Your LED cube

ENGR 40M
Chuan-Zheng Lee
Stanford University
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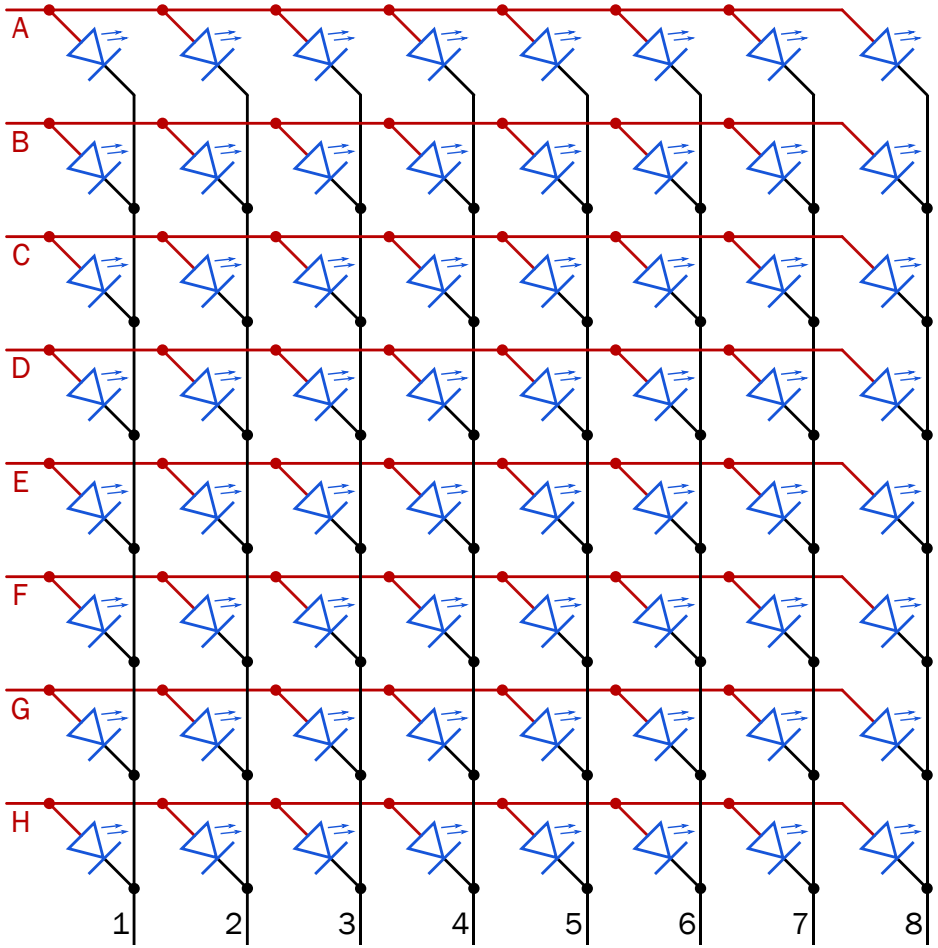
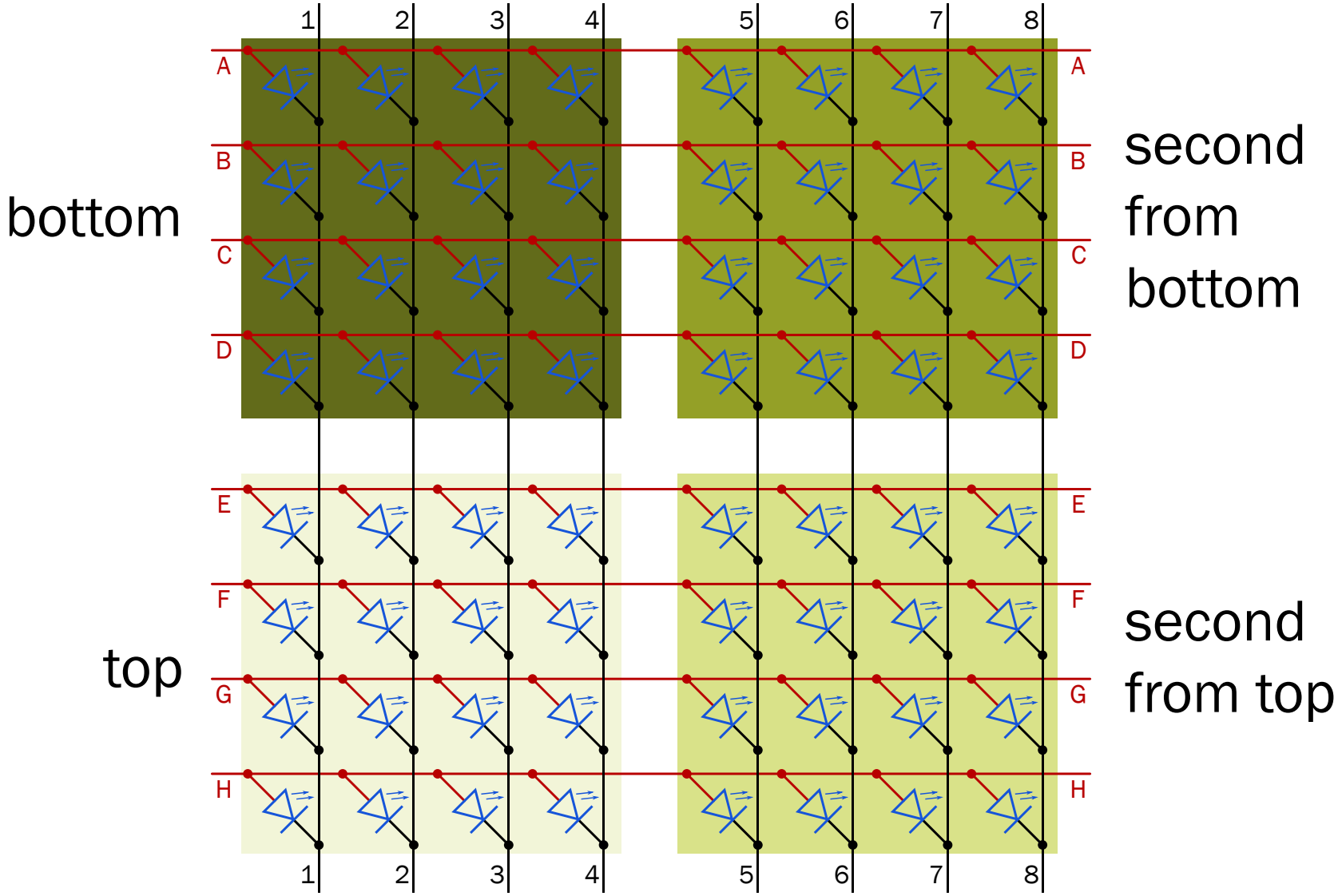
Electrically it's an array, but physically…



How do we arrange these in a $4 \times 4 \times 4$ cube?

...it's a cube?

...it's a cube?


1
2
3
4
5
6
7
8
A
B
C
D
E
F
G
H
bottom
top
second from bottom
second from top

Decomposition

`loop()` — The main Arduino loop

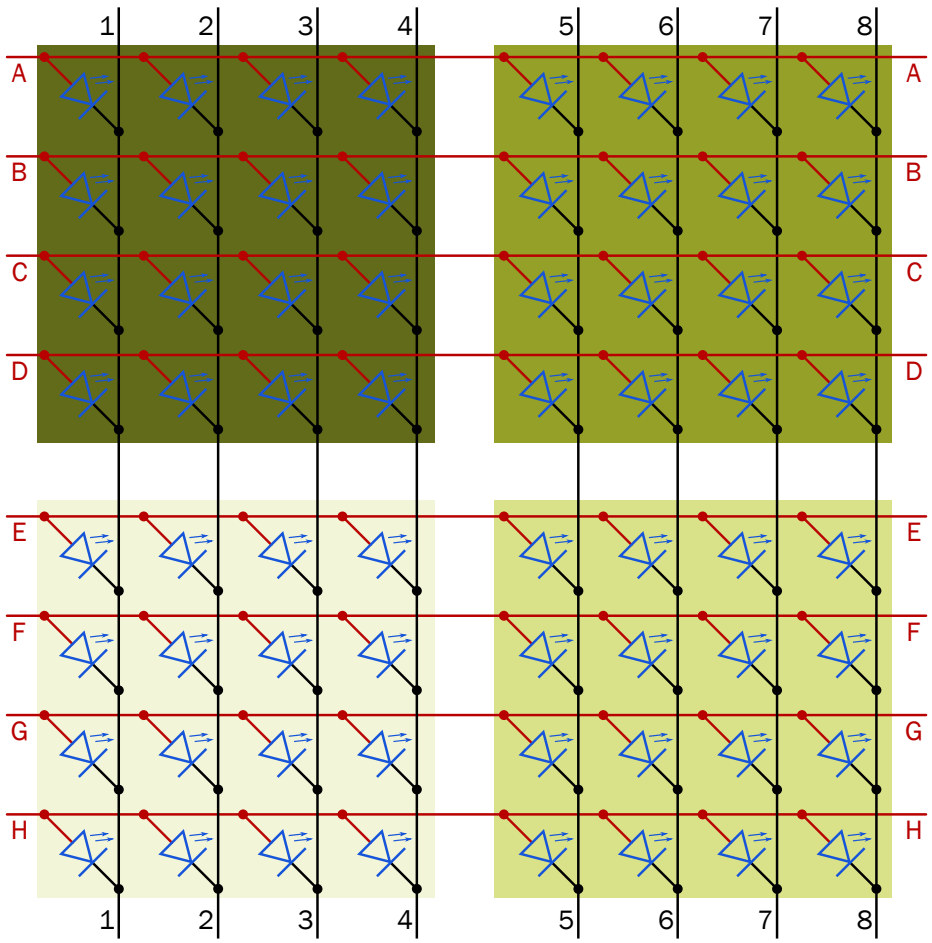
calls

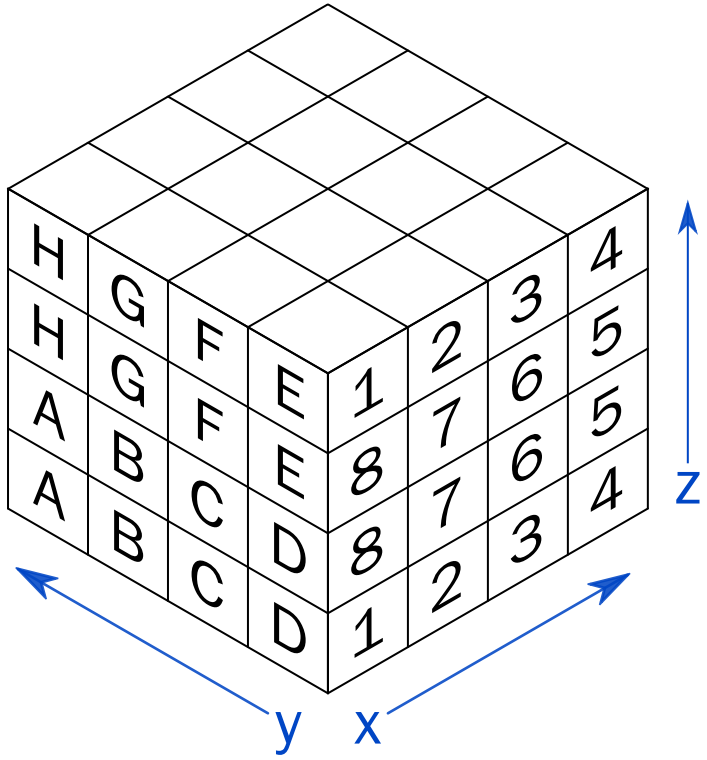
`display()` — Does one pass through the LEDs (time-division multiplexing)

which calls

`getLEDState()` — Looks up the LED state associated with an anode/cathode pair

Mapping between 2-D and 3-D



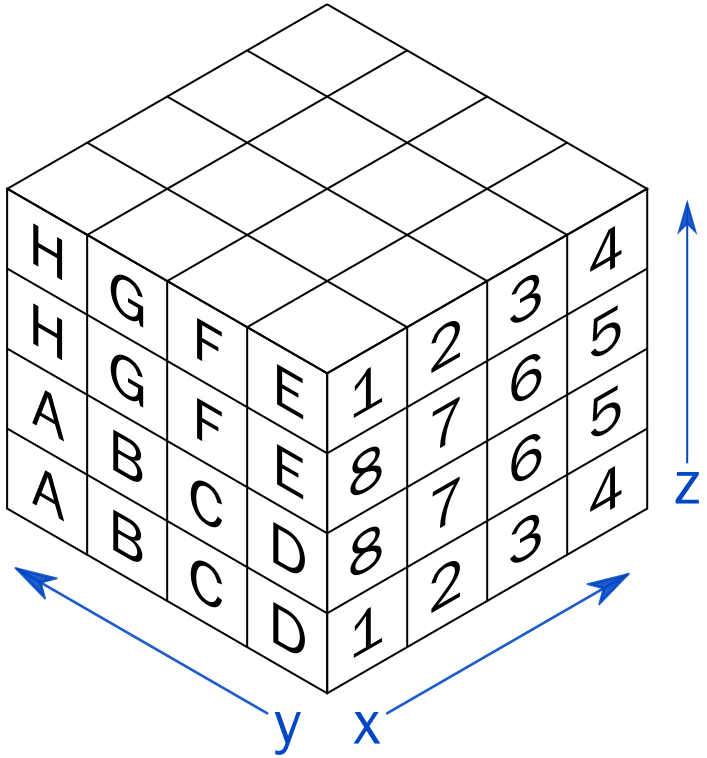


Mapping between 2-D and 3-D

We want a function that maps

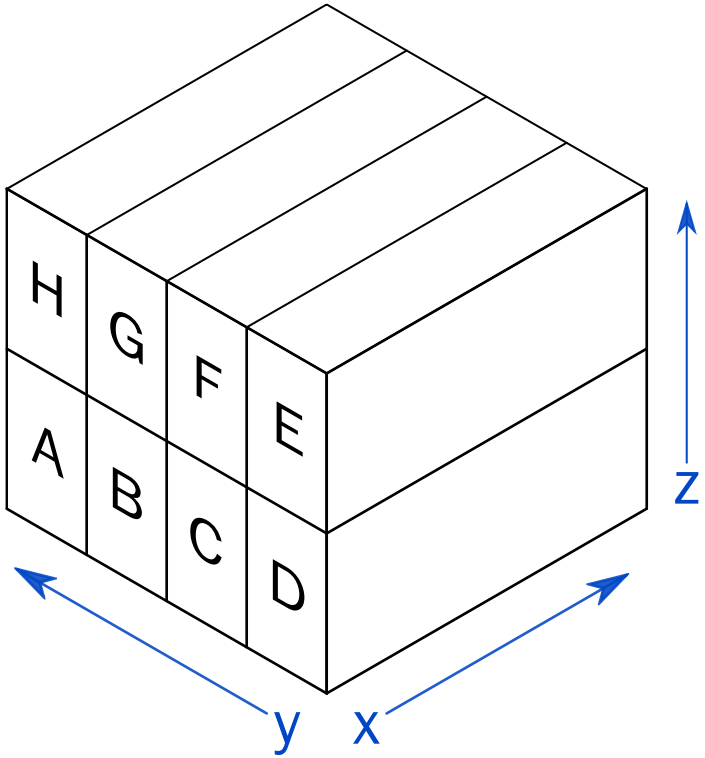
from anode/cathode pairs
(a, c)
(e.g. "D6")

to 3D coordinates
(x, y, z)

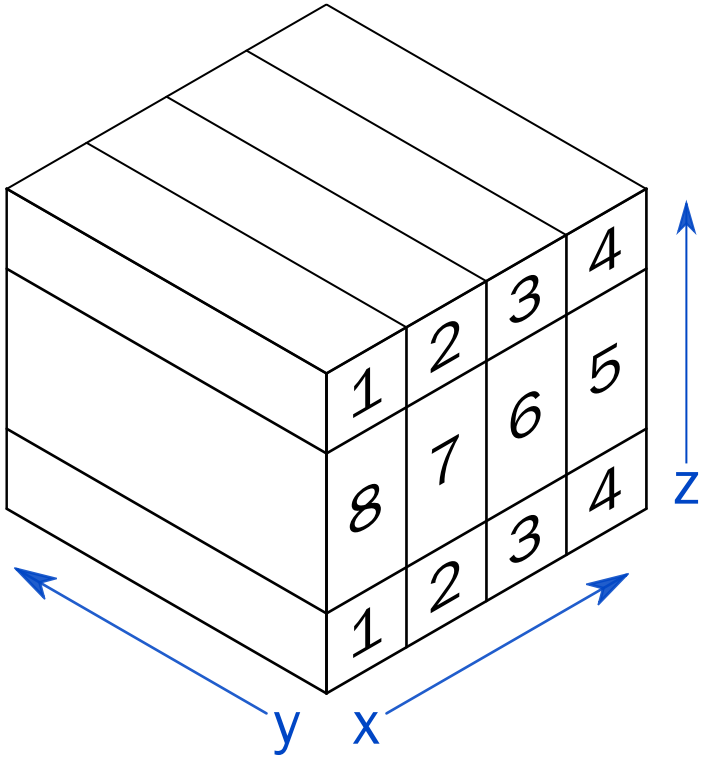


Mapping between 2-D and 3-D

Anodes



Cathodes



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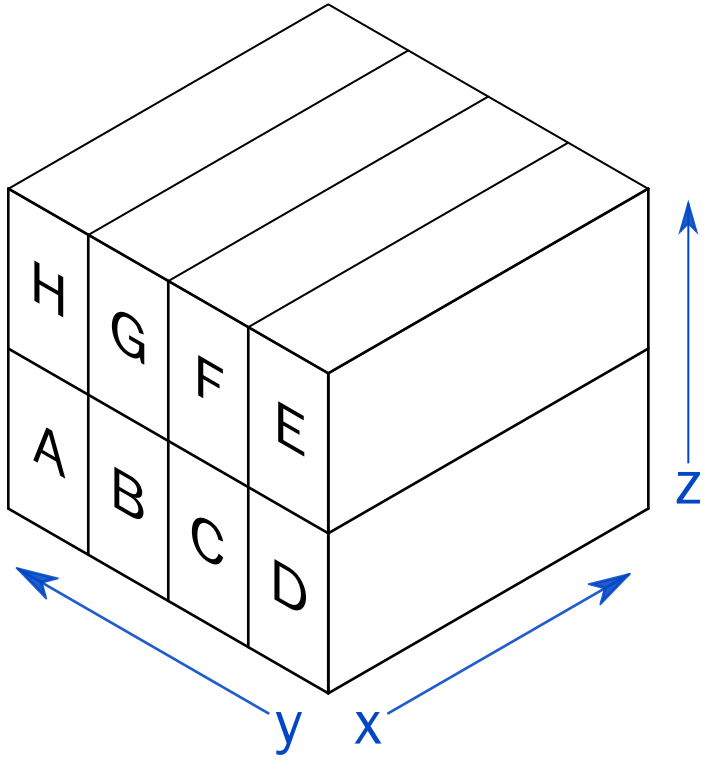

Operations we might consider using:

- * (multiplication)
- % (modulo division)
- / (integer division)
- & (bitwise and)
- | (bitwise or)
- ^ (bitwise xor)

What do bitwise operations do?

- Bitwise operations apply to **each bit** in the binary representation of a number **individually**

Examples (in binary):

```
00110101 | 01100011 == 01110111
00110101 & 01100011 == 00100001
```

```
  00110101        00110101
| 01100011      & 01100011
  01110111        00100001
```

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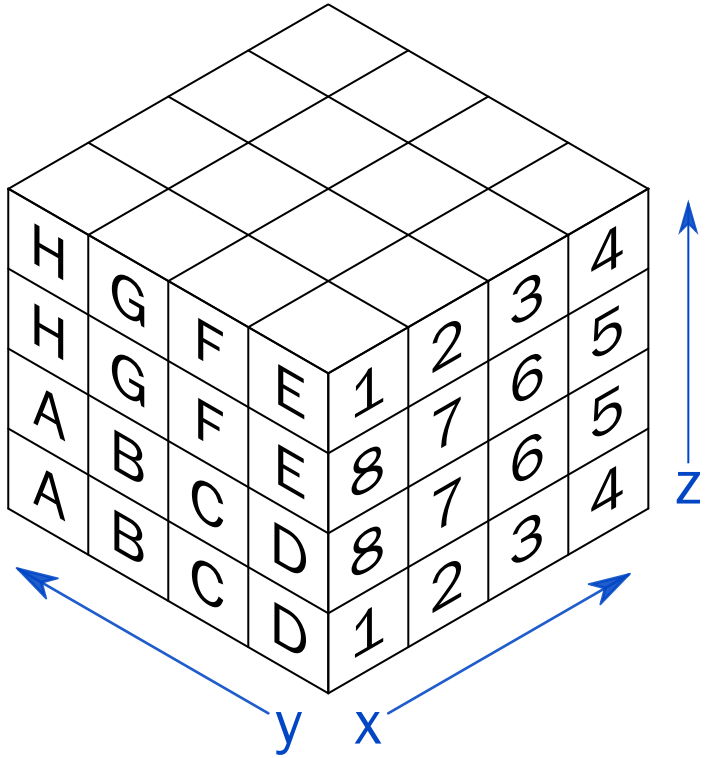
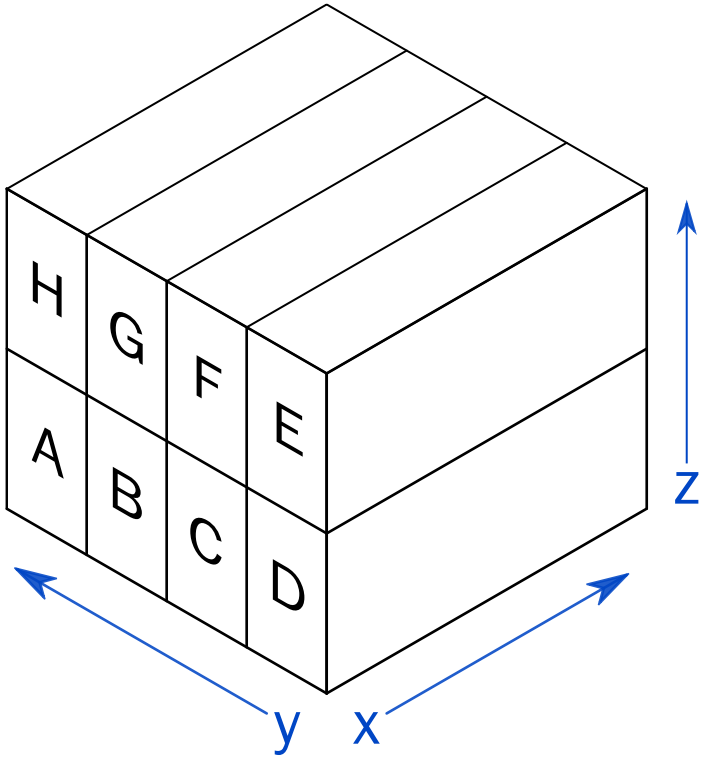
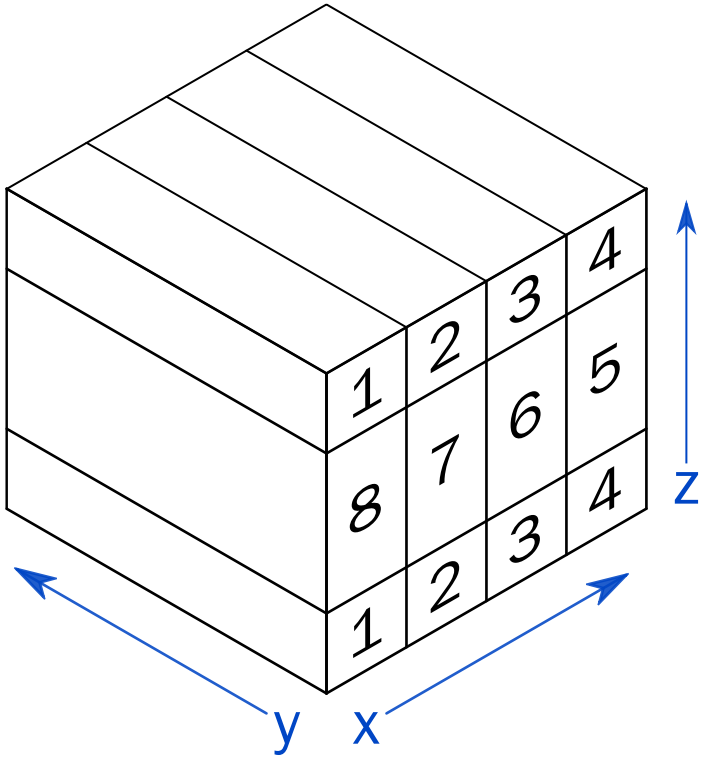


Mapping between 2-D and 3-D

Anodes

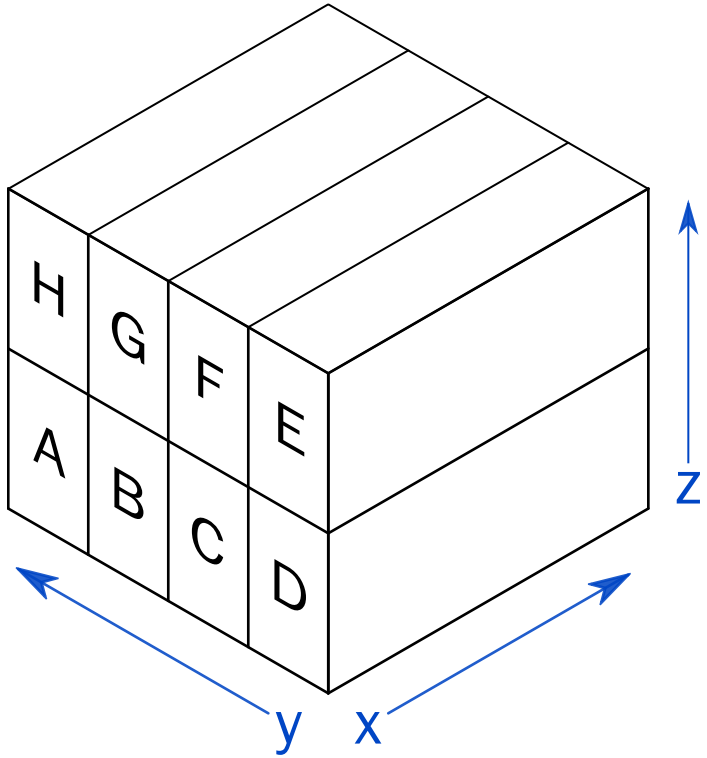


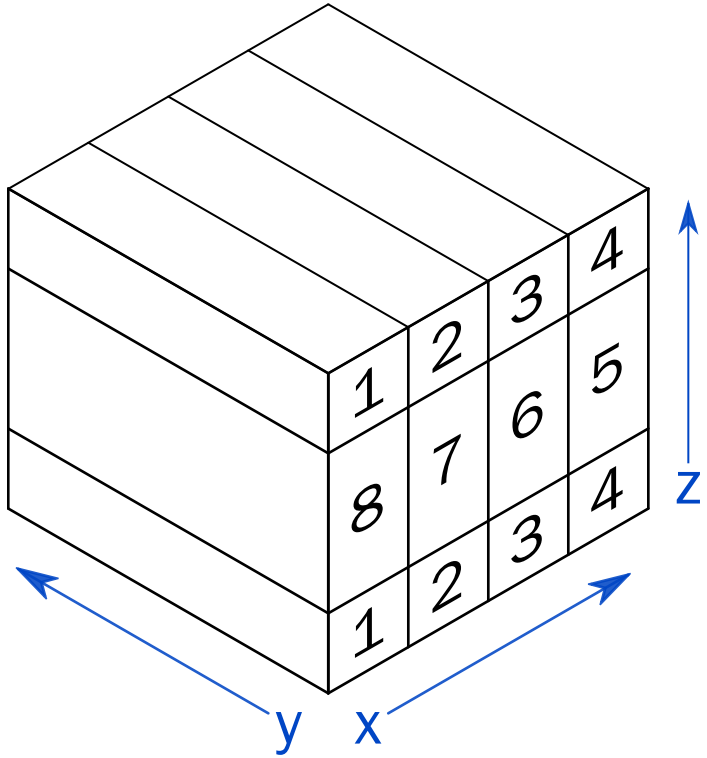
Cathodes



Making the mapping function easier

You can reorder the anodes/cathodes however you like.
Would a different ordering make the relationship simpler?





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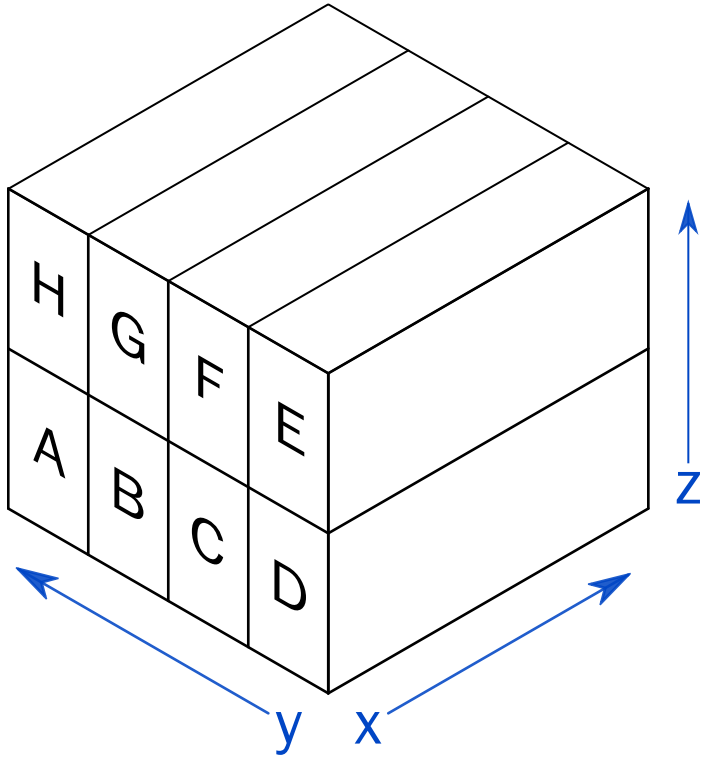

Mapping between 2-D and 3-D