Goal: Understand what is meant by **a fair share** and how to calculate it.

1. The context of Fair Division

- owners of a company dividing the assets
- roommates dividing chores or accumulated stuff
- head of family dividing estate (house, IRA, ..) among heirs.
- Our examples are mostly about food and other silly things and among friends .... not always the case in real life

2. The definition of **a fair share**:

- N parties (the entities splitting stuff, people, companies...)
- A share is fair if it is worth $\frac{1}{N}$ of the total value.
- (More refined)
  A fair share is one that is worth at least $\frac{1}{N}^{th}$ of the total according to the values of the person receiving the share.

3. An starter example

What is being divided:	6 muffins 2 apple-walnut (A) 2 blueberry (B) 2 cheese & jalepeno (C)
Cost:	the package of 6 cost \$12
Parties (or who is doing the splitting):	Xavier (X), Yuri (Y), and Zariah (Z)
Preferences:	X has no particular preference. Y allergic to all nuts so can't eat the apple ones. Z likes A twice as much as B or C

(a) **Ignoring all preferences** and just using the cost of the package, what is the value of a muffin? $\frac{\$12}{6 \text{ muffins}} = \$2$ per muffin

(b) **In a dollar amount**, what would be **the value of** a fair share in this case? $\$12/3 \text{ parties} = \$4$ per party

(c) Fill out the table below indicating for each party (X,Y, or Z), the dollar amount **they** would assign to each muffin. The total value should always sum to \$12. (!!)

party	A	A	B	B	C	C	total for package
X	2	2	2	2	2	2	\$12
Y	0	0	3	3	3	3	\$12
Z	2 3	2 3	1 1.50	1 1.50	1 1.50	1 1.50	\$8 ← \$4 short! \$12

trial and error →

4. **YOU** pick a division of the 6 muffins into three fair shares according to **Xavier's values.**

Many correct answers! → S_1: AA, S_2: BB, S_3: CC. Each worth \$4 to X. ← all are fair

5. What is the value of the each share according to **Yuri's** values?

S_1 worth \$0, S_2 and S_3 worth \$6
↑ not fair ← fair

6. What is the value of the each share according to **Zariah's** values?

S_1 worth \$6, S_2 and S_3 each worth \$3
↑ fair ← not fair