Let $f(x) = x^k$, $\mathcal{P} = \{0, 1, ..., n\}$. Then, $L(f, \mathcal{P}) = \sum_{i=1}^{n} m_i = \sum_{i=1}^{n}(n-1)^k = S_k(n-1)$ and $U(f, \mathcal{P}) = \sum_{i=1}^{n} M_i = \sum_{i=1}^{n}(n)^k = S_k(n)$.

So, know

$$L(f, \mathcal{P}) \leq \int_0^n f(x)dx \leq M f, \mathcal{P}$$

and

$$\int_0^n x^k dx = \frac{n^{k+1}}{n+1}$$

And so,

$$S_k(n-1) = L(f, \mathcal{P}) \leq \int_0^n x^k dx = \frac{n^{k+1}}{n+1} \leq M(f, \mathcal{P}) = S_k(n)$$

So

$$S_k(n-1) \leq \frac{n^{k+1}}{n+1} \leq S_k(n)$$

As desired.