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[343]:=
```
(* 29.1 *) Array[Prime, 100]
```
Out[343]=
```
{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[344]:=
```
(* 29.2 *) Array[Prime[#] - Prime[# - 1] &, 99, 2]
```
Out[344]=
```
{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}
```

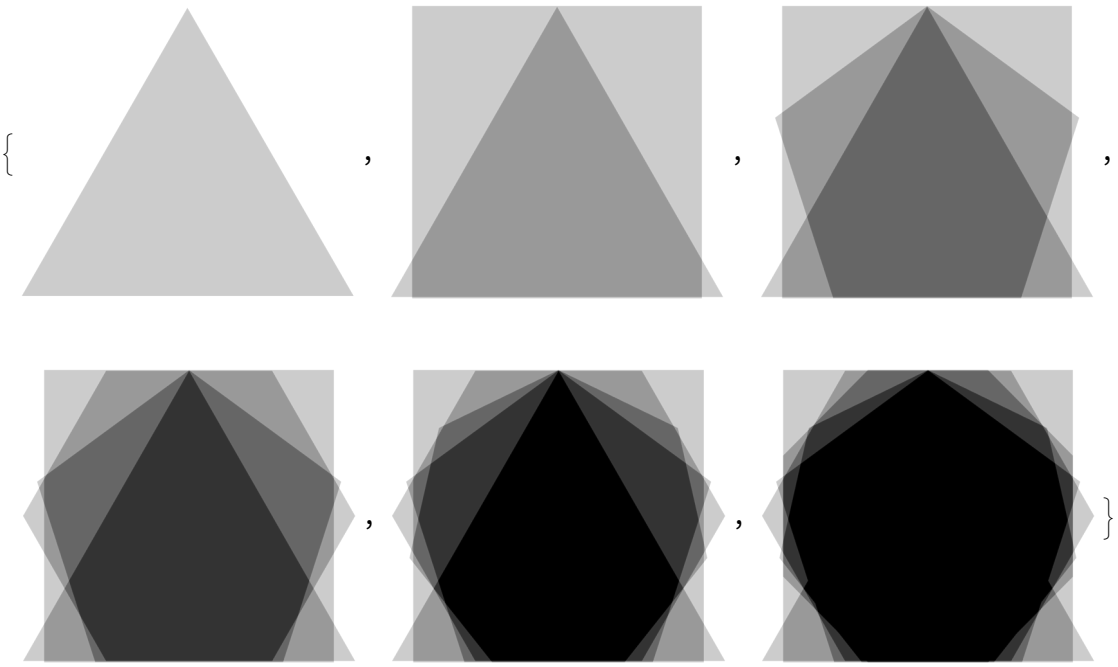
In[345]:=
```
(* 29.3*) Array[Plus, {10, 10}] // Grid
```
Out[345]=

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[346]:=
```
(* 29.4 *) FoldList[Times, Range[10]]
```
Out[346]=
```
{1, 2, 6, 24, 120, 720, 5040, 40 320, 362 880, 3 628 800}
```

In[347]:=
```
(* 29.5 *) FoldList[Times, Array[Prime, 10]]
```
Out[347]=
```
{2, 6, 30, 210, 2310, 30 030, 510 510, 9 699 690, 223 092 870, 6 469 693 230}
```

In[348]:=
```
(* 29.6 *) FoldList[ImageAdd,
 Graphics /@ Array[{Opacity[0.2], RegularPolygon[#]} &, 6, 3]]
```
Out[348]=



Exercises from *EIWL3* Section 30

In[349]:=
```
(* 30.1 *) Thread[Alphabet[] → LetterNumber /@ Alphabet[]]
```
Out[349]=
```
{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[350]:=
```
(* 30.2 *) Partition[Alphabet[], 6] // Grid
```
Out[350]=
```
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[351]:=

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

Out[351]=

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[352]:=

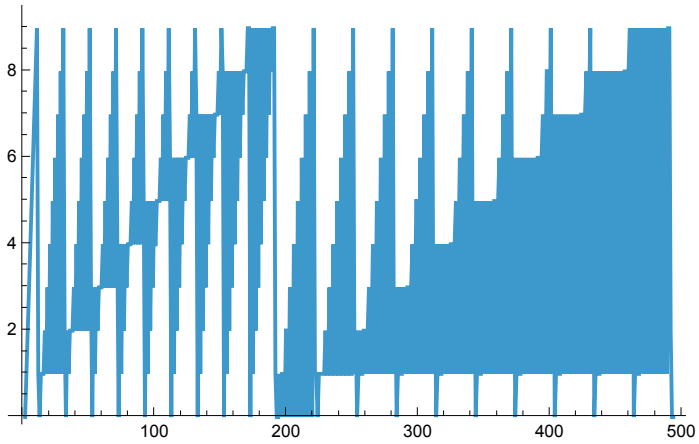
```
(* 30.4 *)
Partition[Characters[StringTake[WikipediaData["computers"], 400]], 20] //
 Grid[#, Frame → All] &
```

Out[352]=

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

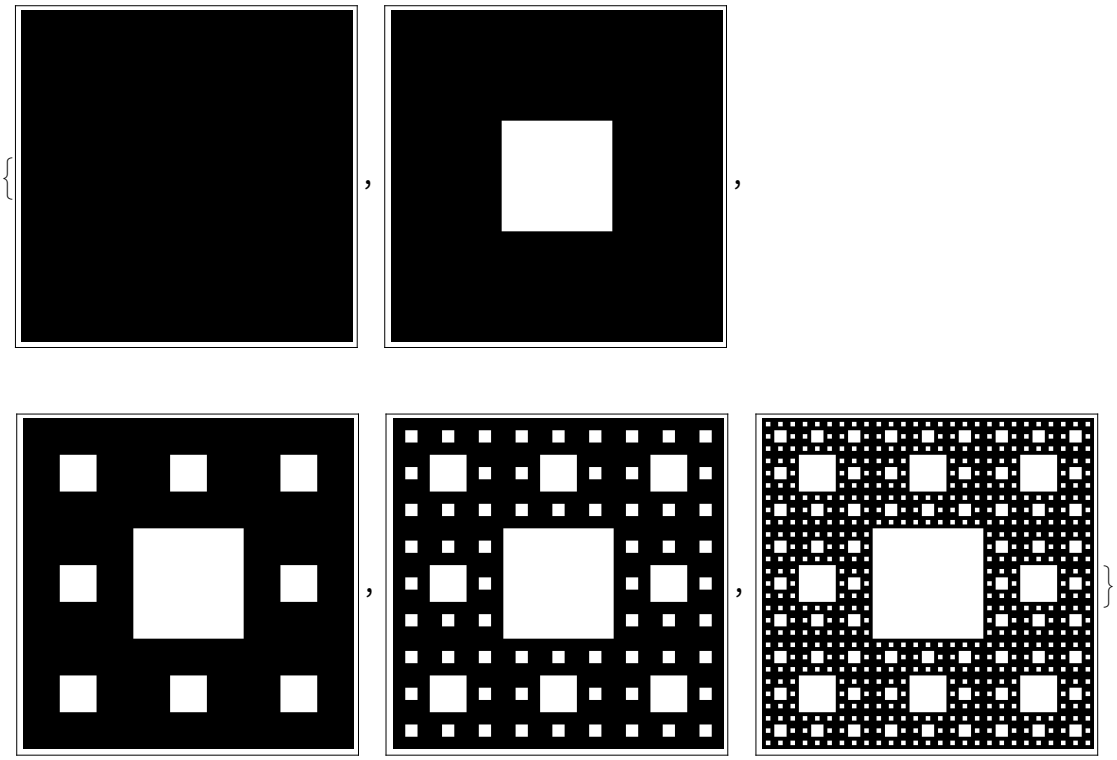
In[353]:=
```
(* 30.5 *)ListLinePlot[Flatten[ IntegerDigits /@ Range[0, 200]]]
```

Out[353]=



In[354]:=
```
(* 30.6 *)
ArrayPlot /@ NestList[ArrayFlatten[{{#, #, #}, {#, 0, #}, {#, #, #}}] &, {{1}}, 4]
```

Out[354]=



In[355]:=
```
(* 30.7 *) myList = Array[{#1, #2, Sqrt[#1^2 + #2^2]} &, {5, 5}]
```

Out[355]=
$$\{\{\{1, 1, \sqrt{2}\}, \{1, 2, \sqrt{5}\}, \{1, 3, \sqrt{10}\}, \{1, 4, \sqrt{17}\}, \{1, 5, \sqrt{26}\}\},$$
$$\{\{2, 1, \sqrt{5}\}, \{2, 2, 2\sqrt{2}\}, \{2, 3, \sqrt{13}\}, \{2, 4, 2\sqrt{5}\}, \{2, 5, \sqrt{29}\}\},$$
$$\{\{3, 1, \sqrt{10}\}, \{3, 2, \sqrt{13}\}, \{3, 3, 3\sqrt{2}\}, \{3, 4, 5\}, \{3, 5, \sqrt{34}\}\},$$
$$\{\{4, 1, \sqrt{17}\}, \{4, 2, 2\sqrt{5}\}, \{4, 3, 5\}, \{4, 4, 4\sqrt{2}\}, \{4, 5, \sqrt{41}\}\},$$
$$\{\{5, 1, \sqrt{26}\}, \{5, 2, \sqrt{29}\}, \{5, 3, \sqrt{34}\}, \{5, 4, \sqrt{41}\}, \{5, 5, 5\sqrt{2}\}\}\}$$

In[356]:=
```
Select[myList, IntegerQ[Last[#]] &]
```

Out[356]=
$$\{\}$$

As noted, my 30.7 solution is broken.

In[357]:=
```
(* 30.8 *) Array[Length[Last[Sort[Split[IntegerDigits[2^#]]]]] &, 100]
```

Out[357]=
$$\{1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 2, 2, 1, 1, 1, 2, 3,$$
$$2, 2, 2, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 2, 3, 3, 4, 3, 3, 3, 3, 2, 2, 1, 2,$$
$$3, 2, 2, 2, 1, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 1, 1, 1, 1, 2, 2, 2, 3, 3,$$
$$3, 3, 3, 2, 2, 1, 2, 2, 3, 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2\}$$

In[358]:=
```
(* 30.9 *) Gather[Array[IntegerName, 100],
 First[Characters[#1]] == First[Characters[#2]] &]
```

Out[358]=
$$\{\{\text{one, one hundred}\},$$
$$\{\text{two, three, ten, twelve, thirteen, twenty, twenty-one,}$$
$$\text{twenty-two, twenty-three, twenty-four, twenty-five, twenty-six, twenty-seven,}$$
$$\text{twenty-eight, twenty-nine, thirty, thirty-one, thirty-two, thirty-three,}$$
$$\text{thirty-four, thirty-five, thirty-six, thirty-seven, thirty-eight, thirty-nine}\},$$
$$\{\text{four, five, fourteen, fifteen, forty, forty-one, forty-two, forty-three,}$$
$$\text{forty-four, forty-five, forty-six, forty-seven, forty-eight,}$$
$$\text{forty-nine, fifty, fifty-one, fifty-two, fifty-three, fifty-four,}$$
$$\text{fifty-five, fifty-six, fifty-seven, fifty-eight, fifty-nine}\},$$
$$\{\text{six, seven, sixteen, seventeen, sixty, sixty-one, sixty-two, sixty-three,}$$
$$\text{sixty-four, sixty-five, sixty-six, sixty-seven, sixty-eight, sixty-nine,}$$
$$\text{seventy, seventy-one, seventy-two, seventy-three, seventy-four,}$$
$$\text{seventy-five, seventy-six, seventy-seven, seventy-eight, seventy-nine}\},$$
$$\{\text{eight, eleven, eighteen, eighty, eighty-one, eighty-two, eighty-three,}$$
$$\text{eighty-four, eighty-five, eighty-six, eighty-seven, eighty-eight, eighty-nine}\},$$
$$\{\text{nine, nineteen, ninety, ninety-one, ninety-two, ninety-three, ninety-four,}$$
$$\text{ninety-five, ninety-six, ninety-seven, ninety-eight, ninety-nine}\}\}$$

In[359]:=
```
(* 30.10 *) Sort[Take[WordList[], 50], Last[Characters[#1]] < Last[Characters[#2]] &]
```

Out[359]=
```
{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[360]:=
```
(* 30.11 *)
Sort[Array[#^2 &, 20], First[IntegerDigits[#1]] < First[IntegerDigits[#2]] &]
```

Out[360]=
```
{196, 169, 144, 121, 100, 16, 1, 289, 256, 225, 25, 361, 324, 36, 400, 49, 4, 64, 81, 9}
```

In[361]:=
```
(* 30.12 *) Sort[Array[IntegerName, 20], StringLength[#1] < StringLength[#2] &]
```

Out[361]=
```
{ten, six, two, one, nine, five, four, eight, seven, three, twenty, twelve,
 eleven, sixteen, fifteen, nineteen, eighteen, fourteen, thirteen, seventeen}
```

In[362]:=
```
(* 30.13 *)
Gather[RandomChoice[WordList[], 20], StringLength[#1] == StringLength[#2] &]
```

Out[362]=
```
{{shine}, {swelled, stumble, descant}, {assemble, methanol, loveless, strainer},
 {niggle, gossip, untidy, carpel}, {eyeglasses, underskirt},
 {opalescence, propinquity}, {vent}, {simultaneity}, {UFO}, {corollary}}
```

In[363]:=
```
(* 30.14 *) Complement[Alphabet["Russian"], Alphabet["Ukrainian"]]
```

Out[363]=
```
{ъ, ы, э, ё}
```

In[364]:=
```
(* 30.15 *) Intersection[Array[#^2 &, 100], Array[#^3 &, 100]]
```

Out[364]=
```
{1, 64, 729, 4096}
```

In[365]:=
```
(* 30.16 *) Intersection[EntityList[ Group of 8 COUNTRIES ],
 EntityList[ North Atlantic Treaty Organization COUNTRIES ]]
```

Out[365]=
```
{ Canada , France , Germany , Italy , United Kingdom , United States }
```

In[366]:=

```
(* 30.17 *) Transpose[Permutations[Range[4]]] // Grid
```

Out[366]=

```
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[367]:=

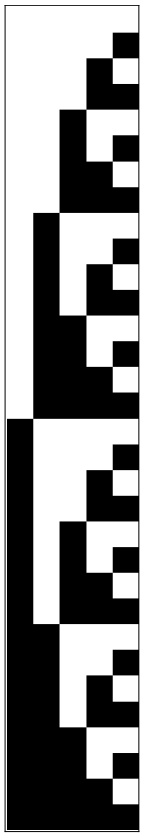
```
(* 30.18 *) Permutations[Characters["hello"]]
```

Out[367]=

```
{{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}}
```

In[368]:=
```
(* 30.19 *)ArrayPlot[Tuples[{0, 1}, 5]]
```

Out[368]=



In[369]:=
```
(* 30.20 *) Table[RandomChoice[Alphabet[], 5], 5]
```

Out[369]=
```
{{q, z, r, m, s}, {e, p, e, y, r}, {t, t, e, t, f}, {a, t, x, q, c}, {b, b, g, s, z}}
```

In[370]:=
```
(* 30.21 *) Flatten[Array[{#1, #2, #3} &, {2, 2, 2}], 2]
```

Out[370]=
```
{{1, 1, 1}, {1, 1, 2}, {1, 2, 1}, {1, 2, 2}, {2, 1, 1}, {2, 1, 2}, {2, 2, 1}, {2, 2, 2}}
```