Brian — PS 11 — 2025-03-18 — Solution

EIWL3 Sections 29 and 30

!! HELP — I HAD TROUBLE WITH 30.7 and 30.10 !!

Exercises from *EIWL3* Section 29

```
In[•]:= (* 29.1 *) Array[Prime, 100]
```

```
Out[•]=
{2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79,
 83, 89, 97, 101, 103, 107, 109, 113, 127, 131, 137, 139, 149, 151, 157, 163,
 167, 173, 179, 181, 191, 193, 197, 199, 211, 223, 227, 229, 233, 239, 241, 251,
 257, 263, 269, 271, 277, 281, 283, 293, 307, 311, 313, 317, 331, 337, 347, 349,
 353, 359, 367, 373, 379, 383, 389, 397, 401, 409, 419, 421, 431, 433, 439,
 443, 449, 457, 461, 463, 467, 479, 487, 491, 499, 503, 509, 521, 523, 541}
```

```
In[•]:= (* 29.2 *) Array[Prime[#] - Prime[# - 1] &, 99, 2]
```

```
Out[•]=
{1, 2, 2, 4, 2, 4, 2, 4, 6, 2, 6, 4, 2, 4, 6, 6, 2, 6, 4, 2, 6, 4, 6, 8, 4, 2,
 4, 2, 4, 14, 4, 6, 2, 10, 2, 6, 6, 4, 6, 6, 2, 10, 2, 4, 2, 12, 12, 4, 2, 4,
 6, 2, 10, 6, 6, 6, 2, 6, 4, 2, 10, 14, 4, 2, 4, 14, 6, 10, 2, 4, 6, 8, 6, 6,
 4, 6, 8, 4, 8, 10, 2, 10, 2, 6, 4, 6, 8, 4, 2, 4, 12, 8, 4, 8, 4, 6, 12, 2, 18}
```

```
In[•]:= (* 29.3*) Array[Plus, {10, 10}] // Grid
```

```
Out[•]=
 2  3  4  5  6  7  8  9 10 11
 3  4  5  6  7  8  9 10 11 12
 4  5  6  7  8  9 10 11 12 13
 5  6  7  8  9 10 11 12 13 14
 6  7  8  9 10 11 12 13 14 15
 7  8  9 10 11 12 13 14 15 16
 8  9 10 11 12 13 14 15 16 17
 9 10 11 12 13 14 15 16 17 18
10 11 12 13 14 15 16 17 18 19
11 12 13 14 15 16 17 18 19 20
```

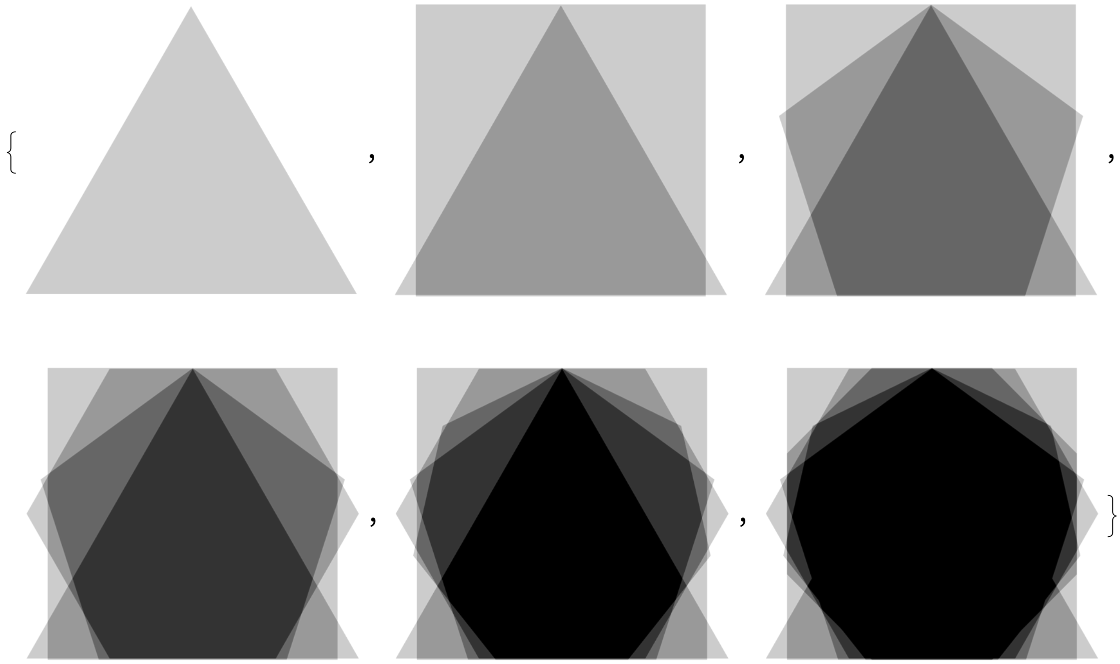
```
In[•]:= (* 29.4 *) FoldList[Times, Range[10]]
```

```
Out[•]=
{1, 2, 6, 24, 120, 720, 5040, 40 320, 362 880, 3 628 800}
```

```
In[•]:= (* 29.5 *) FoldList[Times, Array[Prime, 10]]
```

```
Out[•]=
{2, 6, 30, 210, 2310, 30 030, 510 510, 9 699 690, 223 092 870, 6 469 693 230}
```

In[ ]:=
```
(* 29.6 *) FoldList[ImageAdd,
 Graphics /@ Array[{Opacity[0.2], RegularPolygon[#]} &, 6, 3]]
```
Out[ ]=



Exercises from *EIWL3* Section 30

In[ ]:=
```
(* 30.1 *) Thread[Alphabet[] → LetterNumber /@ Alphabet[]]
```
Out[ ]=
```
{a → 1, b → 2, c → 3, d → 4, e → 5, f → 6, g → 7, h → 8,
 i → 9, j → 10, k → 11, l → 12, m → 13, n → 14, o → 15, p → 16, q → 17,
 r → 18, s → 19, t → 20, u → 21, v → 22, w → 23, x → 24, y → 25, z → 26}
```

In[ ]:=
```
(* 30.2 *) Partition[Alphabet[], 6] // Grid
```
Out[ ]=
```
a b c d e f
g h i j k l
m n o p q r
s t u v w x
```

In[ ]:=
```
(* 30.3 *) Partition[IntegerDigits[2^1000], 50] // Grid[#, Frame → All] &
```
Out[ ]=

1	0	7	1	5	0	8	6	0	7	1	8	6	2	6	7	3	2	0	9	4	8	4	2	5	0	4	9	0	6	0	0	0	1	8	1	0	5	6	1	4	0	4	8	1	1	7
3	3	6	0	7	4	4	3	7	5	0	3	8	8	3	7	0	3	5	1	0	5	1	1	2	4	9	3	6	1	2	2	4	9	3	1	9	8	3	7	8	8	1	5	6	9	5
1	2	7	5	9	4	6	7	2	9	1	7	5	5	3	1	4	6	8	2	5	1	8	7	1	4	5	2	8	5	6	9	2	3	1	4	0	4	3	5	9	8	4	5	7	7	5
9	8	5	7	4	8	0	3	9	3	4	5	6	7	7	7	4	8	2	4	2	3	0	9	8	5	4	2	1	0	7	4	6	0	5	0	6	2	3	7	1	1	4	1	8	7	7
1	8	2	1	5	3	0	4	6	4	7	4	9	8	3	5	8	1	9	4	1	2	6	7	3	9	8	7	6	7	5	5	9	1	6	5	5	4	3	9	4	6	0	7	7	0	6
4	5	7	1	1	9	6	4	7	7	6	8	6	5	4	2	1	6	7	6	6	0	4	2	9	8	3	1	6	5	2	6	2	4	3	8	6	8	3	7	2	0	5	6	6	8	0

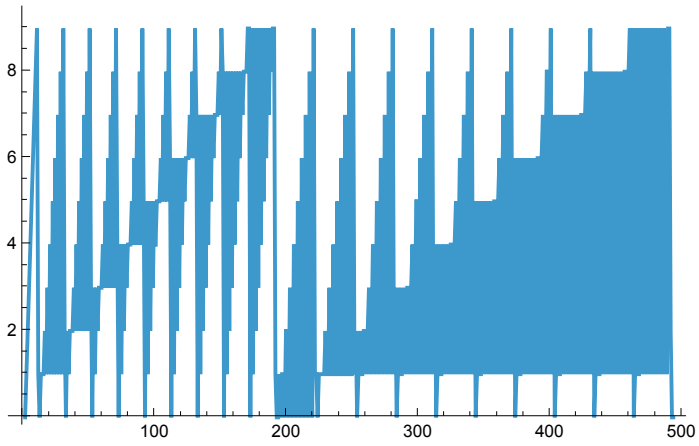
In[ ]:=
```
(* 30.4 *)
Partition[Characters[StringTake[WikipediaData["computers"], 400]], 20] //
 Grid[#, Frame → All] &
```

Out[ ]=

A		c	o	m	p	u	t	e	r		i	s		a		m	a	c	h
i	n	e		t	h	a	t		c	a	n		b	e		p	r	o	g
r	a	m	m	e	d		t	o		a	u	t	o	m	a	t	i	c	a
l	l	y		c	a	r	r	y		o	u	t		s	e	q	u	e	n
c	e	s		o	f		a	r	i	t	h	m	e	t	i	c		o	r
	l	o	g	i	c	a	l		o	p	e	r	a	t	i	o	n	s	
(	c	o	m	p	u	t	a	t	i	o	n	)	.		M	o	d	e	r
n		d	i	g	i	t	a	l		e	l	e	c	t	r	o	n	i	c
	c	o	m	p	u	t	e	r	s		c	a	n		p	e	r	f	o
r	m		g	e	n	e	r	i	c		s	e	t	s		o	f		o
p	e	r	a	t	i	o	n	s		k	n	o	w	n		a	s		p
r	o	g	r	a	m	s	.		T	h	e	s	e		p	r	o	g	r
a	m	s		e	n	a	b	l	e		c	o	m	p	u	t	e	r	s
	t	o		p	e	r	f	o	r	m		a		w	i	d	e		r
a	n	g	e		o	f		t	a	s	k	s	.		T	h	e		t
e	r	m		c	o	m	p	u	t	e	r		s	y	s	t	e	m	
m	a	y		r	e	f	e	r		t	o		a		n	o	m	i	n
a	l	l	y		c	o	m	p	l	e	t	e		c	o	m	p	u	t
e	r		t	h	a	t		i	n	c	l	u	d	e	s		t	h	e
	h	a	r	d	w	a	r	e	,		o	p	e	r	a	t	i	n	g

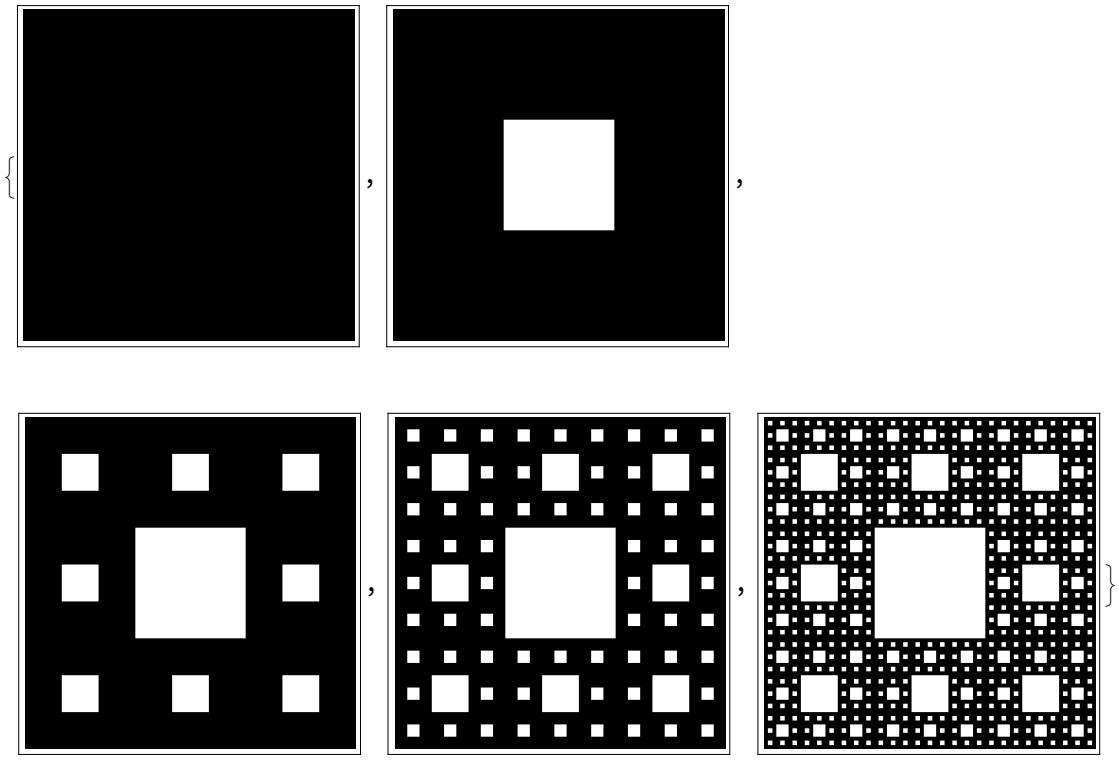
In[ ]:=
```
(* 30.5 *)ListLinePlot[Flatten[ IntegerDigits /@ Range[0, 200]]]
```

Out[ ]=



In[•]:=
```
(* 30.6 *)
ArrayPlot /@ NestList[ArrayFlatten[{{#, #, #}, {#, 0, #}, {#, #, #}}] &, {{1}}, 4]
```

Out[•]=



In[•]:=
```
(* 30.7 *) myList = Array[{#1, #2, Sqrt[#1^2 + #2^2]} &, {5, 5}]
```

Out[•]=
```
{{{1, 1, √2}, {1, 2, √5}, {1, 3, √10}, {1, 4, √17}, {1, 5, √26}},
 {{2, 1, √5}, {2, 2, 2 √2}, {2, 3, √13}, {2, 4, 2 √5}, {2, 5, √29}},
 {{3, 1, √10}, {3, 2, √13}, {3, 3, 3 √2}, {3, 4, 5}, {3, 5, √34}},
 {{4, 1, √17}, {4, 2, 2 √5}, {4, 3, 5}, {4, 4, 4 √2}, {4, 5, √41}},
 {{5, 1, √26}, {5, 2, √29}, {5, 3, √34}, {5, 4, √41}, {5, 5, 5 √2}}}
```

In[•]:=
```
Select[myList, IntegerQ[Last[#]] &]
```

Out[•]=
```
{}
```

In[•]:=
```
(* 30.8 *) Array[Length[Last[Sort[Split[IntegerDigits[2^#]]]]] &, 100]
```

Out[•]=
```
{1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 2, 2, 1, 1, 1, 2, 3,
 2, 2, 2, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 2, 3, 3, 4, 3, 3, 3, 3, 2, 2, 1, 2,
 3, 2, 2, 2, 1, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 1, 1, 1, 1, 2, 2, 2, 3, 3,
 3, 3, 3, 2, 2, 1, 2, 2, 3, 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2}
```

```
(* 30.9 *) Gather[Array[IntegerName, 100],
 First[Characters[#1]] == First[Characters[#2]] &]
```

Out[•]=

```
{{one, one hundred}, {two, three, ten, twelve, thirteen, twenty, twenty-one,
  twenty-two, twenty-three, twenty-four, twenty-five, twenty-six, twenty-seven,
  twenty-eight, twenty-nine, thirty, thirty-one, thirty-two, thirty-three,
  thirty-four, thirty-five, thirty-six, thirty-seven, thirty-eight, thirty-nine},
 {four, five, fourteen, fifteen, forty, forty-one, forty-two, forty-three,
  forty-four, forty-five, forty-six, forty-seven, forty-eight,
  forty-nine, fifty, fifty-one, fifty-two, fifty-three, fifty-four,
  fifty-five, fifty-six, fifty-seven, fifty-eight, fifty-nine},
 {six, seven, sixteen, seventeen, sixty, sixty-one, sixty-two, sixty-three,
  sixty-four, sixty-five, sixty-six, sixty-seven, sixty-eight, sixty-nine,
  seventy, seventy-one, seventy-two, seventy-three, seventy-four,
  seventy-five, seventy-six, seventy-seven, seventy-eight, seventy-nine},
 {eight, eleven, eighteen, eighty, eighty-one, eighty-two, eighty-three,
  eighty-four, eighty-five, eighty-six, eighty-seven, eighty-eight, eighty-nine},
 {nine, nineteen, ninety, ninety-one, ninety-two, ninety-three, ninety-four,
  ninety-five, ninety-six, ninety-seven, ninety-eight, ninety-nine}}
```

In[•]:=

```
(* 30.10 *) Sort[Take[WordList[], 50], Last[Characters[#1]] < Last[Characters[#2]] &]
```

Out[•]=

```
{a, aah, aardvark, aback, abacus, abaft, abalone, abandon, abandoned, abandonment,
 abase, abasement, abash, abashed, abashment, abate, abatement, abattoir,
 abbe, abbess, abbey, abbot, abbreviate, abbreviated, abbreviation, abdicate,
 abdication, abdomen, abdominal, abduct, abducting, abduction, abductor,
 abeam, abed, aberrant, aberration, abet, abettor, abeyance, abhor, abhorrence,
 abhorrent, abidance, abide, abiding, ability, abject, abjection, abjectly}
```

In[•]:=

```
(* 30.11 *)
Sort[Array[#^2 &, 20], First[IntegerDigits[#1]] < First[IntegerDigits[#2]] &]
```

Out[•]=

```
{196, 169, 144, 121, 100, 16, 1, 289, 256, 225, 25, 361, 324, 36, 400, 49, 4, 64, 81, 9}
```

In[•]:=

```
(* 30.12 *) Sort[Array[IntegerName, 20], StringLength[#1] < StringLength[#2] &]
```

Out[•]=

```
{ten, six, two, one, nine, five, four, eight, seven, three, twenty, twelve,
 eleven, sixteen, fifteen, nineteen, eighteen, fourteen, thirteen, seventeen}
```

In[•]:=

```
(* 30.13 *)
Gather[RandomChoice[WordList[], 20], StringLength[#1] == StringLength[#2] &]
```

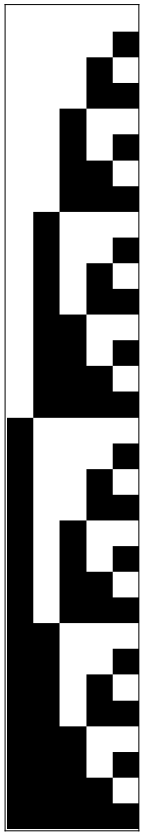
Out[•]=

```
{{jailhouse, cubbyhole, beginning}, {wearer, panzer, nonage},
 {lighten, armored, matador, roofing}, {understandability}, {holographic},
 {transmutable}, {strum, tilde}, {halo, cult, lose}, {attained}, {needlessly}}
```

```
In[•]:= (* 30.14 *) Complement[Alphabet["Russian"], Alphabet["Ukrainian"]]
Out[•]=
{ъ, ы, э, ё}

In[•]:= (* 30.15 *) Intersection[Array[#^2 &, 100], Array[#^3 &, 100]]
Out[•]=
{1, 64, 729, 4096}

In[•]:= (* 30.16 *) Intersection[EntityList[Group of 8 COUNTRIES],
 EntityList[North Atlantic Treaty Organization COUNTRIES]]
Out[•]=
{Canada, France, Germany, Italy, United Kingdom, United States}

In[•]:= (* 30.17 *) Transpose[Permutations[Range[4]]] // Grid
Out[•]=
1 1 1 1 1 1 2 2 2 2 2 2 3 3 3 3 3 3 4 4 4 4 4 4
2 2 3 3 4 4 1 1 3 3 4 4 1 1 2 2 4 4 1 1 2 2 3 3
3 4 2 4 2 3 3 4 1 4 1 3 2 4 1 4 1 2 2 3 1 3 1 2
4 3 4 2 3 2 4 3 4 1 3 1 4 2 4 1 2 1 3 2 3 1 2 1

In[•]:= (* 30.18 *) Permutations[Characters["hello"]]
Out[•]=
{{h, e, l, l, o}, {h, e, l, o, l}, {h, e, o, l, l}, {h, l, e, l, o}, {h, l, e, o, l},
 {h, l, l, e, o}, {h, l, l, o, e}, {h, l, o, e, l}, {h, l, o, l, e}, {h, o, e, l, l},
 {h, o, l, e, l}, {h, o, l, l, e}, {e, h, l, l, o}, {e, h, l, o, l}, {e, h, o, l, l},
 {e, l, h, l, o}, {e, l, h, o, l}, {e, l, l, h, o}, {e, l, l, o, h}, {e, l, o, h, l},
 {e, l, o, l, h}, {e, o, h, l, l}, {e, o, l, h, l}, {e, o, l, l, h}, {l, h, e, l, o},
 {l, h, e, o, l}, {l, h, l, e, o}, {l, h, l, o, e}, {l, h, o, e, l}, {l, h, o, l, e},
 {l, e, h, l, o}, {l, e, h, o, l}, {l, e, l, h, o}, {l, e, l, o, h}, {l, e, o, h, l},
 {l, e, o, l, h}, {l, l, h, e, o}, {l, l, h, o, e}, {l, l, e, h, o}, {l, l, e, o, h},
 {l, l, o, h, e}, {l, l, o, e, h}, {l, o, h, e, l}, {l, o, h, l, e}, {l, o, e, h, l},
 {l, o, e, l, h}, {l, o, l, h, e}, {l, o, l, e, h}, {o, h, e, l, l}, {o, h, l, e, l},
 {o, h, l, l, e}, {o, e, h, l, l}, {o, e, l, h, l}, {o, e, l, l, h}, {o, l, h, e, l},
 {o, l, h, l, e}, {o, l, e, h, l}, {o, l, e, l, h}, {o, l, l, h, e}, {o, l, l, e, h}}
```

```
(* 30.19 *)ArrayPlot[Tuples[{0, 1}, 5]]
```

Out[•]=



```
In[•]:= (* 30.20 *) Table[RandomChoice[Alphabet[], 5], 5]
```

Out[•]=

```
{{t, u, e, d, x}, {v, j, i, d, n}, {u, j, s, f, q}, {m, d, r, k, a}, {b, n, b, d, x}}
```

```
In[•]:= (* 30.21 *) Flatten[Array[{#1, #2, #3} &, {2, 2, 2}], 2]
```

Out[•]=

```
{{1, 1, 1}, {1, 1, 2}, {1, 2, 1}, {1, 2, 2}, {2, 1, 1}, {2, 1, 2}, {2, 2, 1}, {2, 2, 2}}
```