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Assignment 0

Example 1: We define

$$S_n = 1 + 2 + ... + n.$$

We present a proof of this formula without induction. We write S_n in two ways as follows:

$$S_n = 1 + 2 + ... + (n-1) + n$$
$$S_n = n + (n-1) + ... + 2 + 1$$

Notice that on the right side we have two rows and n columns. In each column the sum of the two numbers is $n+1$. Indeed, the sum in the first column is $1+n = n+1$, in the second column is $2+(n-1) = n+1$, and so on.

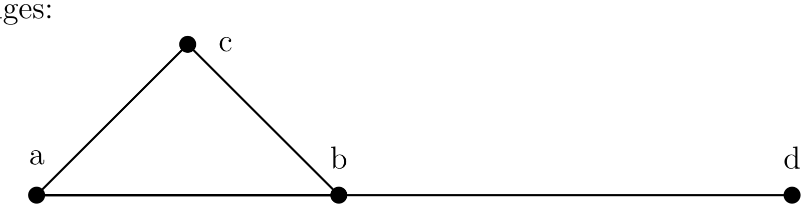
So, if we add the two rows we obtain

$$2S_n = (n+1) + (n+1) + ... + (n+1) = n \times (n+1).$$

and therefore $S_n = n(n+1)/2$.

Of course, there is also a proof by induction, but it is less fun.

Example 2: The following is a directed graph with 3 vertices and 3 edges:



Example 3: Here is a formula involving the greek letters α, β and ϵ:

$$\alpha^2 + \beta^2 = \epsilon^2.$$