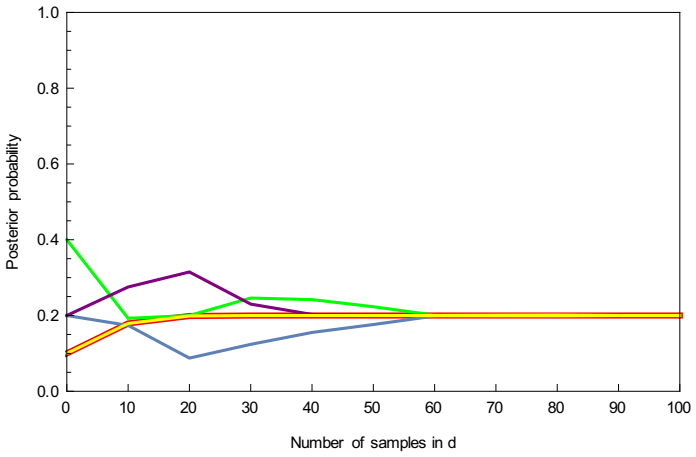
Out[539]= {0.4, 0.192561, 0.200015, 0.246132, 0.241944,
 0.223146, 0.200919, 0.20184, 0.202707, 0.200138, 0.200202}

Out[540]= {0.2, 0.275274, 0.314896, 0.230128, 0.202791,
 0.200638, 0.200475, 0.200114, 0.200027, 0.200006, 0.200001}

Out[541]= {0.1, 0.179126, 0.198739, 0.199929, 0.199996, 0.2, 0.2, 0.2, 0.2, 0.2, 0.2}

Out[547]= 1.

Out[548]=



In[627]:=