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MS Computer Science
CSE 5400 Functional Programming

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Assignment

1. The post system has variables {x, y, z} and signs {N, |, -, =}

   The productions are:

$$\frac{}{N} \quad \frac{Nx}{Nx|} \quad \frac{Ny}{-y = y} \quad \frac{-y = y \quad y + z = w}{w - y = z}$$

   Eg.

$$\dfrac{\dfrac{\dfrac{N}{N|}}{N||} \quad \dfrac{\dfrac{N}{N|}}{+||=||}}{|+||=|||} \qquad \dfrac{\dfrac{N}{N|}}{-|=|}$$

$$|||-|=||$$

2. The post system has variables {x, y, z} and signs {N, |, ·, !, =}

   The productions are:

$$\frac{}{N} \quad \frac{Nx}{Nx|} \quad \frac{Nx}{x\ \cdot =} \quad \frac{x \cdot y = z}{x \cdot y| = xz} \quad \frac{x \cdot y = z}{xy! = z|} \quad \frac{x! = z}{x! = xz}$$

   Proof: |||!=||||

$$\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{N}{N|}}{N||}}{||\cdot =}}{||\cdot|=||}}{|||!=|||}}{|||!=||||||}$$

3. This post system produces multiples of *x* where *x* = {|,||,|||...}

   Eg. *x* = ||| produces ||||||||| (3 * 3 = 9)

$$\frac{\mathrm{N}}{\mathrm{N|}}\quad\frac{\mathrm{N|}}{\mathrm{N|||}}\quad\frac{\mathrm{N|||}}{\mathrm{|||\cdot=}}\quad\frac{\mathrm{|||\cdot=}}{\mathrm{|||\cdot|=|||}}\quad\frac{\mathrm{|||\cdot|=|||}}{\mathrm{|||\cdot||=|||||||}}\quad\frac{\mathrm{|||\cdot||=|||||||}}{\mathrm{|||\cdot|||=|||||||||}}\quad\frac{\mathrm{|||\cdot|||=|||||||||}}{\mathrm{|||||||||}}$$

6. Given the **MIU** post system

$$\frac{}{MI}\quad\frac{xI}{xIU}\quad\frac{Mx}{Mxx}\quad\frac{xIIIy}{xUy}\quad\frac{xUUy}{xy}$$

MU	Begins with M	Ends in U	2 characters

Production	**Beginning with**	**Ending with**	**Total characters**
1	M	I	2
2	M / I / U	U	> 2
3	M	M / I / U	> 1
4	M / I / U	M / I / U	> 1
5	M / I / U	M / I / U	> 0

Eg.

$$\frac{\mathrm{MI}}{\mathrm{MIU}}\quad\frac{\mathrm{MIU}}{\mathrm{MIUIU}}\qquad\qquad\frac{\mathrm{MI}}{\mathrm{MII}}\quad\frac{\mathrm{MII}}{\mathrm{MIIU}}\quad\frac{\mathrm{MIIU}}{\mathrm{MUU}}$$

According to production 2, for a string ending in **I**, a **U** can be appended.
According to production 3, a string occurring after **M** can be doubled.
According to production 4, a string containing **III** can be replaced by a **U.**
According to production 5, a string containing **UU** can be removed.

Rule 3, can double the number of strings and rule 4 can reduce it by 3.

Eg.

$$\frac{\frac{\frac{MI}{MII}}{MIIII}}{MUI}$$

This means that the number of **I**'s should be divisible by 3.
But MI cannot be replaced by **MU** since **MI** contains only 1 **I** and 1 is not divisible by 3.

This justifies that **MU** is not derivable in the MIU post system.

9.

$$\frac{\frac{\frac{P}{FP} \quad \frac{\frac{P}{FP}}{FNP}}{FCNPN} \quad \frac{P}{FP}}{ThCCPCNPPCCCNPPPCPP} \quad \frac{\frac{P}{FP} \quad \frac{P}{FP}}{ThCPCNPP}}{ThCCCNPPPCPP} \quad \frac{\frac{P}{FP}}{ThCCNPPP}}{ThCPP}$$

X. Consider the following post canonical system:

$$\frac{}{()} \quad \frac{N}{[N]} \quad \frac{N}{\{N\}}$$

Eg.

$$\frac{\frac{()}{[()]}}{\{[()]\}}$$