223 (factor count) Write a program to find the number of distinct factors (not necessarily prime factors) of a given natural number.

After trying the question, scroll down to the solution.

§ Let the given natural number be n. We consider only natural numbers to be factors. We can say m is a factor of n in either of the following ways:

$n: m{\times}nat$ $\qquad\qquad$ $mod\ n\ m = 0$

If $n{=}0$ then all natural numbers are factors, and the result is ∞. So exclude $n{=}0$.

Let c be a natural variable to count the factors of n. Our specification S is

$S \;=\; c' = \not\in\S m: 1,..n{+}1\cdot\ n: m{\times}nat$

Let p be a natural variable, and define specification R as

$R \;=\; c' = c + \not\in\S m: p,..n{+}1\cdot\ n: m{\times}nat$

We now refine

$S \Leftarrow p{:=}\,1.\ c{:=}\,0.\ R$

$R \Leftarrow$ **if** $n: p{\times}nat$ **then** $c{:=}\,c{+}1$ **else** *ok* **fi**. **if** $p{=}n$ **then** *ok* **else** $p{:=}\,p{+}1.\ R$ **fi**

If $n: p{\times}nat$ is an implemented expression (in the programming language), we are done. If not, then use $mod\ n\ p = 0$ in its place.