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Optimization in Computer Networks

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1 NUM Problem

$$
\begin{aligned}
\max_{x} \quad & \sum_{i=1}^{3} x_i \\
\text{s.t.} \quad & \\
& x_1 \leq 20 \\
& x_1 + x_2 \leq 30 \\
& x_2 \leq 20 \\
& x_2 + x_3 \leq 30 \\
& x_3 \leq 25 \\
& x_2 \leq \log(x_1)
\end{aligned}
\tag{1.1}
$$

1.1 Standard Form

$$\max_x \quad \sum_{i=1}^{3} x_i$$

s.t.

$$\begin{aligned} & x_1 - 20 \leq 0 \\ & x_1 + x_2 - 30 \leq 0 \\ & x_2 - 20 \leq 0 \\ & x_2 + x_3 - 30 \leq 0 \\ & x_3 - 25 \leq 0 \\ & x_2 - \log(x_1) \leq 0 \end{aligned} \tag{1.2}$$

1.1.1 Barriers

$$\begin{aligned} \max_x \quad & \sum_{i=1}^{3} x_i \\ & + \mu \frac{1}{x_1 - 20} \\ & + \mu \frac{1}{x_1 + x_2 - 30} \\ & + \mu \frac{1}{x_2 - 20} \\ & + \mu \frac{1}{x_2 + x_3 - 30} \\ & + \mu \frac{1}{x_3 - 25} \\ & + \mu \frac{1}{x_2 - \log(x_1)} \end{aligned} \tag{1.3}$$