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1. Introduction

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2. Main Results

Let $\mathcal{S}$ denote the set of objects satisfying some condition.

Definition 2.1. Let n be a positive integer. An object has the property $P(n)$ if some additional condition involving the integer n is satisfied. We will denote by S_n the set of all s in $\mathcal{S}$ with the property $P(n)$.

The following proposition is a simple consequence of the definition.

Proposition 2.2. *The sets $S_1, S_2, \ldots$ are mutually exlusive.*

Lemma 2.3. *If $\mathcal{S}$ is infinite then $\mathcal{S} = \bigcup_{n=1}^{\infty} S_n$.*

Proof. Since $\mathcal{S}$ is the set of objects satisfying some condition, it follows from [**?**]. that

$$\mathrm{obj}(\mathcal{S}) < 1. \tag{2.1}$$

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Figure 1. An EPS Picture Example.

By [**?**, Theorem 3.17] we have

$$\operatorname{obj}(S_n) > 2^{-n}$$

for each positive integer n. This result combined with (**??**) and Proposition **??** completes the proof of the lemma. $\square$

$$\begin{tikzcd}
X_0 \arrow[d, "f_0"'] & X_1 \arrow[l, "g_1"'] \arrow[d, "f_1"'] & X_2 \arrow[l, "g_2"'] \arrow[d, "f_2"'] & X_3 \arrow[l, "g_3"'] \arrow[d, "f_3"'] & \dots \arrow[l, "g_4"'] \\
Y_0 & Y_1 \arrow[l, "h_1"] & Y_2 \arrow[l, "h_2"] & Y_3 \arrow[l, "h_3"] & \dots \arrow[l, "h_4"]
\end{tikzcd} \tag{*}$$

Theorem 2.4 (Main Theorem)**.** *Let $f : \mathcal{S} \to \mathcal{S}$ be a function such that $f(S_n) \subset S_{n+1}$ for each positive integer n. Then the following conditions are equivalent.*

(1) $\mathcal{S} = \emptyset$.
(2) $S_n = \emptyset$ *for each positive integer* n.
(3) $f(\mathcal{S}) = \mathcal{S}$.

Remark 2.5. Observe that the condition in the definition of $\mathcal{S}$ may be replaced by some other condition.

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Department of Mathematics, Auburn University, Auburn, Alabama 36849
E-mail address: `topolog@auburn.edu`