Lecture #3: Modelling Computation of Functions II

What Will Happen During the Lecture

Remember... You Had Homework!

Students were asked to have worked through a set of notes before this first lecture:

- Lecture Notes — “Modelling Computation of Functions II”

Of course, you may attend the lecture presentation if you have not worked through this material ahead of time — but it will not be repeated for you during the lecture presentation.

Solving a Problem

A ***perfect number*** is an integer that is greater than or equal to 2 that is equal to the sum of its positive integer divisors — including 1 but not including itself. For example, 6 is the smallest perfect number because

$$6 = 1 + 2 + 3$$

and none of 2, 3, 4 or 5 are perfect. As of December 2018, 51 perfect numbers are known.

In this lecture, a predicate $p_{\text{perfect}} : \mathbb{N} \to \{0, 1\}$ and partial function $f_{\text{perfect:}} : \mathbb{N} \to \mathbb{N}$ will be considered:

- For $n \in \mathbb{N}$,

$$p_{\text{perfect}}(n) = \begin{cases} 1 & \text{if } n \text{ is a perfect number,} \\ 0 & \text{if } n \text{ is not a perfect number.} \end{cases}$$

- $f_{\text{perfect}}(0) = 0$. For $n \in \mathbb{N}$ such that $n \geq 1$, $f_{\text{perfect}}(n)$ is the n^{th} perfect number (where there listed in increasing order) if at least n perfect numbers exist — so that $f_{\text{perfect}}(1) = 6$ — and $f_{\text{perfect}}(n)$ is undefined, otherwise.

During the lecture it will be shown that p_{perfect} is a ***primitive recursive*** predicate, and that f_{perfect} is a ***μ-recursive*** partial or total function.

An incomplete set of notes is available. If you would like to get ahead then you can try to fill in these notes (solving some or all of the problem to be considered) before the lecture presentation.