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A Theory of Sequential Files

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Summary. This article is a continuation of [6]. We present the notion of files and records. These are two finite sequences. One is a record and another is a separator for the carriage return and/or line feed. So, we define the record. The sequential text file contains records and separators. Generally, a record and a separator are paired in the file. And in a special situation, the separator does not exist in the file, for that the record is only one record or record is nothing. And the record does not exist in the file, for that some separator is in the file. In this article, we present a theory for files and records.

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The terminology and notation used here are introduced in the following articles: [11], [12], [7], [1], [10], [13], [8], [2], [3], [4], [9], [5], and [6].

In this paper a, b, c denote sets.

The following propositions are true:

(1) Let D be a non empty set and p, q, r, s be finite sequences of elements of D. Then $p \frown q \frown r \frown s = p \frown (q \frown r) \frown s$ and $(p \frown q \frown r) \frown s = p \frown q \frown (r \frown s)$ and $(p \frown (q \frown r)) \frown s = p \frown q \frown (r \frown s)$.

(2) For every set D and for every finite sequence f of elements of D holds $f \restriction \mathrm{len}\, f = f$.

(3) For every non empty set D and for all finite sequences p, q of elements of D such that $\mathrm{len}\, p = 0$ holds $q = p \frown q$.

(4) Let D be a non empty set, f be a finite sequence of elements of D, and n, m be natural numbers. If $n \leq m$, then $\mathrm{len}(f_{\lfloor m}) \leq \mathrm{len}(f_{\lfloor n})$.

(5) For every non empty set D and for all finite sequences f, g of elements of D such that $\mathrm{len}\, g \geq 1$ holds $\mathrm{mid}(f \frown g, \mathrm{len}\, f + 1, \mathrm{len}\, f + \mathrm{len}\, g) = g$.

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(6) Let D be a non empty set, f, g be finite sequences of elements of D, and i, j be natural numbers. If $1 \leq i$ and $i \leq j$ and $j \leq \mathrm{len}\, f$, then $\mathrm{mid}(f \frown g, i, j) = \mathrm{mid}(f, i, j)$.

(7) Let D be a non empty set, f be a finite sequence of elements of D, and i, j, n be natural numbers. If $1 \leq i$ and $i \leq j$ and $i \leq \mathrm{len}(f{\restriction}n)$ and $j \leq \mathrm{len}(f{\restriction}n)$, then $\mathrm{mid}(f, i, j) = \mathrm{mid}(f{\restriction}n, i, j)$.

(8) For every non empty set D and for every finite sequence f of elements of D such that $f = \langle a \rangle$ holds $a \in D$.

(9) For every non empty set D and for every finite sequence f of elements of D such that $f = \langle a, b \rangle$ holds $a \in D$ and $b \in D$.

(10) Let D be a non empty set and f be a finite sequence of elements of D. If $f = \langle a, b, c \rangle$, then $a \in D$ and $b \in D$ and $c \in D$.

(11) For every non empty set D and for every finite sequence f of elements of D such that $f = \langle a \rangle$ holds $f{\restriction}1 = \langle a \rangle$.

(12) For every non empty set D and for every finite sequence f of elements of D such that $f = \langle a, b \rangle$ holds $f_{\downharpoonleft 1} = \langle b \rangle$.

(13) For every non empty set D and for every finite sequence f of elements of D such that $f = \langle a, b, c \rangle$ holds $f{\restriction}1 = \langle a \rangle$.

(14) For every non empty set D and for every finite sequence f of elements of D such that $f = \langle a, b, c \rangle$ holds $f{\restriction}2 = \langle a, b \rangle$.

(15) For every non empty set D and for every finite sequence f of elements of D such that $f = \langle a, b, c \rangle$ holds $f_{\downharpoonleft 1} = \langle b, c \rangle$.

(16) For every non empty set D and for every finite sequence f of elements of D such that $f = \langle a, b, c \rangle$ holds $f_{\downharpoonleft 2} = \langle c \rangle$.

(17) For every non empty set D and for every finite sequence f of elements of D such that $\mathrm{len}\, f = 0$ holds $\mathrm{Rev}(f) = f$.

(18) Let D be a non empty set, r be a finite sequence of elements of D, and i be a natural number. If $i \leq \mathrm{len}\, r$, then $\mathrm{Rev}(r_{\downharpoonleft i}) = \mathrm{Rev}(r){\restriction}(\mathrm{len}\, r -' i)$.

(19) Let D be a non empty set and f, C_1 be finite sequences of elements of D. If C_1 is not a substring of f and C_1 separates uniquely, then $\mathrm{instr}(1, f \frown C_1) = \mathrm{len}\, f + 1$.

(20) For every non empty set D and for every finite sequence f of elements of D holds every finite sequence f, g of elements of D is a preposition of $(f \frown g)_{\downharpoonleft \mathrm{len}\, f}$.

(21) Let D be a non empty set and f, C_1 be finite sequences of elements of D. Suppose C_1 is not a substring of f and C_1 separates uniquely. Then $f \frown C_1$ is terminated by C_1.

Let D be a set. We introduce file of D as a synonym of finite sequence of elements of D.

Let D be a non empty set and let r, f, C_1 be files of D. We say that r is a record of f and C_1 if and only if:

(Def. 1) $C_1 \frown r$ is a substring of $\mathrm{addcr}(f, C_1)$ or r is a preposition of $\mathrm{addcr}(f, C_1)$ but r is terminated by C_1.

The following propositions are true:

(22) For every non empty set D and for every finite sequence r of elements of D holds $\mathrm{ovlpart}(\varepsilon_D, r) = \varepsilon_D$ and $\mathrm{ovlpart}(r, \varepsilon_D) = \varepsilon_D$.

(23) For every non empty set D holds every finite sequence C_1 of elements of D is a record of ε_D and C_1.

(24) Let D be a non empty set, a, b be sets, and f, r, C_1 be files of D. Suppose $a \neq b$ and $D = \{a, b\}$ and $C_1 = \langle b \rangle$ and $f = \langle b, a, b \rangle$ and $r = \langle a, b \rangle$. Then C_1 is a record of f and C_1 and r is a record of f and C_1.

(25) For every non empty set D and for all files f, C_1 of D holds f is a preposition of $f \frown C_1$.

(26) For every non empty set D and for all files f, C_1 of D holds f is a preposition of $\mathrm{addcr}(f, C_1)$.

(27) For every non empty set D and for all files r, C_1 of D such that C_1 is a postposition of r holds $0 \leq \mathrm{len}\, r - \mathrm{len}\, C_1$.

(28) For every non empty set D and for all files C_1, r of D such that C_1 is a postposition of r holds $r = \mathrm{addcr}(r, C_1)$.

(29) For every non empty set D and for all files C_1, r of D such that r is terminated by C_1 holds $r = \mathrm{addcr}(r, C_1)$.

(30) For every non empty set D and for all files f, g of D such that f is terminated by g holds $\mathrm{len}\, g \leq \mathrm{len}\, f$.

(31) For every non empty set D and for all files f, C_1 of D holds $\mathrm{len}\, \mathrm{addcr}(f, C_1) \geq \mathrm{len}\, f$ and $\mathrm{len}\, \mathrm{addcr}(f, C_1) \geq \mathrm{len}\, C_1$.

(32) For every non empty set D and for all finite sequences f, g of elements of D holds $g = (\mathrm{ovlpart}(f, g)) \frown \mathrm{ovlrdiff}(f, g)$.

(33) For every non empty set D and for all finite sequences f, g of elements of D holds $\mathrm{ovlcon}(f, g) = (\mathrm{ovlldiff}(f, g)) \frown g$.

(34) For every non empty set D and for all files C_1, r of D holds $\mathrm{addcr}(r, C_1) = (\mathrm{ovlldiff}(r, C_1)) \frown C_1$.

(35) Let D be a non empty set and r_1, r_2, f be files of D. If $f = r_1 \frown r_2$, then r_1 is a substring of f and r_2 is a substring of f.

(36) Let D be a non empty set and r_1, r_2, r_3, f be files of D. Suppose $f = r_1 \frown r_2 \frown r_3$. Then r_1 is a substring of f and r_2 is a substring of f and r_3 is a substring of f.

(37) Let D be a non empty set and C_1, r_1, r_2 be files of D. Suppose r_1 is terminated by C_1 and r_2 is terminated by C_1. Then $C_1 \frown r_2$ is a substring

of addcr($r_1 \frown r_2, C_1$).

(38) Let D be a non empty set, f, g be files of D, and n be a natural number. If $0 < n$ and $g = \emptyset$, then $\mathrm{instr}(n, f) = n$.

(39) Let D be a non empty set, f, g be files of D, and n be a natural number. If $0 < n$ and $n \leq \mathrm{len}\, f$, then $\mathrm{instr}(n, f) \leq \mathrm{len}\, f$.

(40) For every non empty set D and for every file f of D holds every file f, C_1 of D is a substring of ovlcon(f, C_1).

(41) For every non empty set D and for every file f of D holds every file f, C_1 of D is a substring of addcr(f, C_1).

(42) Let D be a non empty set, f, g be finite sequences of elements of D, and n be a natural number. If g is a substring of $f{\restriction}n$ and $\mathrm{len}\, g > 0$ and $\mathrm{len}\, g \leq n$, then g is a substring of f.

(43) For every non empty set D and for all files f, C_1 of D holds there exists a file of D which is a record of f and C_1.

(44) For every non empty set D and for all files f, C_1, r of D such that r is a record of f and C_1 holds r is a record of r and C_1.

(45) Let D be a non empty set and C_1, r_1, r_2, f be files of D. Suppose r_1 is terminated by C_1 and r_2 is terminated by C_1 and $f = r_1 \frown r_2$. Then r_1 is a record of f and C_1 and r_2 is a record of f and C_1.

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