

# Rania — PS 9 (2.20.2025)

EIWL3 Sections 23, 24, and 25

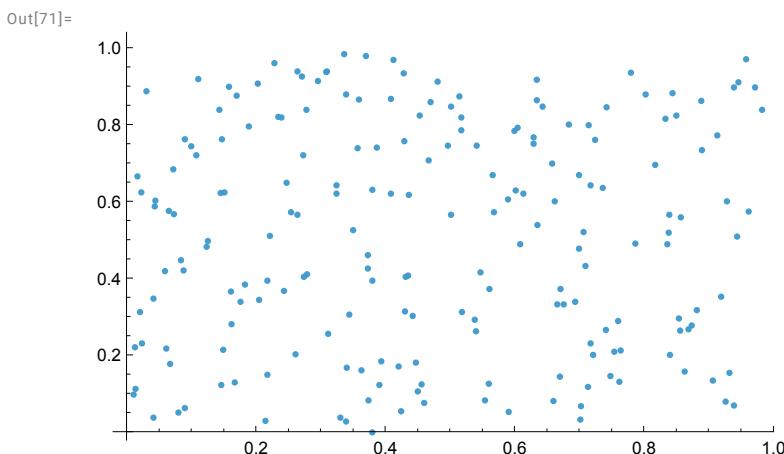
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## Section 23

```
In[69]:= (*23.1 Find sqrt 2 to 500-digit precision.*)
N[Sqrt[2], 500]
Out[69]=
1.4142135623730950488016887242096980785696718753769480731766797379907324784621070...
38850387534327641572735013846230912297024924836055850737212644121497099935831413...
22266592750559275579995050115278206057147010955997160597027453459686201472851741...
86408891986095523292304843087143214508397626036279952514079896872533965463318088...
29640620615258352395054745750287759961729835575220337531857011354374603408498847...
16038689997069900481503054402779031645424782306849293691862158057846311159666871...
30130156185689872372
```

```
In[70]:= (*23.2 Generate 10 random real numbers between 0 and 1. *)
RandomReal[1, 10]
Out[70]=
{0.478985, 0.565053, 0.474835, 0.777362,
 0.164697, 0.662163, 0.19913, 0.267706, 0.279953, 0.141348}
```

```
In[71]:= (*23.3 A plot of 200 points with random
real x and y coordinates between 0 and 1.*)
ListPlot[Table[{RandomReal[1], RandomReal[1]}, 200]]
```



```
In[72]:= (*23.4 A random walk using AnglePath
and 1000 random real numbers between 0 and 2π *)
Graphics[Line[AnglePath[Table[RandomReal[2 Pi], 1000]]]]
```

Out[72]=



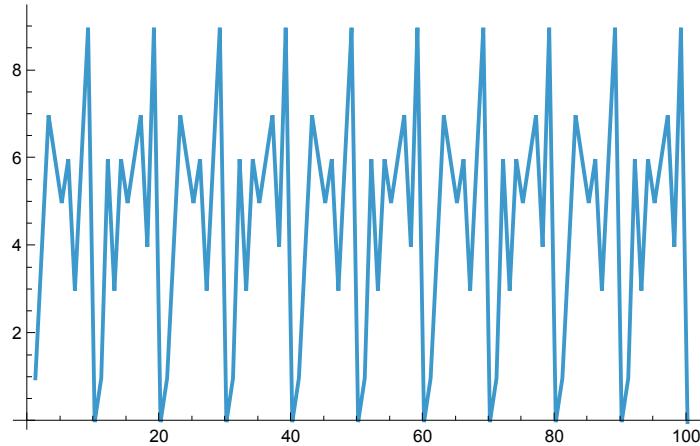
```
In[73]:= (*23.5 Table of Mod[n^2,10] for n from 0 to 30*)
Table[Mod[n^2, 10], {n, 0, 30}]
```

Out[73]=

```
{0, 1, 4, 9, 6, 5, 6, 9, 4, 1, 0, 1, 4, 9, 6, 5, 6, 9, 4, 1, 0, 1, 4, 9, 6, 5, 6, 9, 4, 1, 0}
```

```
In[74]:= (*23.6 Line plot of Mod[n^n,10] for n from 1 to 100.*)
ListLinePlot[Table[Mod[n^n, 10], {n, 1, 100}]]
```

Out[74]=

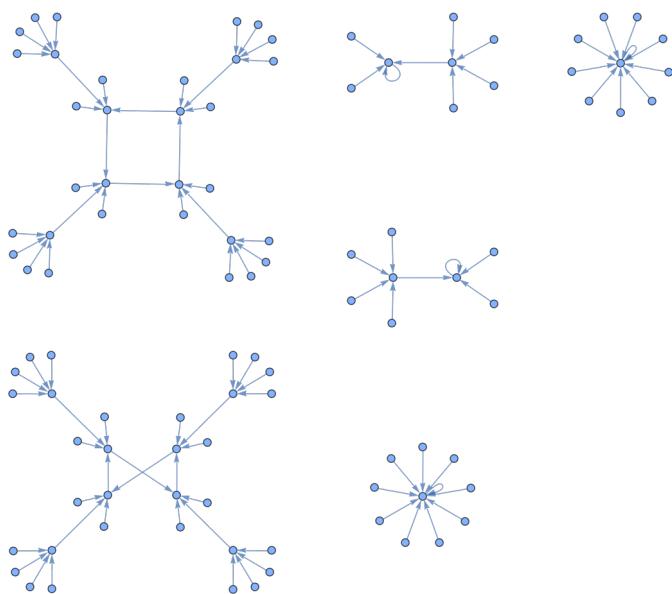


```
In[75]:= (*23.7 Table of the first 10 powers of pi, rounded to integers*)
Table[Round[\pi^n], {n, 1, 10}]
```

```
Out[75]= {3, 10, 31, 97, 306, 961, 3020, 9489, 29809, 93648}
```

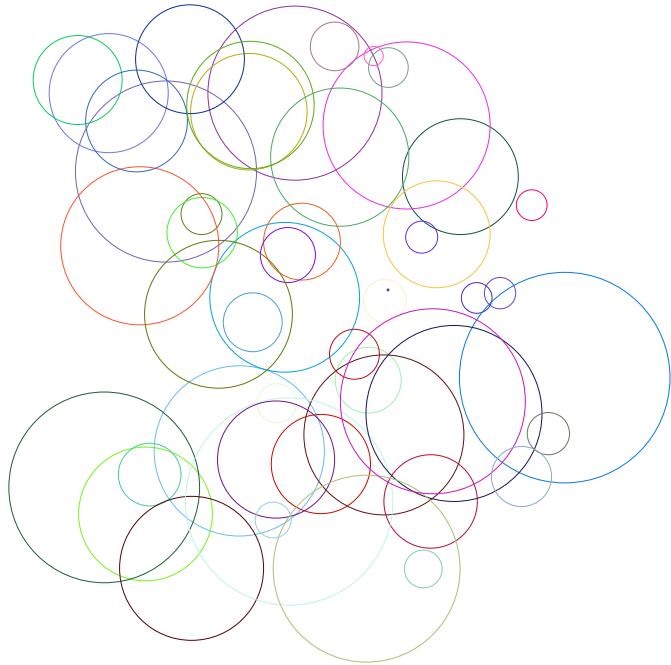
```
In[76]:= (*23.8 A graph by connecting n with Mod[n^2,100] for n from 0 to 99*)
Graph[Table[n \[Rule] Mod[n^2, 100], {n, 0, 99}]]
```

```
Out[76]=
```



```
In[77]:= (*23.9 Graphics of 50 circles with random real coordinates 0 to 10,
random real radii from 0 to 2, and random colors.*)
Graphics[Table[Style[
  Circle[{RandomReal[10], RandomReal[10]}, RandomReal[2]], RandomColor[]], 50]]
```

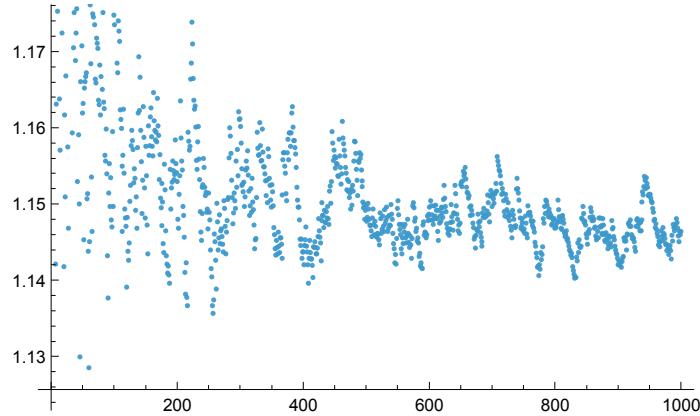
Out[77]=



```
In[78]:= (*23.10 A plot of the nth prime divided by n*Log[n], for n from 2 to 1000*)
```

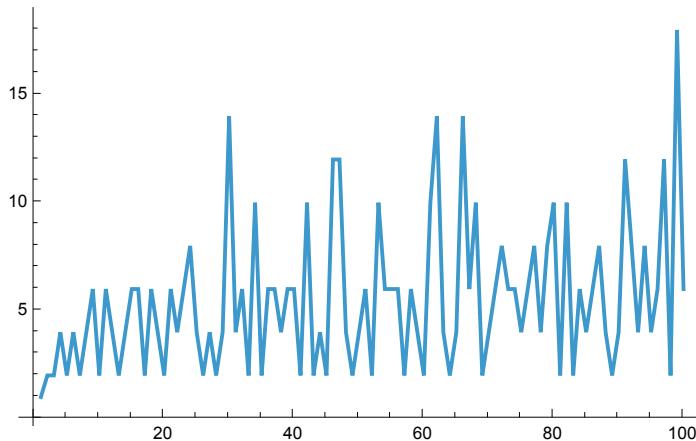
```
ListPlot[Table[ $\frac{\text{Prime}[n]}{n \cdot \text{Log}[n]}$ , {n, 2, 1000}]]
```

Out[78]=



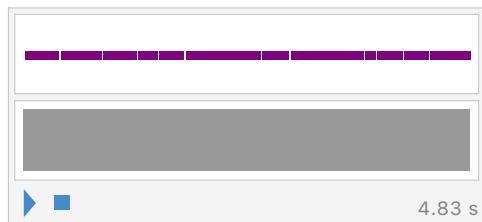
```
In[79]:= (*23.11 Line plot of the differences between successive primes up to 100*)
ListLinePlot[Table[Prime[n + 1] - Prime[n], {n, 1, 100}]]
```

Out[79]=



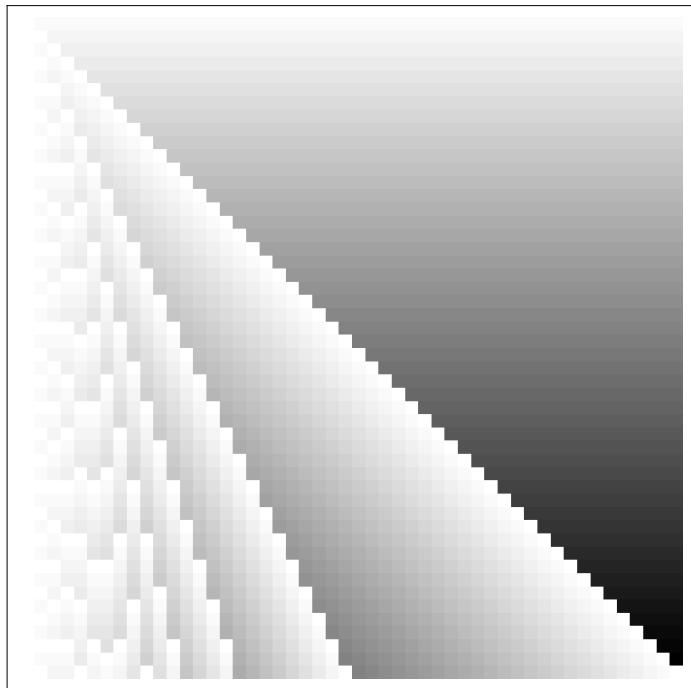
```
In[80]:= (*23.12 A sequence of 20 middle C notes
with random durations between 0 to 0.5 seconds*)
Sound[Table[SoundNote["C", RandomReal[.5]], 20]]
```

Out[80]=



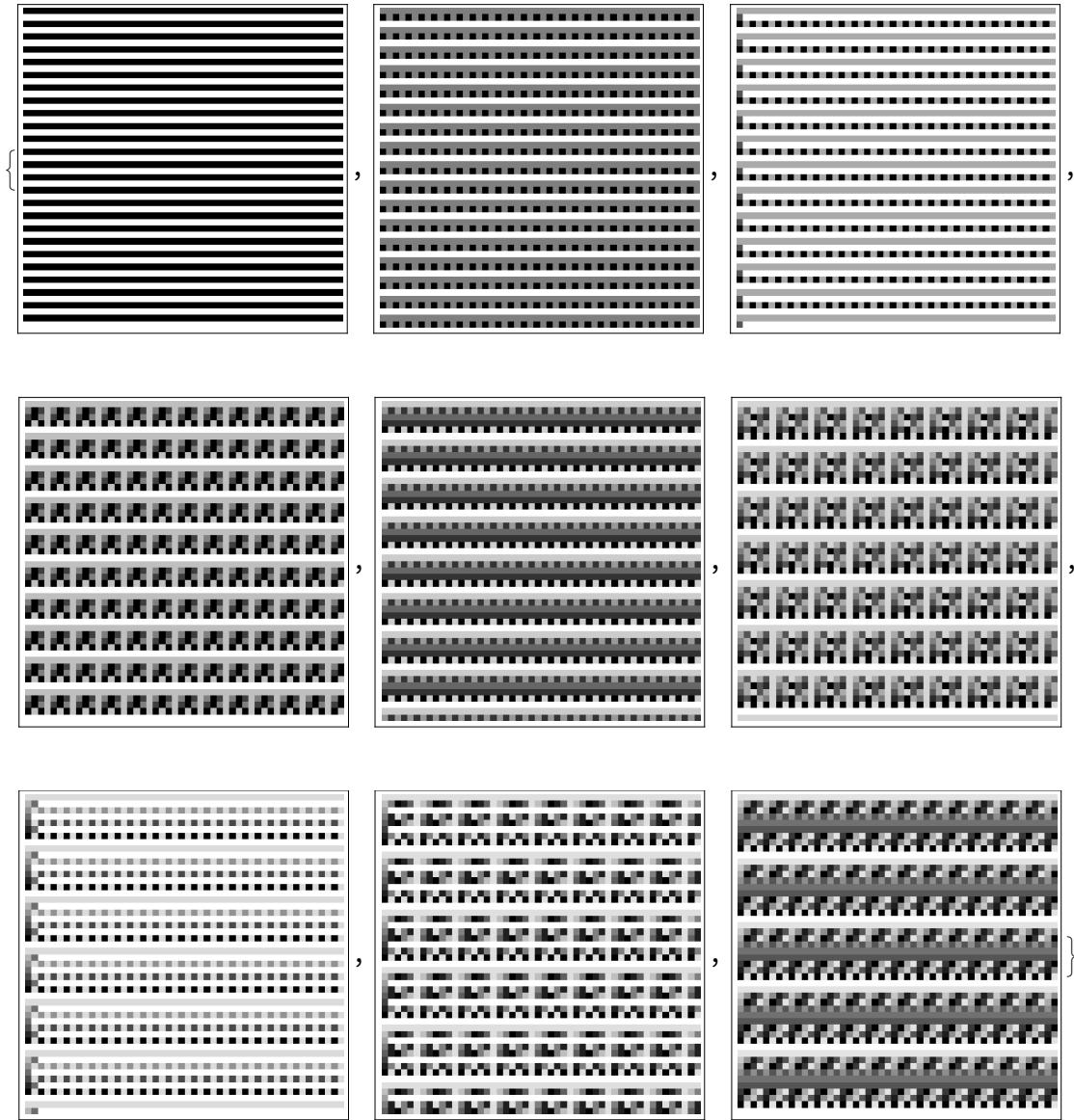
```
In[81]:= (*23.13 An array plot of Mod[i,j] for i and j up to 50 *)
ArrayPlot[Table[Mod[i, j], {i, 1, 50}, {j, 1, 50}]]
```

```
Out[81]=
```



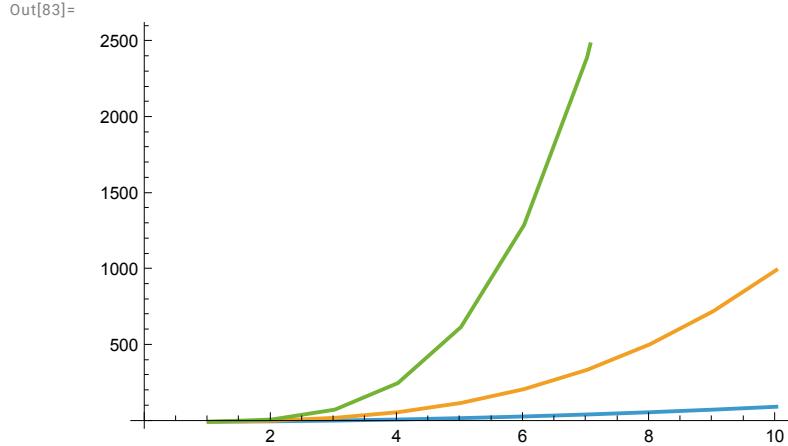
```
In[82]:= (*23.14 A list for n from 2 to 10 of  
array plots of x and y up to 50 of x^y mod n*)  
Table[ArrayPlot[Table[Mod[x^y, n], {x, 1, 50}, {y, 1, 50}]], {n, 2, 10}]
```

Out[82]=

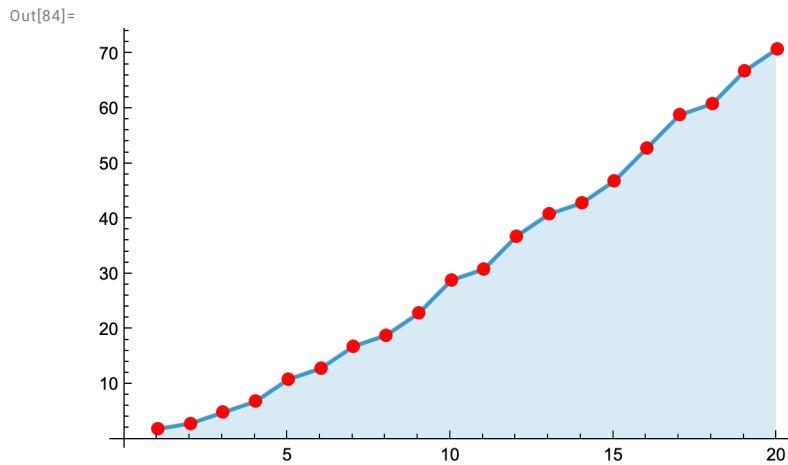


## Section 24

```
In[83]:= (*24.1 Plot with lines joining the squares,
the cubes and the 4th powers of integers up to 10.*)
ListLinePlot[
{Table[x^2, {x, 1, 10}], Table[x^3, {x, 1, 10}], Table[x^4, {x, 1, 10}]}]
```



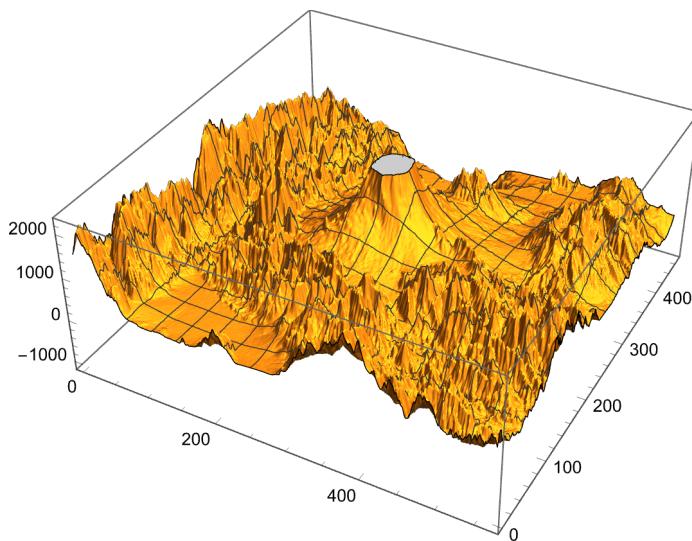
```
In[84]:= (*24.2 Plot the first 20 primes, joined by a line,
filled to the axis and with a red dot at each prime*)
ListLinePlot[Table[Prime[n], {n, 1, 20}],
Filling -> Axis, Mesh -> All, MeshStyle -> Red]
```



In[85]:= (\*24.3 3D plot of the topography for 20 miles around Mount Fuji\*)

```
ListPlot3D[GeoElevationData[GeoDisk[Mount Fuji MOUNTAIN, 20 mi]]]
```

Out[85]=



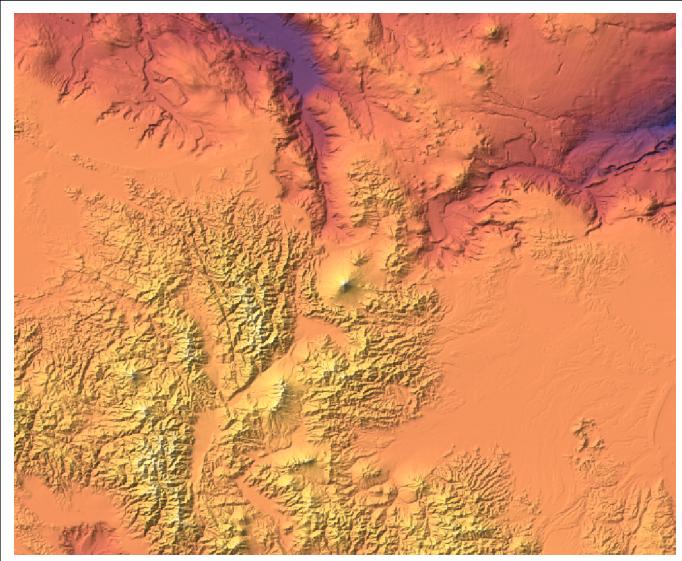
Mt. Fuji looks a load better if you add PlotRange->All.

In[86]:=

In[87]:= (\*24.4 A relief plot of the topography for 100 miles around Mount Fuji.\*)

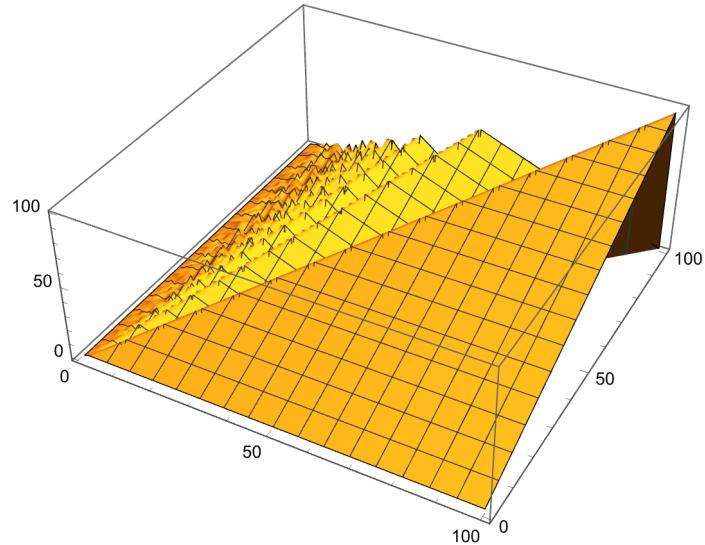
```
ReliefPlot[GeoElevationData[GeoDisk[Mount Fuji MOUNTAIN, 100 mi]]]
```

Out[87]=



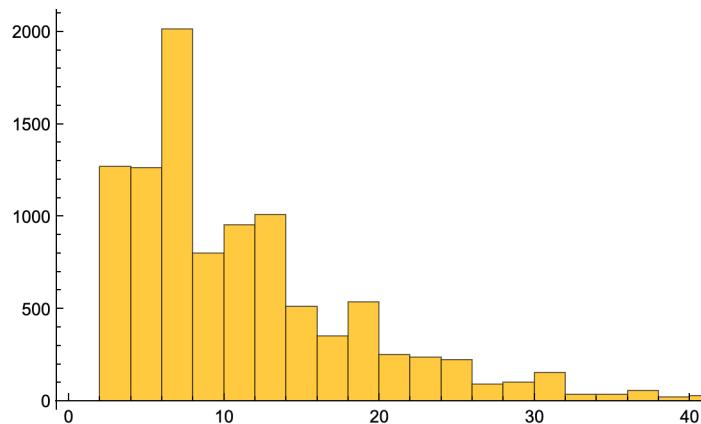
```
In[88]:= (*24.5 A 3D plot of heights generated  
from Mod[i,j] with i and j going up to 100.*)  
ListPlot3D[Table[Mod[i, j], {i, 1, 100}, {j, 1, 100}]]
```

Out[88]=

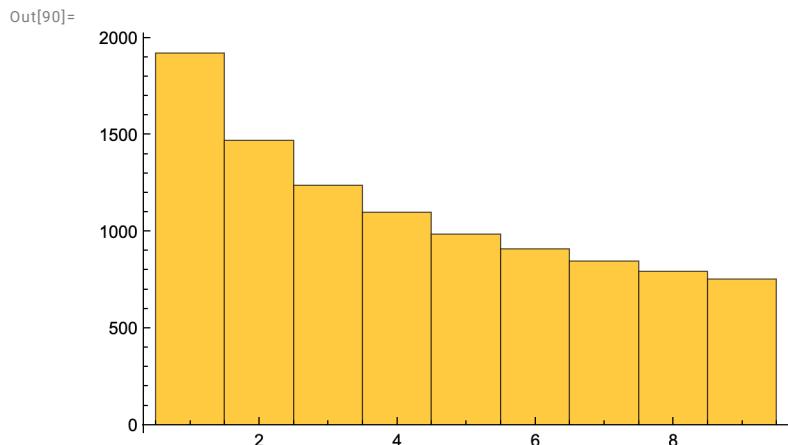


```
In[89]:= (*24.6 Histogram of the differences between  
successive primes for the first 10000 primes*)  
Histogram[Table[Prime[n + 1] - Prime[n], {n, 1, 10000}]]
```

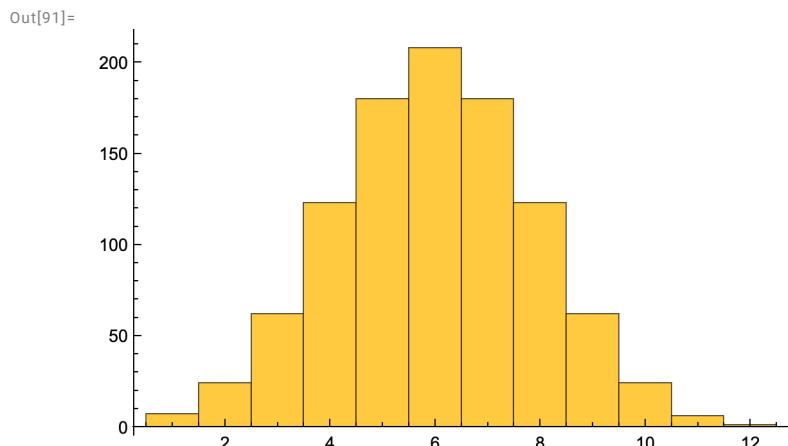
Out[89]=



```
In[90]:= (*24.7 A histogram of the first digits of squares  
of integers up to 10000 (illustrating Benford's law).*)  
Histogram[Flatten[Table[Take[IntegerDigits[x^2], 1], {x, 1, 10000}]]]
```

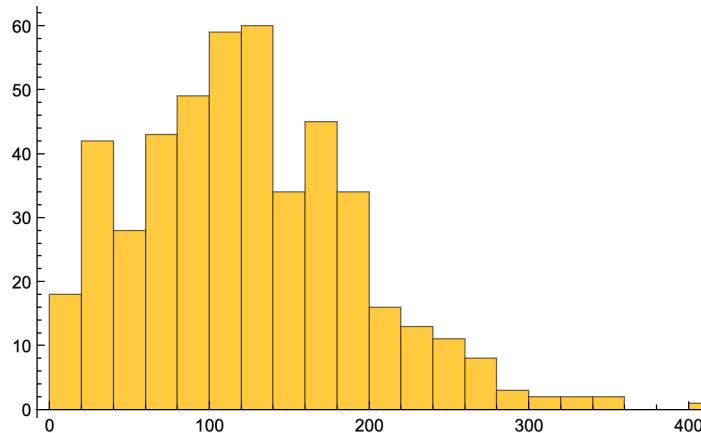


```
In[91]:= (*24.8 A histogram of the length of Roman numerals up to 1000.*)  
Histogram[Table[StringLength[RomanNumeral[n]], {n, 1, 1000}]]
```



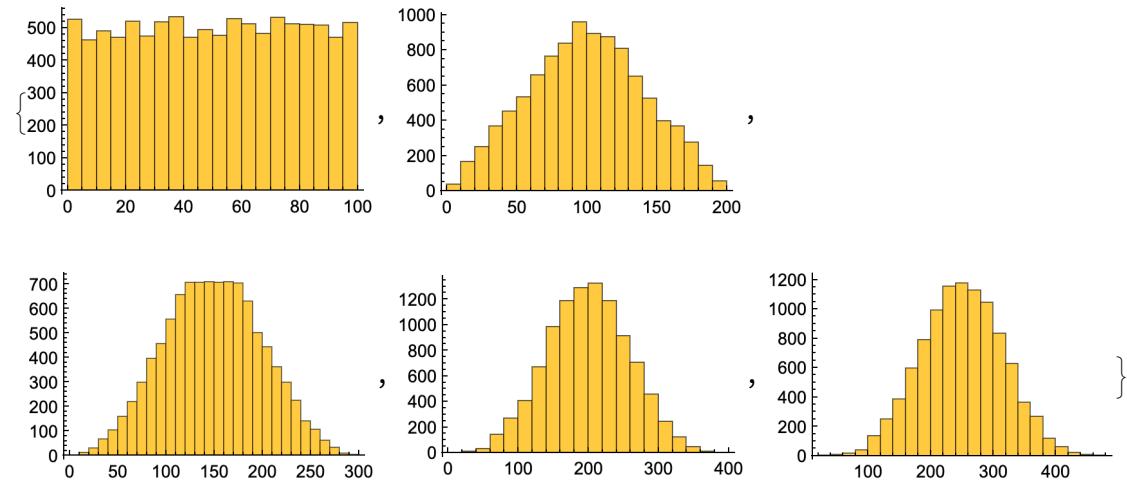
```
In[92]:= (*24.9 A histogram of sentence lengths in the Wikipedia article on computers.*)
Histogram[StringLength[TextSentences[WikipediaData["computers"]]]]
```

Out[92]=



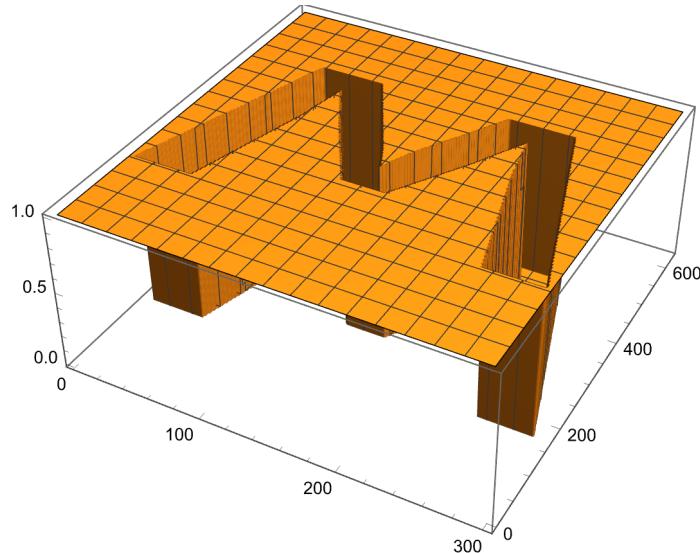
```
In[93]:= (*24.10 A list of histograms of 10000 instances of totals of n random reals up to 100,
with n going from 1 to 5 (illustrating the central limit theorem*)
Table[Histogram[Table[Total[RandomReal[100, n]], 10000]], {n, 1, 5}]
```

Out[93]=



```
In[94]:= (*24.11 Generate a 3D list plot using the image data from a binarized size-  
200 letter "W" as heights*)  
ListPlot3D[ImageData[Binarize[Rasterize[Style["W", 200]]]]]
```

Out[94]=



## Section 25

```
In[95]:= (*Check your answers in the Wolfram Cloud  
25.1Use/@and Range to reproduce the result of Table[f[n],{n,5}].»  
25.2Use/@twice to generate Table[f[g[n]],{n,10}].»  
25.3Use//to create a[b[c[d[x]]]].»  
25.4Make a list of letters of the alphabet,with a frame around each one..»  
25.5Color negate an image of each planet,giving a list of the results..»  
25.6Use/@to draw separate maps of each country in the G5..»  
25.7Binarize each flag in Europe,and make an image collage of the result..»  
25.8Find a list of the dominant colors in images of the planets,  
putting the results for each planet in a column..»  
25.9Find the total of the letter numbers given  
by LetterNumber for the letters in the word "wolfram".*)
```

```
In[96]:= (*25.1 *)  
f /@ Range[5]
```

Out[96]=

```
{f[1], f[2], f[3], f[4], f[5]}
```

```
In[97]:= (*25.2*)
f /@ g /@ Range[10]
Out[97]= {f[g[1]], f[g[2]], f[g[3]], f[g[4]],
f[g[5]], f[g[6]], f[g[7]], f[g[8]], f[g[9]], f[g[10]]}

In[98]:= (*25.3*)
x // d // c // b // a
Out[98]= a[b[c[d[x]]]]

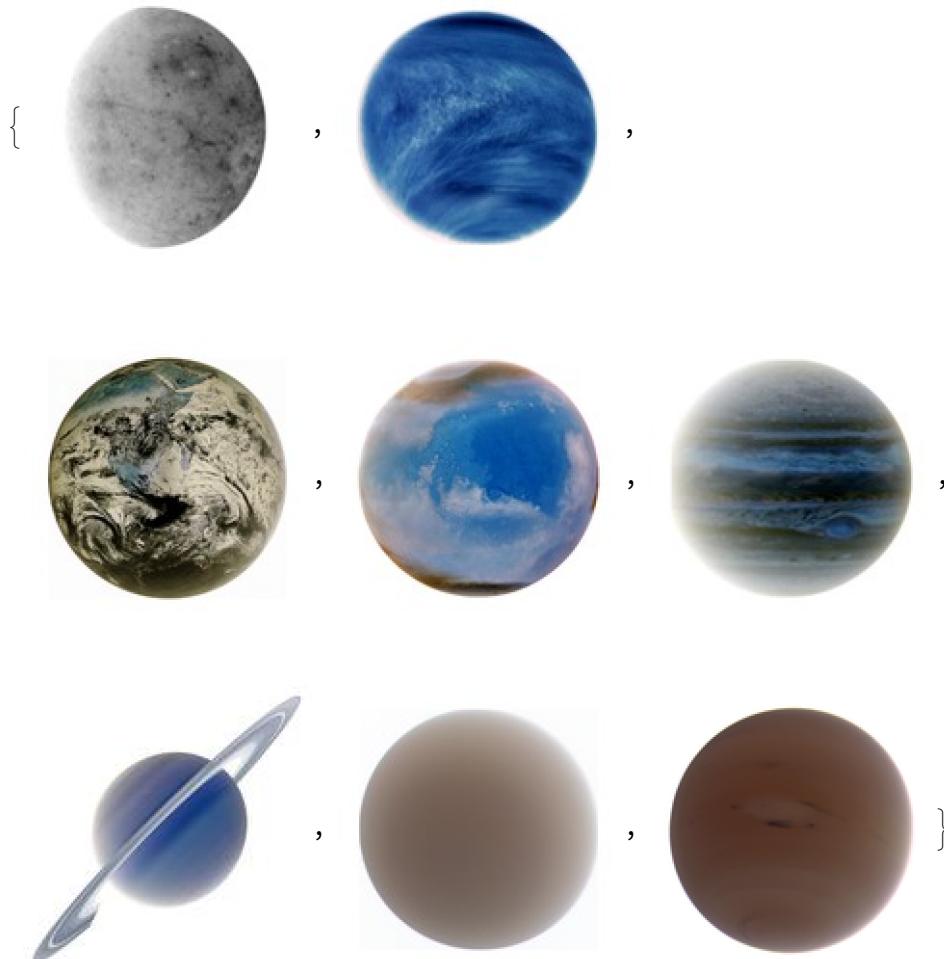
In[99]:= (*25.4*)
Framed /@ Alphabet[]
Out[99]= {a, b, c, d, e, f, g, h, i, j, k, l,
m, n, o, p, q, r, s, t, u, v, w, x, y, z}
```

In[100]:=

(\*25.5\*)

ColorNegate @  planets PLANETS [  ]

Out[100]=



In[101]:=

(\*25.6\*)

GeoGraphics /@ EntityList[EntityClass["Country", "Group0f5"]]

GeoServer: Unable to download one or more vector tiles.

Out[101]=

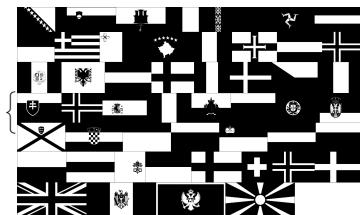


In[102]:=

(\*25.7\*)

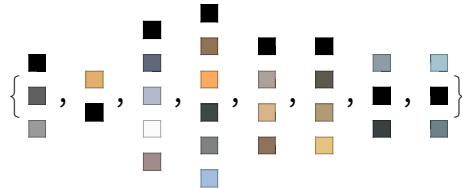
ImageCollage /@ {Binarize /@ EntityValue[Europe GEOGRAPHIC REGION [countries], flag]}

Out[102]=



You have a stray set of curly brackets in this.

```
In[103]:= (*25.8*)
Column /@ DominantColors /@ planets PLANETS [ image ]
Out[103]=
```



```
In[104]:= (*25.9*)
Total /@ LetterNumber /@ {"wolfram"}
Out[104]= {88}
```

## Section 26

I'll look at Section 26 when you turn in PS 10.

Some notes because Wolfram didn't really:

/@: apply the previous thing to all elements in list following it

&: indicates the previous is a pure function

#: "slot" in which element is put (if it's followed /@ it will each element into the list)

EXAMPLE:

Rotate[#, 90 degree] &/@{"one", "two", "three"} -> Rotate[one, 90 degree], Rotate[two, 90 degree]...

vs.

Rotate["hello", #] &/@[30 deg, 90 deg, 80 deg] -> Rotate["hello", 30 degree], Rotate["hello", 90 degree]...

#: can also be used to pair

{#, ColorNegate[]} &/@{Red, Blue, Green}

```
In[105]:= (*26.1 Use Range and a pure function to create a list of the first 20 squares.*)
Power[#, 2] & /@ Range[20]
Out[105]= {1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225, 256, 289, 324, 361, 400}
```

```
In[106]:= (*26.2 A list of the result of blending yellow,green and blue with red*)
Blend[{#, Red}] & /@ {Yellow, Green, Blue}
Out[106]= {Orange, GreenishYellow, Magenta}
```

In[107]:=

(\*26.3 Generate a list of framed columns containing the uppercase and lowercase versions of each letter of the alphabet.\*)

```
Framed[Column[{ToUpperCase[#], #}]] & /@ Alphabet[]
```

Out[107]=

```
{A, B, C, D, E, F, G, H, I, J, K, L,
 a, b, c, d, e, f, g, h, i, j, k, l,
 M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z}
 m, n, o, p, q, r, s, t, u, v, w, x, y, z}
```

In[108]:=

(\*26.4 A list of letters of the alphabet,in random colors, with frames having random background colors.\*)

```
Framed[Style[#, RandomColor[]], Background → RandomColor[]] & /@ Alphabet[]
```

Out[108]=

```
{a, b, c, d, e, f, g, h, i, j, k, l,
 m, n, o, p, q, r, s, t, u, v, w, x, y, z}
```

In[109]:=

(\*26.5 A table of G5 countries,together with their flags, and arrange the result in a fully framed grid.\*)

```
Framed[Grid[Table[{#, CountryData[#, "Flag"]}, 1]]] & /@
```

```
EntityList[ Group of 5 COUNTRIES ]
```

Out[109]=

```
{France, France, Germany, Germany, Japan, Japan,
 United Kingdom, United Kingdom, United States, United States}
```

In[110]:=

( \* \* )

```
WordCloud[WikipediaData[##]] & /@ {"apple", "peach", "pear"}]
```

Out[110]=

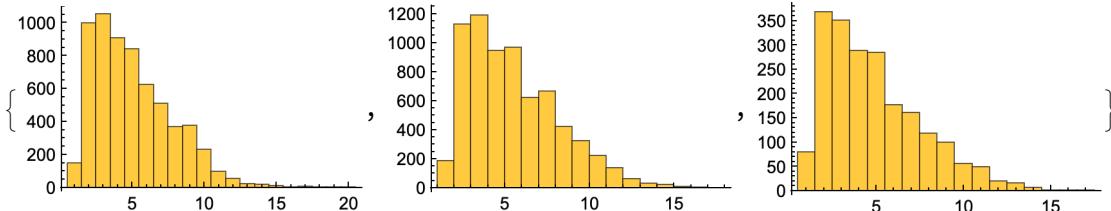


In[111]:=

(\* 26.7 List of histograms of the word lengths in Wikipedia articles on apple, peach and pear.\*)

```
Histogram[StringLength[TextWords[WikipediaData[#[#]]]]] & /@ {"apple", "peach", "pear"}]
```

Out[111]=



In[112]:=

(\*26.8 A list of maps of Central America,highlighting each country in turn\*)  
GeoListPlot[#, GeoRange → ] & /@  
EntityList[ ]

Out[112]=

