

Research Article

Exploiting mathematical positional notation in consumer debt-collection cases to uncover fraud in electronic banking documents without relying on metadata

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ABSTRACT

In 2016, Emmy Award winning host John Oliver reported on the debt-collection industry, in which he exposed fraud being committed on a massive scale. That same fraud-prevalent industry has been the subject of numerous investigations and penalties imposed by the Consumer Financial Protection Bureau (CFPB). Because the fraudulent behaviors of debt collectors have been exposed through lawsuits and reports from various media outlets, debt collectors now employ more sophisticated evidence-manufacturing techniques in pursuit of their collection efforts. Those techniques are so convincing that alleged debtors face resistance from courts that routinely enter adverse judgments based on the manufactured evidence. Insofar as judges are less familiar with metadata in electronic documents but more familiar with traditional mathematical concepts, this paper introduces procedures that use traditional (and relatively simple) mathematics to reliably detect anomalies in manufactured electronic evidence. Specifically, this paper introduces how mathematical positional notation can be exploited in consumer debt-collection cases to uncover fraud in electronic banking documents without relying on metadata.

Keywords: Positional notation, Numerical representation, Base-10 system, Number encoding, Mathematical notation, Decimal structure, Digital numeric

INTRODUCTION

In 2016, Emmy Award winning host John Oliver reported on the debt-collection industry, in which he exposed fraud being committed on a massive scale in that industry [1-3]. That same fraud-rife industry has been the subject of numerous investigations and penalties imposed by the Consumer Financial Protection Bureau (CFPB), whose parent agency is the U.S. Federal Reserve [4,5].

Because the fraudulent behaviors of debt collectors have been exposed through lawsuits by the CFPB and through reports from various media outlets, debt collectors now employ more sophisticated electronic-evidence-manufacturing techniques in pursuit of their debt-collection efforts [6-8]. Those techniques are so convincing that alleged debtors face resistance from courts that routinely ignore the anomalies in the manufactured evidence and

enter judgment against consumer-debtors based on the manufactured evidence [9].

Insofar as judges are less familiar with metadata in electronic documents but have sufficient familiarity with traditional mathematics, this paper introduces procedures that use traditional (and relatively simple) mathematics (e.g., counting and positional notation (including decimal points)) to reliably detect anomalies in manufactured electronic evidence. Specifically, this paper introduces how mathematical positional notation can be exploited in consumer debt-collection cases to uncover fraud in electronic banking documents without relying on metadata.

MATERIALS AND METHODS

For purposes of organization, this paper includes the following sections:

- Section 2 discusses the mathematical concept of positional notation and counting digits beyond a radix (or decimal point).
- Section 3 shows examples from paper documents that were allegedly printed directly from original electronic documents.
- Section 4 applies positional notation (and counting from radix) to those paper printouts and explains why formatting irregularities demonstrate fabrication of evidence.
- Section 5 cites to sworn testimony from debt collectors, thus going beyond the manufactured documents themselves, with the sworn testimony confirming that the documents are not direct printouts from original bank files (but are, instead, made-for-litigation documents).
- Section 6 provides concluding remarks. Before continuing, the author wishes to clarify that this paper is applicable only to the legal system in the United States (U.S.), as the author is not a practitioner in any other foreign jurisdiction.

Also, documents from which enlarged portions were copied for the figures are available from publicly filed court documents (as demonstrated from the electronic court stamp on the documents). Because those documents were downloaded from public records (such as court proceedings), the publicly available documents were uploaded and made available for access through a reputable research repository, such as Zenodo (which is used by the National Aeronautics and Space Administration (NASA)) [10]. In other words, rather than providing an appendix, citations to the Zenodo links are provided in footnotes, along with citations to the court docket numbers for the cases from which the documents were obtained.

Traditional mathematics used to identify anomalies

This section identifies and explains the mathematical principle of positional notation to familiarize the reader before proceeding to subsequent sections that apply positional notation to the printouts of allegedly original electronic bank documents. Also, this section provides the reasons for why positional notation is significant.

Even though professionals in the legal field may be unacquainted with the nomenclature of "positional notation," the authors are fairly confident that everyone is familiar with the concepts associated with positional notation. This is because well-known examples of positional notation include the decimal system [11,12].

Using the decimal system as an example of positional notation, briefly, the decimal system defines the total number of digits in a particular number, including the total number of digits before a radix (*i.e.*, decimal point) and the total number of digits after the radix [13]. Positional notation and counting position based on a radix is relevant to demonstrating the fabrication of documents because, United States (U.S.) banking laws require the expression of currency to be in a very particular decimal format.

Specifically, under the United States Code (USC), "United States money is expressed in dollars, dimes or tenths, cents or hundredths, and mills or thousandths. A dime is a tenth of a dollar, a cent is a hundredth of a dollar, and a mill is a thousandth of a dollar" [14]. Furthermore, the Code of Federal Regulations (CFR) mandates that bank account files be maintained using very strict data structures

[15]. Specifically, the CFR mandates the file to be a tab-delimited or pipe-delimited ASCII (American Standard Code for Information Interchange) file, which is a text file with no additional formatting for style (e.g., bold, underline, italics, etc.) or layout (e.g., justification, margins, pagination, spacing (both horizontal and vertical), etc.) [16,17]. For monetary values, the CFR requires that the specific format be "Decimal [14,2]" (meaning, fourteen (14) total digits, with only two (2) decimal places after a radix (*i.e.*, decimal point)) [18]. The reason for standardizing banking files to ASCII and standardizing the ASCII formats for money and dates is to avoid or prevent errors when digitally transferring funds from one institution to another [19]. As one can imagine, inconsistent treatment of the same data type (such as misplacing a decimal point) can result in catastrophic consequences [20].

Consequently, any file that is allegedly from a U.S. bank that is insured by the Federal Deposit Insurance Company (FDIC) must comply with the USC and CFR formatting requirements. In other words, the USC and CFR compliant entries should not have: (a) More than fourteen (14) total digits; or (b) More than two (2) digits after the decimal point. Also, while not mathematical, any USC or CFR compliant file cannot have data that is formatted for style or layout (because ASCII lacks any ability to preserve layout or style information) [21].

Manufactured evidence to which mathematics are applied

With positional notation explained, this Section 3 reproduces and enlarges several excerpts from printouts that have been filed in various courts. The enlarged portions are shown as figure inserts, with their respective corresponding full documents cited as downloadable links in footnotes. For purposes of illustration, added to the excerpts are red circles, of which one of the circles identifies the relevant number that is later analyzed. Also, for consistency, the examples herein are documents from one (1) particular entity (namely, LVNV Funding, LLC (hereinafter, "LVNV")) filed in one (1) particular jurisdiction (namely, the Municipal Court of Hamilton County, Ohio, USA) [22]. However, the same mathematical principles of positional notation apply to correspondingly similar documents from other similar entities filed in other jurisdictions [23].

RESULTS AND DISCUSSION

With this in mind, the documents for analysis in this paper are shown in the excerpts below, all of which were taken from their respective files in LVNV Funding, LLC v. Tamika Brown, Case Number 24CV01441 (Municipal Court, Hamilton County, Ohio) (hereinafter, "Brown Case"); LVNV Funding, LLC v. Nancy Duvall, Case Number 23CV28211 (Municipal Court, Hamilton County, Ohio) (hereinafter, "Duvall Case"); LVNV Funding, LLC v. Henry Flowers, Case Number 24CV21667 (Municipal Court, Hamilton County, Ohio) (hereinafter, "Flowers Case"); LVNV Funding, LLC v. Paul Loveless, Case Number 24CV17562 (Municipal Court, Hamilton County, Ohio) (hereinafter, "Loveless Case"); LVNV Funding, LLC v. Eileen Pike, Case Number 23CV28432 (Municipal Court, Hamilton County, Ohio) (hereinafter, "Pike Case"); LVNV Funding, LLC v. Damien Townsend, Case Number 23CV28432 (Municipal Court, Hamilton County, Ohio) (hereinafter, "Townsend Case"); and LVNV Funding, LLC v. Baron Wynter, Case Number 24CV21026 (Municipal Court, Hamilton County, Ohio) (hereinafter, "Wynter Case") [24-30].

LineNumber	FirstName	LastName	CurrentBalanceOwing	ChargeOffAmount
2156	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2157	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2158	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2159	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2160	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2161	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2162	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2163	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2164	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2165	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2166	TAMIKA	BROWN	1862.9200	1862.92
2167	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2168	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2169	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2170	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2171	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2172	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2173	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2174	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2175	[Redacted]	[Redacted]	[Redacted]	[Redacted]
2176	[Redacted]	[Redacted]	[Redacted]	[Redacted]

11th Line

LineNumber	CHNAME	BALANCE	Cur_Bal
1523	[Redacted]	[Redacted]	[Redacted]
1524	[Redacted]	[Redacted]	[Redacted]
1525	[Redacted]	[Redacted]	[Redacted]
1526	[Redacted]	[Redacted]	[Redacted]
1527	[Redacted]	[Redacted]	[Redacted]
1528	[Redacted]	[Redacted]	[Redacted]
1529	[Redacted]	[Redacted]	[Redacted]
1530	[Redacted]	[Redacted]	[Redacted]
1531	[Redacted]	[Redacted]	[Redacted]
1532	[Redacted]	[Redacted]	[Redacted]
1533	DUVALL, NANCY	\$1,450.92	1450.9200
1534	[Redacted]	[Redacted]	[Redacted]
1535	[Redacted]	[Redacted]	[Redacted]
1536	[Redacted]	[Redacted]	[Redacted]
1537	[Redacted]	[Redacted]	[Redacted]
1538	[Redacted]	[Redacted]	[Redacted]
1539	[Redacted]	[Redacted]	[Redacted]
1540	[Redacted]	[Redacted]	[Redacted]
1541	[Redacted]	[Redacted]	[Redacted]
1542	[Redacted]	[Redacted]	[Redacted]
1543	[Redacted]	[Redacted]	[Redacted]

11th Line

LineNumber	BrwrFirstName	BrwrLastName	PurchaseBalance	ChgOffBalance	PurchaseIntBal	ChgOffInt
230	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
231	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
232	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
233	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
234	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
235	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
236	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
237	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
238	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
239	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
240	HENRY	FLOWERS	1257.350	1257.35	77.650	77.65
241	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
242	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
243	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
244	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
245	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
246	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
247	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
248	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
249	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
250	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]

11th Line

LineNumber	FirstName	LastName	CurrentBalanceOwing
3141	[Redacted]	[Redacted]	[Redacted]
3142	[Redacted]	[Redacted]	[Redacted]
3143	[Redacted]	[Redacted]	[Redacted]
3144	[Redacted]	[Redacted]	[Redacted]
3145	[Redacted]	[Redacted]	[Redacted]
3146	[Redacted]	[Redacted]	[Redacted]
3147	[Redacted]	[Redacted]	[Redacted]
3148	[Redacted]	[Redacted]	[Redacted]
3149	[Redacted]	[Redacted]	[Redacted]
3150	[Redacted]	[Redacted]	[Redacted]
3151	PAUL	LOVELESS	900.4200
3152	[Redacted]	[Redacted]	[Redacted]
3153	[Redacted]	[Redacted]	[Redacted]
3154	[Redacted]	[Redacted]	[Redacted]
3155	[Redacted]	[Redacted]	[Redacted]
3156	[Redacted]	[Redacted]	[Redacted]
3157	[Redacted]	[Redacted]	[Redacted]
3158	[Redacted]	[Redacted]	[Redacted]
3159	[Redacted]	[Redacted]	[Redacted]
3160	[Redacted]	[Redacted]	[Redacted]
3161	[Redacted]	[Redacted]	[Redacted]

11th Line

LineNumber	first_name	last_name
341	[Redacted]	[Redacted]
342	[Redacted]	[Redacted]
343	[Redacted]	[Redacted]
344	[Redacted]	[Redacted]
345	[Redacted]	[Redacted]
346	[Redacted]	[Redacted]
347	[Redacted]	[Redacted]
348	[Redacted]	[Redacted]
349	[Redacted]	[Redacted]
350	[Redacted]	[Redacted]
351	Eileen	Pike
352	[Redacted]	[Redacted]
353	[Redacted]	[Redacted]
354	[Redacted]	[Redacted]
355	[Redacted]	[Redacted]
356	[Redacted]	[Redacted]
357	[Redacted]	[Redacted]
358	[Redacted]	[Redacted]
359	[Redacted]	[Redacted]
360	[Redacted]	[Redacted]
361	[Redacted]	[Redacted]

11th Line

LineNumber	CHNAME	COAMOUNT	Cur_Bal
1960	[Redacted]	[Redacted]	[Redacted]
1961	[Redacted]	[Redacted]	[Redacted]
1962	[Redacted]	[Redacted]	[Redacted]
1963	[Redacted]	[Redacted]	[Redacted]
1964	[Redacted]	[Redacted]	[Redacted]
1965	[Redacted]	[Redacted]	[Redacted]
1966	[Redacted]	[Redacted]	[Redacted]
1967	[Redacted]	[Redacted]	[Redacted]
1968	[Redacted]	[Redacted]	[Redacted]
1969	[Redacted]	[Redacted]	[Redacted]
1970	TOWNSEND,DAMIEN	\$1,333.10	1333.1000
1971	[Redacted]	[Redacted]	[Redacted]
1972	[Redacted]	[Redacted]	[Redacted]
1973	[Redacted]	[Redacted]	[Redacted]
1974	[Redacted]	[Redacted]	[Redacted]
1975	[Redacted]	[Redacted]	[Redacted]
1976	[Redacted]	[Redacted]	[Redacted]
1977	[Redacted]	[Redacted]	[Redacted]
1978	[Redacted]	[Redacted]	[Redacted]
1979	[Redacted]	[Redacted]	[Redacted]
1980	[Redacted]	[Redacted]	[Redacted]

11th Line

LineNumber	CHNAME	HIGHBALANCE	COAMOUNT	Cur_Bal	LastPurchaseAmount
26309	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26310	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26311	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26312	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26313	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26314	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26315	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26316	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26317	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26318	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26319	WYNTER,BARON	\$637.67	\$637.67	637.6700	58.3700
26320	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26321	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26322	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26323	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26324	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26325	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26326	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26327	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26328	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
26329	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]

11th Line

As shown by several of the numbers that are circled in red, some of the monetary values in the LVNV Files exhibit three (3) or four (4) digits beyond the radix (meaning, a finer granularity than what the C.F.R. permits), thereby demonstrating that the entries cannot be in the mandatory "Decimal [14,2]" format for currency values.

The irregularities in the LVNV files demonstrate that the LVNV files have been altered or modified prior to being printed on paper, as explained in Section 4, *infra* [31].

Mathematical analysis of manufactured evidence

This Section 4 straightforwardly applies the mathematical concept of positional notation from Section 2 to the enlarged portions of the printouts from Section 3. Additionally, this Section 4 explains (in as simple terms as possible) how positional notation demonstrates that documents were manufactured (rather than being directly printed from an original electronic banking file that complies with the USC and the CFR). In applying positional notation, this section focuses on within-document mathematical anomalies (rather than between-document mathematical anomalies) to demonstrate fabrication of documents. As shown herein, document fabrication is uncovered without referencing any metadata or underlying document properties, even though the underlying document properties would only reinforce the conclusion that the documents are fabricated (as shown in Section 5, *infra*).

Recall that the USC and the CFR require bank documents to: (a) Be ASCII text files (which have no stylistic formatting or layout formatting); and (b) Represent all monetary sums with no more than two (2) digits following the decimal point (or radix). Thus, anomalies in printouts can be identified by using simple positional notation and counting of digits past the radix.

Applying positional notation to the Brown file, Duvall file, Flowers file, Loveless file, Townsend file, and Wynter file (hereinafter, collectively, "LVNV files") from Section 3, a mathematical anomaly emerges from the LVNV files. Specifically, the LVNV files show U.S. monetary values being represented with more than two (2) decimal places. For example, contrary to the requirements of the USC and the CFR, the Brown file shows a column with "CurrentBalanceOwing" as 1862.9200 (a number that has four (4) decimal places). Similarly, the Duvall

File shows a column with "Cur_Bal" being 1450.9200 (which represents the same amount as the "BALANCE," which is oddly in a proper two (2) decimal place format as \$1,450.92). The Flowers File shows both 1257.350 (improper three (3) decimal places in "PurchaseBalance") compared to 1257.35 (proper two (2) decimal places in "ChgOffBalance"); and, also, 77.650 (improper three (3) decimal places) compared to 77.65 (proper two (2) decimal places). The Loveless file similarly shows 900.4200 (improper four (4) decimal places). The Townsend file shows 1333.1000 (improper four (4) decimal places) along with \$1,333.10 (proper two (2) decimal places, but with formatting, which should not exist in an ASCII file). The Wynter file similarly displays 637.6700 (improper four (4) decimal places) for "Cur_Bal," which is the same amount as "COAMOUNT" of \$637.67 (two (2) decimal places); the Wynter file also has 58.3700 (improper four (4) decimal places) for "LastPurchaseAmount."

As noted above, the U.S. banking systems (and, indeed, international banking regulations) require uniform treatment of data (especially currency values) to prevent or minimize any risks that may arise from formatting errors when electronically transferring documents. Consequently, the simple fact that direct printouts from allegedly original electronic banking files are non-compliant with the two-decimal-place requirements in the banking regulations demonstrates a mathematical irregularity that cannot be reasonably explained. Without that reasonable explanation, and without the need to review any underlying metadata, this mathematical anomaly leads to a reasonable conclusion that the printed document (which is allegedly a direct printout from an original electronic bank file) is a printout of an intermediate document that was made specifically for litigation purposes from an original ASCII file.

Confirmation that the evidence was manufactured

From a scientific standpoint, the discrepancy from the positional notation (namely, the more-than-two-decimal places after the radix) should be sufficient to conclude with a reasonable degree of certainty that the LVNV files are manufactured (rather than directly printed from an original electronic bank file). The conclusion that the documents are manufactured for litigation is confirmed by sworn testimony from the debt collectors themselves.

For example, the corporate representative for LVNV confirmed that: (a) The original files from the banks are text files (meaning, ASCII files with no style or layout formatting); and (b) The original ASCII files are not re-formatted for appearance or ease-of-use [32]. The LVNV representative testimony reinforces the fact that the style-and-layout formatted LVNV Files shown in Section 3 are manufactured documents (and not original ASCII-formatted bank files. Additionally, the testimony that the original bank files are not modified supports the conclusion that the non-CFR compliant files (with fail to comply with the mandatory Decimal [14,2] formatting requirements for currency) are manufactured documents that have been fabricated for purposes of litigation by a third-party debt collector.

CONCLUSION

As demonstrated in this paper, in certain types of consumer legal cases, such as consumer collections cases in which electronic banking documents are governed by the USC and CFR, there are specific requirements imposed on the format of the documents (e.g., ASCII files, Decimal [14,2] format for monetary sums, Date (YYYYMMDD) for dates, etc.). Because of this, when the bench and bar (having less familiarity with metadata in electronic documents) must determine whether or not paper copies of documents are direct printouts of alleged original electronic files, the reliable and time-tested positional notation can assist in that determination.

This paper has identified and applied positional notation as a mathematical tool that can be exploited to uncover electronic banking documents that fail to comply with the USC and CFR. As demonstrated herein, traditional and relatively simple mathematics (e.g., counting, positional notation (including decimal points)) can reliably detect anomalies in manufactured electronic evidence when one knows a priori how certain documents must be formatted (e.g., "Decimal [14,2]"). The positional notation and counting from the radix, as explained herein, can identify within-document mathematical anomalies that demonstrate non-compliance and, thus, fabrication of electronic documents in consumer debt cases.

Insofar as the results from these mathematical tools and the reasonable conclusions that can be inferred from those results have been confirmed by sworn testimony, it is clear that conventional mathematics can be applied to detect patterns, which demonstrate (more likely than not) that evidence has been manufactured. At its core, because mathematics is always reliable, the mathematical approaches described herein can be implemented independently or in conjunction with metadata analysis as a redundancy.

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