# 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[2]:= `(* 29.1 *) Array[Prime, 100]`

Out[2]= {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[15]:= `(* 29.2 *) Array[Prime[#] - Prime[# - 1] &, 99, 2]`

Out[15]=

{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[8]:= `(* 29.3*) Array[Plus, {10, 10}] // Grid`

Out[8]=
```
 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
```
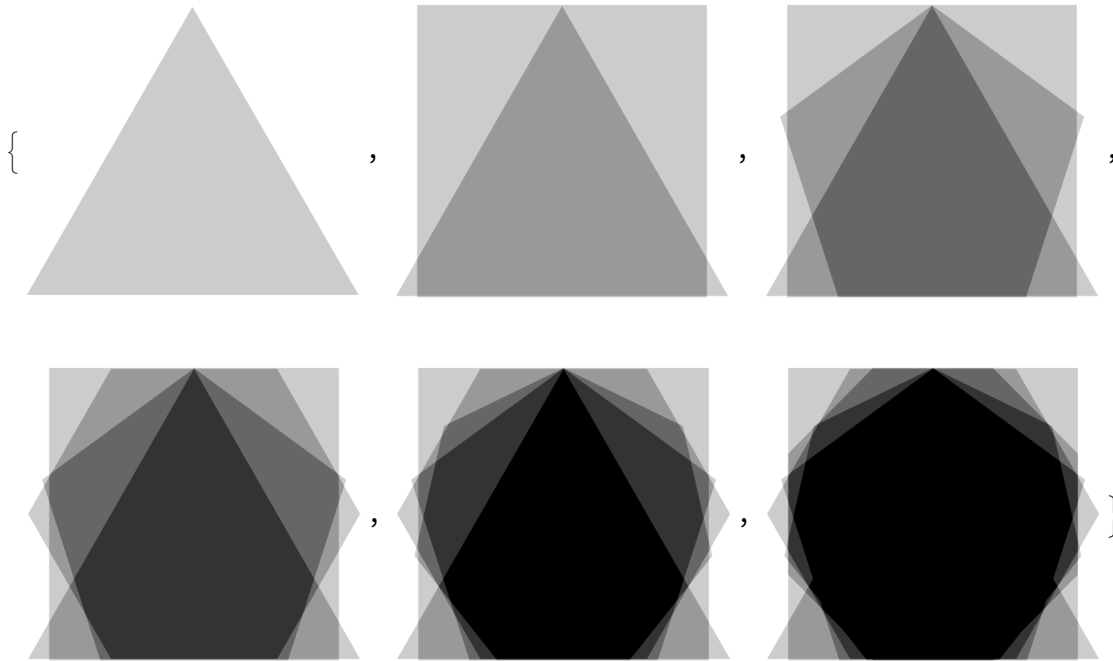
In[11]:= `(* 29.4 *) FoldList[Times, Range[10]]`

Out[11]=

{1, 2, 6, 24, 120, 720, 5040, 40 320, 362 880, 3 628 800}

In[12]:= `(* 29.5 *) FoldList[Times, Array[Prime, 10]]`

Out[12]=

{2, 6, 30, 210, 2310, 30 030, 510 510, 9 699 690, 223 092 870, 6 469 693 230}

In[28]:= `(* 29.6 *) FoldList[ImageAdd,`
` Graphics /@ Array[{Opacity[0.2], RegularPolygon[#]} &, 6, 3]]`

Out[28]=



---

# Exercises from *EIWL3* Section 30

In[33]:= `(* 30.1 *) Thread[Alphabet[] → LetterNumber /@ Alphabet[]]`

Out[33]=

$\{a \to 1, b \to 2, c \to 3, d \to 4, e \to 5, f \to 6, g \to 7, h \to 8,$
$i \to 9, j \to 10, k \to 11, l \to 12, m \to 13, n \to 14, o \to 15, p \to 16, q \to 17,$
$r \to 18, s \to 19, t \to 20, u \to 21, v \to 22, w \to 23, x \to 24, y \to 25, z \to 26\}$

In[35]:= `(* 30.2 *) Partition[Alphabet[], 6] // Grid`

Out[35]=

```
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[42]:= `(* 30.3 *) Partition[IntegerDigits[2^1000], 50] // Grid[#, Frame → All] &`

Out[42]=

| 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[47]:= `(* 30.4 *)`
`Partition[Characters[StringTake[WikipediaData["computers"], 400]], 20] //`
` Grid[#, Frame → All] &`

Out[47]=

| 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 |

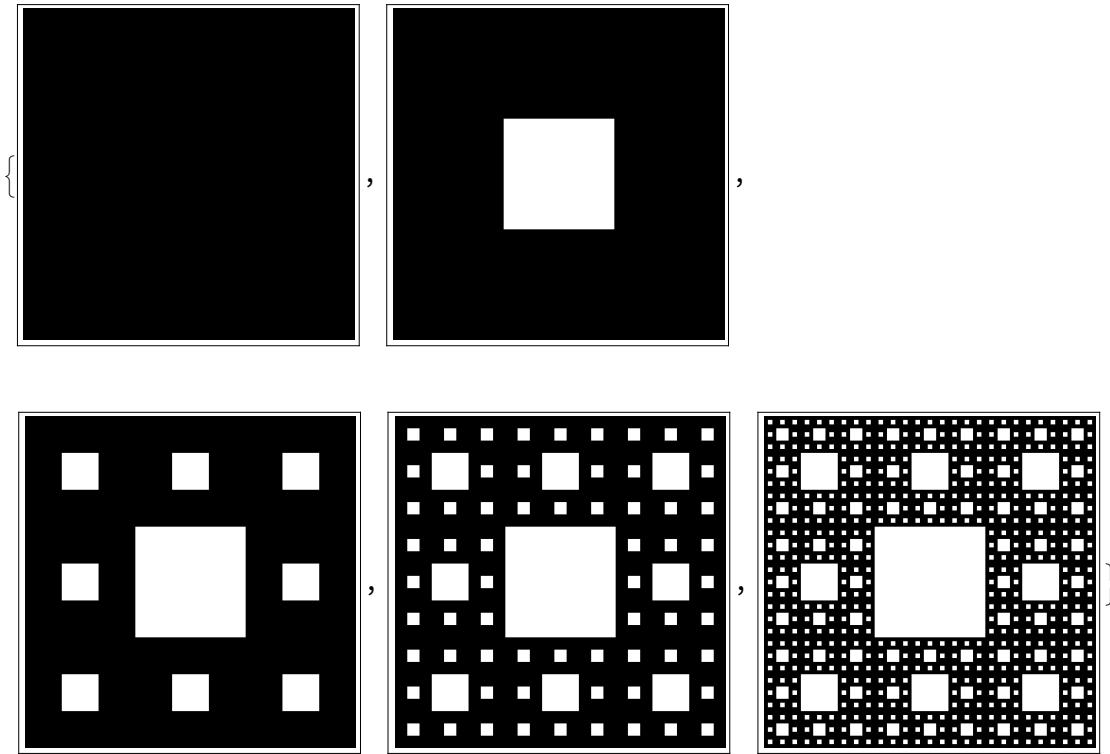In[52]:= `(* 30.5 *)ListLinePlot[Flatten[ IntegerDigits /@ Range[0, 200]]]`

Out[52]=
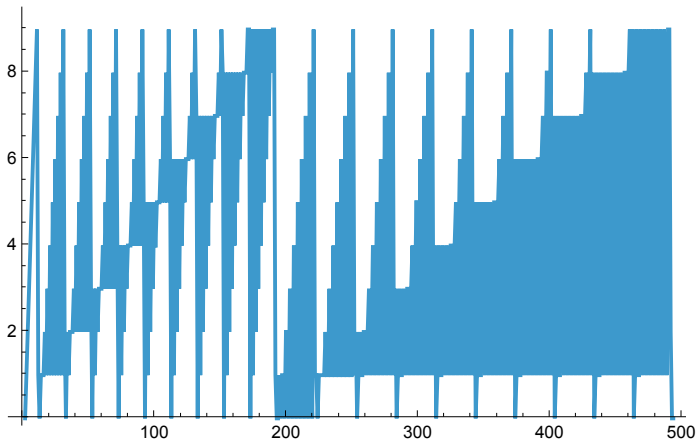
*In[ ]:=*
```
(* 30.6 *)
ArrayPlot /@ NestList[ArrayFlatten[{{#, #, #}, {#, 0, #}, {#, #, #}}] &, {{1}}, 4]
```
*Out[ ]=*



```
(* 30.7 *) myList = Array[{#1, #2, Sqrt[#1^2 + #2^2]} &, {5, 5}]
```
*Out[72]=*

$$\{\{\{1, 1, \sqrt{2}\}, \{1, 2, \sqrt{5}\}, \{1, 3, \sqrt{10}\}, \{1, 4, \sqrt{17}\}, \{1, 5, \sqrt{26}\}\},$$
$$\{\{2, 1, \sqrt{5}\}, \{2, 2, 2\sqrt{2}\}, \{2, 3, \sqrt{13}\}, \{2, 4, 2\sqrt{5}\}, \{2, 5, \sqrt{29}\}\},$$
$$\{\{3, 1, \sqrt{10}\}, \{3, 2, \sqrt{13}\}, \{3, 3, 3\sqrt{2}\}, \{3, 4, 5\}, \{3, 5, \sqrt{34}\}\},$$
$$\{\{4, 1, \sqrt{17}\}, \{4, 2, 2\sqrt{5}\}, \{4, 3, 5\}, \{4, 4, 4\sqrt{2}\}, \{4, 5, \sqrt{41}\}\},$$
$$\{\{5, 1, \sqrt{26}\}, \{5, 2, \sqrt{29}\}, \{5, 3, \sqrt{34}\}, \{5, 4, \sqrt{41}\}, \{5, 5, 5\sqrt{2}\}\}\}$$

*In[75]:=*
```
Select[myList, IntegerQ[Last[#]] &]
```
*Out[75]=*

$$\{\}$$

*In[84]:=*
```
(* 30.8 *) Array[Length[Last[Sort[Split[IntegerDigits[2^#]]]]] &, 100]
```
*Out[84]=*

$$\{1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 2, 2, 1, 1, 1, 2, 3,$$
$$2, 2, 2, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 2, 3, 3, 4, 3, 3, 3, 3, 2, 2, 1, 2,$$
$$3, 2, 2, 2, 1, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 1, 1, 1, 1, 2, 2, 2, 3, 3,$$
$$3, 3, 3, 2, 2, 1, 2, 2, 3, 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2\}$$

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

Out[88]=

```
{{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[97]:= `(* 30.10 *) Sort[Take[WordList[], 50], Last[Characters[#1]] < Last[Characters[#2]] &]`

Out[97]=

```
{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[96]:=

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

Out[96]=

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

In[100]:=

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

Out[100]=

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

In[103]:=
```
(* 30.13 *)
Gather[RandomChoice[WordList[], 20], StringLength[#1] == StringLength[#2] &]
```

Out[103]=
```
{{jailhouse, cubbyhole, beginning}, {wearer, panzer, nonage},
 {lighten, armored, matador, roofing}, {understandability}, {holographic},
 {transmutable}, {strum, tilde}, {halo, cult, lose}, {attained}, {needlessly}}
```

In[104]:=
```
(* 30.14 *) Complement[Alphabet["Russian"], Alphabet["Ukrainian"]]
```

Out[104]=
```
{ъ, ы, э, ё}
```

In[105]:=
```
(* 30.15 *) Intersection[Array[#^2 &, 100], Array[#^3 &, 100]]
```

Out[105]=
```
{1, 64, 729, 4096}
```

In[111]:=
```
(* 30.16 *) Intersection[EntityList[▦ Group of 8 COUNTRIES],
  EntityList[▦ North Atlantic Treaty Organization COUNTRIES]]
```

Out[111]=
```
{ Canada , France , Germany , Italy , United Kingdom , United States }
```

In[116]:=
```
(* 30.17 *) Transpose[Permutations[Range[4]]] // Grid
```

Out[116]=
```
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[117]:=
```
(* 30.18 *) Permutations[Characters["hello"]]
```

Out[117]=
```
{{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[119]=
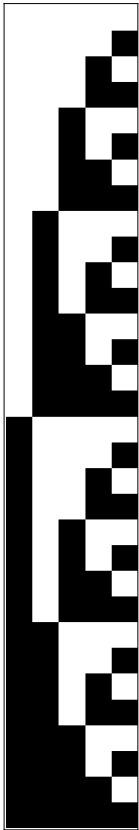
```
In[122]:=
```

(* 30.20 *) Table[RandomChoice[Alphabet[]], 5], 5]

Out[122]=

{{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[128]:=
```

(* 30.21 *) Flatten[Array[{#1, #2, #3} &, {2, 2, 2}], 2]

Out[128]=

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