What is...quantum topology - part 17?

Or: Monoidal categories 5 from Chapter 3

Generators-relations

Groups encoded efficiently

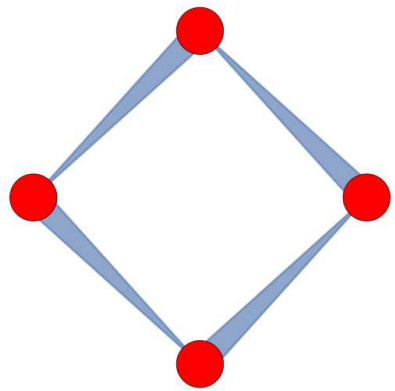
$\mathbb{Z}/4\mathbb{Z}$ (written additively):

$+$	0	1	2	3
0	0	1	2	3
1	1	2	3	0
2	2	3	0	1
3	3	0	1	2

1 is a generator of $\mathbb{Z}/4\mathbb{Z}$:

$\emptyset = 0, \quad 1 = 1, \quad 11 = 1+1 = 2, \quad 111 = 1+1+1 = 3$

Illustrated as a graph:

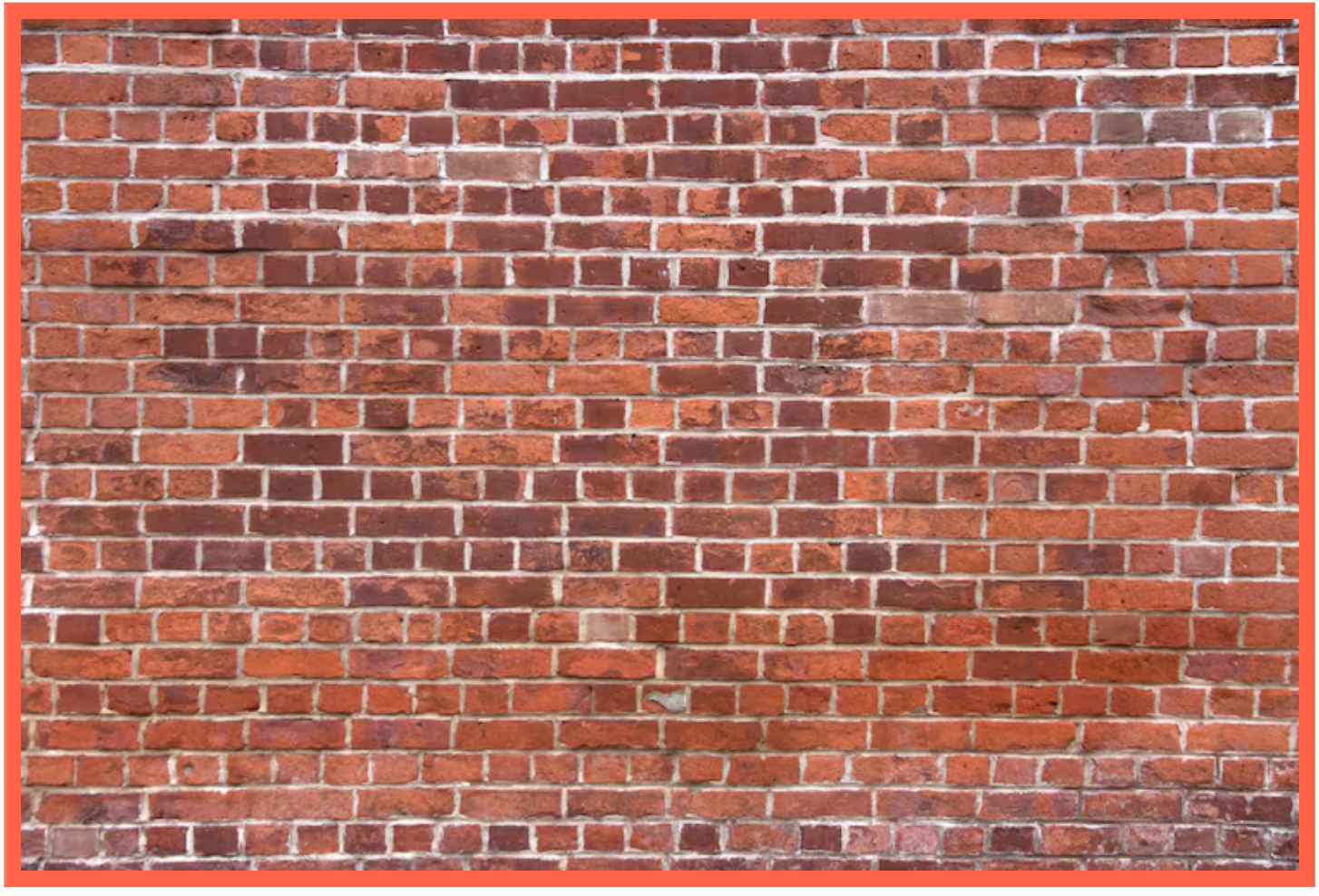


- Above A group given as a multiplication table
- Above 2 A group given by generators-relations
- Game we will play Try to find generators-relations of 'nice' categories

Generators-relations for sets

- Alphabets S = the symbols we use ("pearls"); we do not include $\emptyset$ (id)
- Words = concatenations of pearls on a line
- Relations R = the ways to manipulate pearls

Generators-relations for monoidal categories



- Objects As for sets
- Morphisms Similarly, but we stack them like bricks; generators T
- Relations R $=$ the ways to manipulate bricks

For completeness: A formal definition

Annoying but not difficult to write down...

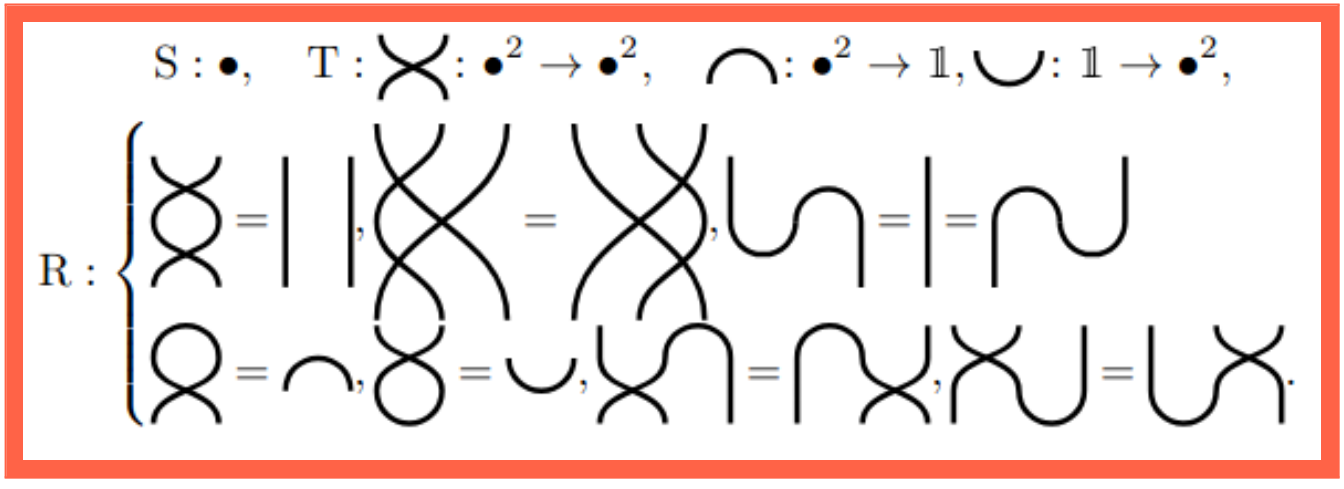
make me a list of the ten most annoying things

Sure — here's a list of ten widely considered annoying things, based on common human experiences. You might relate to a few of them:

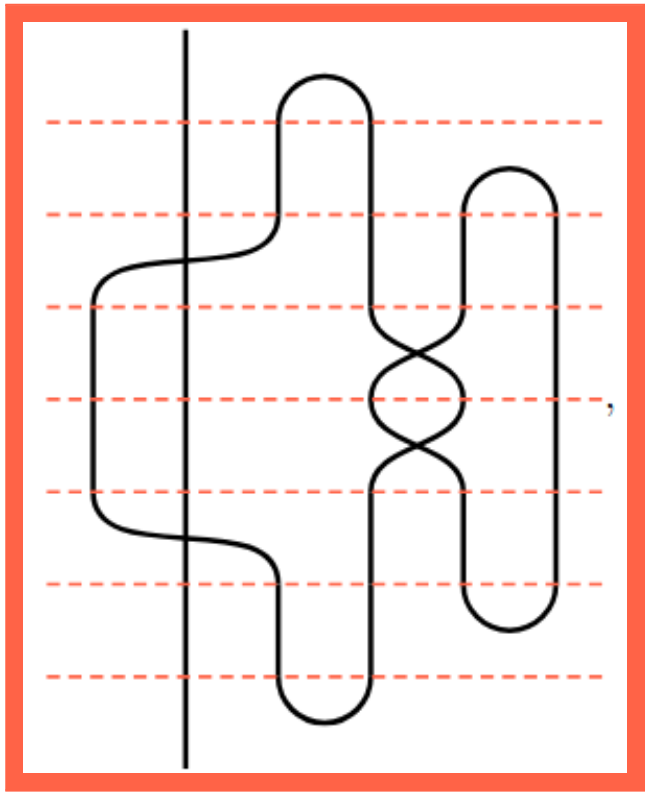
1. **Loud chewing or slurping** – Especially in quiet settings.
2. **Slow walkers in crowded places** – Bonus irritation if they block the whole path.
3. **People who interrupt constantly** – Especially mid-thought.
4. **Unskippable ads (especially back-to-back ones)** – Just let us watch the video!
5. **Getting a song stuck in your head** – And only knowing one line of it.
6. **When autocorrect changes a perfectly fine word** – You meant what you typed!
7. **Wi-Fi cutting out during important moments** – Bonus rage if it's during a live call.
8. **People who leave dishes *near* the sink** – But not *in* it or, better, the dishwasher.
9. **"We need to talk" texts with no follow-up** – Instant stress activation.
10. **Getting ghosted after making plans** – Time is precious, don't waste it!

Want a version that's more niche or targeted (like workplace, roommates, or internet behavior)?

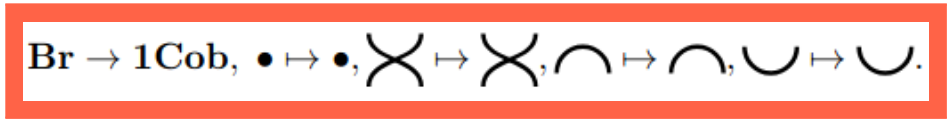
Example The Brauer category Br



A generators-relations presentation



- Theorem Br is monoidally equivalent to 1Cob
- Here is the equivalence :



- Proof? E.g. writing cobordisms in Morse form (as above) shows fullness

Thank you for your attention!

I hope that was of some help.