§0. Introduction

In the paper we propose certain methods of economizing the storage space of a computer while storing there a system of information storage and retrieval.

The problem may be viewed as follows. As observed by the second author and Z. Pawlak (cf. [5]) while a family of sets is stored in the memory of a computer it is reasonable to put together elements of every component of the family. If we want however to retrieve the sets of this family as segments we have to resign the economy and to store the same components several times. But still the redundancy less than that in the method of inverted files can be achieved. This paper shows how to do this. To solve the problem we apply here the theory developed in the papers [3],[4] and in some special case by S.P. Ghosh in [2].

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§1. Basic Definitions

Throughout the text we use the standard mathematical notation. In particular \( \mathcal{P}(X) \) denotes the power set (i.e. the set of all subsets) of \( X \), \( |Y| \) is the cardinality of a set \( Y \).

**Definition 1.1.** (a) An \( f \)-graph on \( X \) is an ordered pair \( \langle X, S \rangle \) where \( S \subseteq X \times X \) is a function without fixed points.

(b) A set \( Y \subseteq X \) is a segment in \( \langle X, S \rangle \) if

\[
Y = \{ x, S(x), \ldots, S^{\mid Y \mid - 1}(x) \}
\]

for some \( x \in Y \) or \( Y = \emptyset \). Such an \( x \) is called a head of \( Y \) and \( S^{\mid Y \mid - 1}(x) \) the tail corresponding to the head \( x \). If in addition \( S^{\mid Y \mid}(x) = x \) then the segment \( Y \) is called a cycle.

(c) A family \( M \subseteq \mathcal{P}(X) \) is segmental over \( \langle X, S \rangle \) if each \( M \in M \) is a segment in \( \langle X, S \rangle \).

(d) A family \( M \subseteq \mathcal{P}(X) \) is admissible if there exists an \( f \)-graph \( \langle X, S \rangle \) such that \( M \) is segmental over it.

**Example 1.2.** Let \( M = \{ \{1,2\}, \{2,3\}, \{3,1\}, \{4,2\} \} \). Then \( M \) is admissible (segmental over the \( f \)-graph shown in Fig. 1), whereas \( M \cup \{\{4,3\}\} \) is not admissible.

![Fig. 1. An admissible family of sets and an f-graph realizing its admissibility.](image)

Among \( f \)-graphs we distinguish **linear** \( f \)-graphs (which have the form of a single path), **cyclic** \( f \)-graphs (having the form of a cycle) and **acyclic** \( f \)-graphs (having no cycles). Similarly among admissible families we distinguish **linear**, **cyclic** and **acyclic** families (segmental over an \( f \)-graph of the corresponding type).

\( f \)-graphs can be used to describe different types of storage, e.g. tapes (linear \( f \)-graphs), drums, discs (cyclic \( f \)-graphs), a storage