

The %K of Stochastics Is the Position in the Range Itself [F006]

%K and "where the close sits between the recent high and low" differ by $0.00e+00$, not once in 144,463 comparisons — the share touching the upper edge first is almost exactly the position, with a median gap of +1.0445 points — a touch rate of 94.0897% must not be compared with 50%; the thing to compare it with is the position, 90.3830%

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Abstract

This paper asks whether the %K of stochastics carries anything beyond "the position in the range" — the answer is that it carries almost nothing beyond it. It claims neither a new mathematical theorem nor a new law.

First, %K and $(\text{close} - \text{recent low}) \div (\text{recent high} - \text{recent low})$ differ by at most $0.00e+00$ across 144,463 comparisons in four series. **Not one differs. They are the same expression under two names** (Section 3).

Second, and this is the core of the paper, in the bin where %K is 80 or above, the share touching the recent high before the recent low is **94.0897%**. **But the mean position in that bin is 90.3830%.** **The touch rate is a restatement of the position, and 94% is not a surprising number** (Section 4).

Third, across all twenty bins the median gap between touch rate and position is **+1.0445 points** (minimum **-4.0244**, maximum **+6.2701**). Against a position that itself runs from **9.6382%** to **90.3830%**, **the remainder is more than an order of magnitude smaller** (Section 4).

Fourth,  that small remainder is **not reproduced by a synthetic random walk**, where the gap is **0.1001 to 0.1946 points**. **The remainder is real — and more than an order of magnitude smaller than the position itself** (Sections 4 and 7).

Fifth, on the directional side the daily t reaches 2 in absolute value in **2 of the 4** cells (chance gives about **0.2**), and **0 of 4** once the overlap is removed (Sections 5 and 7).

Sixth, moving the thresholds from 70 to 90 and the period from 5 to 21 moves the share selected, but **both are quantities set by the person choosing** (Section 6).

Scope of this paper (scope note): No new mathematical theorem and no new law is claimed — the definition of stochastics, the optional stopping theorem and random walks are all known. **That %K is an expression for the position also follows from the definition.**

What this paper adds is to confirm it by count, to place the touch rate beside the position, and to compare with a random walk. **No particular product or proponent is discussed** — no real course, author, or vendor is the subject here, and none is named. What is treated is the public indicator itself. **Trading is not discussed** — what is measured is directional information, not trading performance including commissions, fills and money management.

The scope is intraday and a small number of instruments — four series, six years, one-hour bars. This paper does not contradict results documented at longer holding periods, such as monthly time-series momentum. **Crosses of %D and %K are not treated** — a cross of two lines is not a question about position and lies outside this paper. **No forecast is claimed.**

Relation to earlier papers: Paper 423 showed that a touch-probability table can be right while the trade still loses, and that **a touch rate must always be read beside the position** — this paper applies that reading to another indicator. Paper 264 showed that a threshold belongs to its lattice. F004 of this series showed that the thresholds of RSI belong to the bar size, and F005 that the zero cross of MACD is the same expression as a moving-average cross — this paper stands beside them and measures the same thing for a fifth indicator. What is added here is **confirming the identity of %K and position by count, placing the touch rate beside the position and reporting the gap bin by bin, and measuring the same gap on a synthetic random walk, so that the reality of the remainder and its size are separated.**

1. Notation and the question

Stochastics is built as follows.

Line	Definition
%K	$100 \times (\text{close} - \text{lowest low of the last } n \text{ bars}) \div (\text{highest high of the last } n \text{ bars} - \text{lowest low of the last } n \text{ bars})$
%D	3-bar simple moving average of %K

A period of 14 is widely used. The common reading is "**80 or above is overbought, 20 or below is oversold**".

Observation 1.1: the expression for %K writes down directly **where the close sits inside the span of the recent high and low**. This follows from the definition.

Observation 1.2: ⚠ something must be watched here. **The position carries a meaning that comes from the optional stopping theorem**. In a process without drift, **the closer one is to the upper edge, the higher the probability of touching the upper edge first**. And that probability equals the position itself.

Observation 1.3: so "when %K is 90, the probability of touching the upper edge first is 90%" is **not surprising**. **When a rate is reported, what it would be by chance must always be reported alongside**. Here that "by chance" figure is **the position**.

Question: does %K carry anything beyond a restatement of the position?

2. Writing the quantity and the design in advance

Three quantities are measured.

① **the touch rate** — the share touching the highest high of the last n bars before the lowest low.

② **the position** — %K itself, the thing to compare ① against.

③ **directional information** —

...

$D = \text{mean}(\text{sign of the signal} \times \text{the price move over the next } h \text{ bars})$ in pips

...

The signal is -1 (sell) when %K is 80 or above, $+1$ (buy) when 20 or below, and 0 between them. This is the mean-reverting reading. The trend-following reading is its sign flipped and is not measured.

Design (declared before running and unchanged at run time)

Item	Decision
Indicator	%K, period 14
Bars	one hour, mid price, closing value of completed bars only
Instruments	USDJPY, EURUSD, GBPUSD, XAUUSD
Period	2019–2024. Selection 2019–2021 / evaluation 2022–2024
Horizon	$h = 14$ (one period)
Separator	whether the touch rate is read beside the position
Deciding a touch	within the 14 bars after the bar, whether the highest high of the last 14 bars or the lowest low is touched first. If neither is touched, the case is "undecided" and dropped
Thresholds	30/70, 20/80, 10/90 (standard is 20/80)
Period n	5, 14, 21 (standard is 14)

Observation 2.1: ⚠ dropping the undecided cases can bias the result. **The nearer edge is touched first more easily, so among the decided cases the nearer side is over-represented.** This bias is handled by the baseline of Section 7: **the same truncation is applied to the random walk.**

The bar counts are **36,534** for USDJPY, **36,554** for EURUSD, **36,535** for GBPUSD and **34,892** for XAUUSD.

3. Is %K the same expression as the position?

Calculation 3.1 The difference between %K and the position

Instrument	Compared	Maximum difference	Cases above 1e-9
USDJPY	36,521	0.00e+00	0
EURUSD	36,541	0.00e+00	0
GBPUSD	36,522	0.00e+00	0
XAUUSD	34,879	0.00e+00	0

Observation 3.2: across **144,463 comparisons** in four series, the maximum difference is **0.00e+00**. **Not one differs.**

Observation 3.3:  **this is not a discovery; it follows from the definition.** What this paper adds is only to confirm it by count. Confirming it is still worth doing — **everything that follows stands on the premise that %K is the position.**

4. Reading the touch rate beside the position — this is the separator

Calculation 4.1 Touch rate and position by %K bin (evaluation period)

Instrument	%K bin	Count	Touch rate	Mean position	Gap (points)
USDJPY	0–20	2,412	7.5456%	10.4455%	– 2.8999
USDJPY	20–40	2,511	25.7268%	29.7512%	– 4.0244
USDJPY	40–60	2,399	50.1042%	50.1165%	– 0.0123
USDJPY	60–80	3,060	76.8954%	70.6253%	+6.2701
USDJPY	80–100	4,636	94.0897%	90.3830%	+3.7068
EURUSD	0–20	3,527	7.1732%	9.6480%	– 2.4747
EURUSD	20–40	2,582	27.2270%	29.5001%	– 2.2732
EURUSD	40–60	2,516	50.5167%	49.9601%	+0.5566
EURUSD	60–80	2,620	74.5420%	70.4964%	+4.0456
EURUSD	80–100	3,470	92.8818%	90.2339%	+2.6480
GBPUSD	0–20	3,414	6.9420%	9.6382%	– 2.6962
GBPUSD	20–40	2,650	26.6038%	29.6512%	– 3.0475
GBPUSD	40–60	2,447	51.6551%	50.1226%	+1.5325
GBPUSD	60–80	2,774	73.2877%	70.4117%	+2.8759
GBPUSD	80–100	3,568	92.9372%	90.3706%	+2.5667
XAUUSD	0–20	2,879	6.4953%	10.3655%	– 3.8702
XAUUSD	20–40	2,585	27.1180%	29.5490%	– 2.4310

XAUUSD	40–60	2,352	52.3810%	50.0242%	+2.3568
XAUUSD	60–80	2,818	73.7048%	70.2498%	+3.4550
XAUUSD	80–100	3,623	93.4309%	89.9499%	+3.4810

Observation 4.2: in the bin where %K is 80 or above, the touch rate reaches 94.0897%. Stopping here reads as "stochastics is right nine times in ten".

Observation 4.3: but the mean position in that bin is 90.3830%. The touch rate simply sits on the position, and the gap is only 3.7068 points.

Observation 4.4: ⚠ a touch rate of 94.0897% must not be compared with 50%. The thing to compare it with is the position, 90.3830%. Against 50% it looks like a gap of 44 points; against the position it is 3.7068 points. Which denominator is chosen changes the story more than tenfold.

Observation 4.5: across all twenty bins the median gap is +1.0445 points (minimum −4.0244, maximum +6.2701). The position itself runs from 9.6382% to 90.3830%, so the remainder is more than an order of magnitude smaller.

Observation 4.6: the gap has a shape. The two lower bins (0–20 and 20–40) are negative in all four series, and the two upper bins (60–80 and 80–100) are positive in all four. The higher the position, the further above what the position says price goes. That is the trend-following direction.

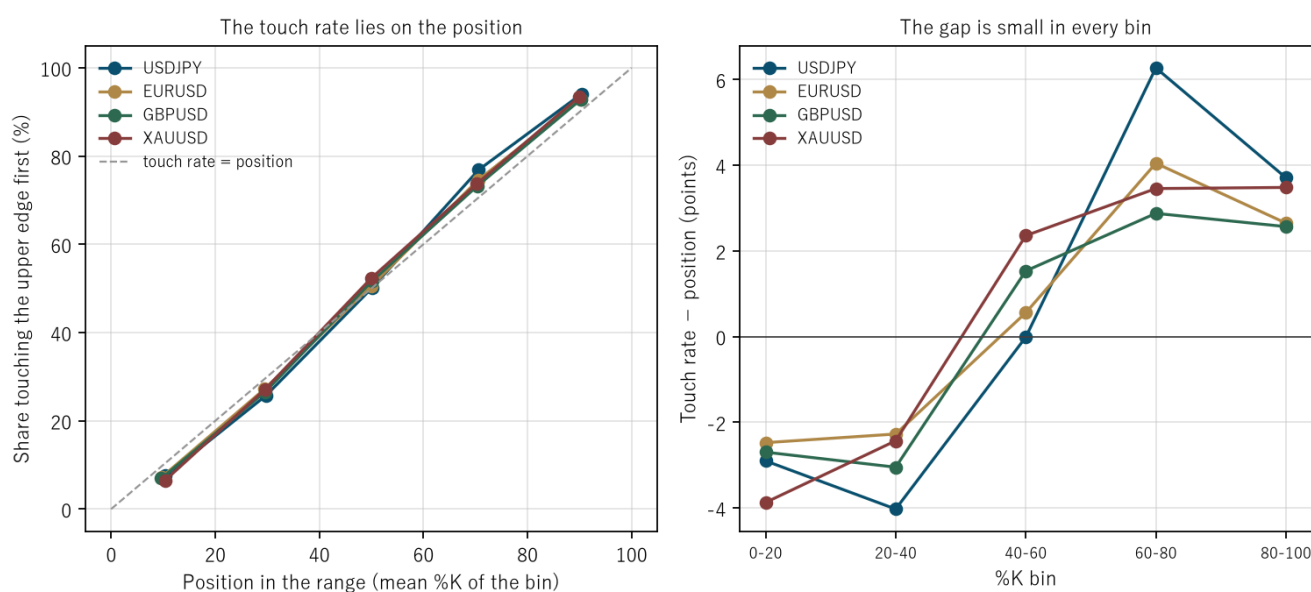


Figure 1: on the left the touch rate against the position (the dashed line marks "touch rate = position"); on the right the gap. **The points lie almost on the dashed line and the gap stays within a band from −4 to +6 points.**

5. Directional information

Calculation 5.1 Measuring with the mean-reverting signal ($h = 14$)

Instrument	Period	Count	D (overall)	Dd (daily)	Daily t	Per day	spr
USDJPY	selection	7,566	− 1.4198	1.3609	1.71	9.0	0.30
USDJPY	evaluation	7,857	− 4.3700	− 0.8046	− 0.46	9.0	0.60
EURUSD	selection	8,029	1.2200	2.8119	4.15	9.0	0.30
EURUSD	evaluation	7,874	1.3966	3.0813	3.65	9.0	0.30
GBPUSD	selection	8,247	− 0.4876	2.2540	2.06	10.0	0.90
GBPUSD	evaluation	7,864	1.2378	3.6650	3.26	9.0	0.90
XAUUSD	selection	6,882	− 6.4170	4.6595	1.59	8.0	3.37
XAUUSD	evaluation	7,384	− 5.5671	3.7955	1.23	9.0	3.57

Observation 5.2: in the evaluation period the daily t reaches 2 in absolute value in **2 of the 4** cells. By chance about **0.2** would be expected, so stopping here reads as "it works".

Observation 5.3: the absolute value of the overall mean exceeds the spread in **all four series**.

Observation 5.4: ⚠ yet the overall mean and the daily mean **disagree in sign** in some cells. USDJPY in the selection period is **−1.4198** overall and **1.3609** daily; XAUUSD in the evaluation period is **−5.5671** and **3.7955**. **Days with many observations are making the overall mean.**

Observation 5.5: ⚠ and there are **8.0** to **10.0** entries a day against a horizon of 14 bars. **The shape that should prompt suspicion of overlap is present** (Section 7).

6. Moving the thresholds and the period

Calculation 6.1 Moving the thresholds (evaluation period, $n = 14$)

Instrument	30/70 share	30/70 D	20/80 share	20/80 D	10/90 share	10/90 D
USDJPY	64.1646%	− 3.7989	44.0302%	− 4.3700	21.5281%	− 5.8229
EURUSD	63.4118%	1.1003	44.0668%	1.3966	22.3464%	2.2414
GBPUSD	63.4833%	0.7755	44.0472%	1.2378	22.3509%	1.5719
XAUUSD	63.3095%	− 3.3704	42.2578%	− 5.5671	19.6456%	− 5.8436

Calculation 6.2 Moving the period (evaluation period, thresholds 20/80)

Instrument	n=5 share	n=5 D	n=14 share	n=14 D	n=21 share	n=21 D
USDJPY	42.1383%	− 0.9813	44.0302%	− 4.3700	45.0434%	− 6.6558
EURUSD	43.5079%	0.2794	44.0668%	1.3966	43.7874%	0.0611
GBPUSD	43.5773%	0.5485	44.0472%	1.2378	43.4989%	1.0924
XAUUSD	41.2918%	− 0.9963	42.2578%	− 5.5671	41.9548%	− 3.9114

Observation 6.3: moving the thresholds from 70 to 90 cuts the share selected from **64.1646%** to **21.5281%**, by a third. **The threshold decides how far toward the edge a situation must be to be picked up.**

Observation 6.4: ⚠ moving the period from 5 to 21, by contrast, moves the share only between 41.2918% and 45.0434%. Because %K is the position, changing the period barely changes how much of the time price sits near an edge. What moves it is the threshold.

Observation 6.5: ⚠ yet the directional information moves a great deal with the period (USDJPY from −0.9813 to −6.6558). The share not moving while D does means the contents of what is picked up have changed.

7. Removing the overlap — and the baseline

Calculation 7.1 Measuring again with non-overlapping windows (evaluation period)

Instrument	Count with overlap	D	Daily t	Count without	D	t
USDJPY	7,857	− 4.3700	− 0.46	544	− 4.4593	− 1.06
EURUSD	7,874	1.3966	3.65	545	− 0.4854	− 0.32
GBPUSD	7,864	1.2378	3.26	565	2.9485	1.07
XAUUSD	7,384	− 5.5671	1.23	506	− 9.2515	− 0.70

◀  ▶

Observation 7.2: the cells with a daily t above 2 in absolute value fall from **2 of 4** to **0 of 4**. EURUSD falls from **3.65** to **−0.32**, and its sign changes as well.

Observation 7.3: ⚠ the count falls from 7,857 to 544. **The power of the test falls sharply.** "Down to 0" is not "there is none"; it is **not visible at this count**.

Calculation 7.4 The baseline — synthetic series whose within-bar movement is also random (20 realisations, evaluation period)

Instrument	Measured D	Median random D	Random minimum	Random maximum	
USDJPY	−4.3700	−0.0935	−1.7048	4.3591	r
EURUSD	1.3966	−0.0437	−1.1456	2.9371	y
GBPUSD	1.2378	−0.0983	−1.6868	4.3034	y
XAUUSD	−5.5671	−0.7680	−4.3560	10.2720	r

Observation 7.5: ⚠ on the random walk the gap "touch rate – position" is 0.1001 to 0.1946 points. The measured median was +1.0445. The same truncation (dropping undecided cases) is applied to the random walk, so the gap cannot be explained by that bias. The remainder of Section 4 is real.

Observation 7.6: but look at its size. The position itself runs from 9.6382% to 90.3830%. What sits on top of it has a median of +1.0445 points. Almost all of what is explained is the position; the remainder is a small amount outside it.

Observation 7.7: on the directional side, 2 of the 4 series fall outside the range of the random walk. ⚠ Both that do (USDJPY −4.3700, XAUUSD −5.5671) are **negative**. A negative value for the mean-reverting signal concerns **the trend-following side** — which agrees in direction with Section 4's finding that the higher the position, the further above it price goes.

8. Splitting by session

Design: five **non-overlapping** bins in Coordinated Universal Time.

Calculation 8.1 Directional information in each of the five bins (evaluation period)

Instrument	Tokyo 0–7	London 7–12	Overlap 12–16	NY late 16–21	Night 21–24
USDJPY	− 4.49 (t 0.43)	− 4.57 (t 0.40)	− 2.05 (t 1.36)	− 3.70 (t − 0.11)	− 8.73 (t − 1.31)
EURUSD	1.39 (t 1.18)	1.59 (t 1.60)	2.53 (t 4.44)	0.97 (t 2.71)	0.23 (t 0.59)
GBPUSD	0.46 (t 0.86)	0.77 (t 2.23)	2.79 (t 3.57)	2.17 (t 3.13)	0.22 (t 0.09)
XAUUSD	− 5.83 (t 0.95)	− 8.82 (t − 0.07)	− 7.58 (t 0.81)	− 1.97 (t 2.01)	− 1.68 (t − 0.03)

Observation 8.2: the daily t reaches 2 in absolute value in **6 of the 20** cells. By chance about **0.9** would be expected, so the measured figure is far above it.

Observation 8.3: ⚠️ **but this table does not remove the overlap.** In Section 7, removing it dropped the same kind of t from **2 to 0**. **The figure of six cannot be read as it stands.**

Observation 8.4: ⚠️ five of the six are EURUSD and GBPUSD and **cluster in the overlap session (12–16)**. The directional information itself is **2.53** and **2.79 pips**, above the spread (**0.30** and **0.90**), but no correction for overlap has been applied. **Going further requires measuring again with the overlap removed. This paper does not do that.**

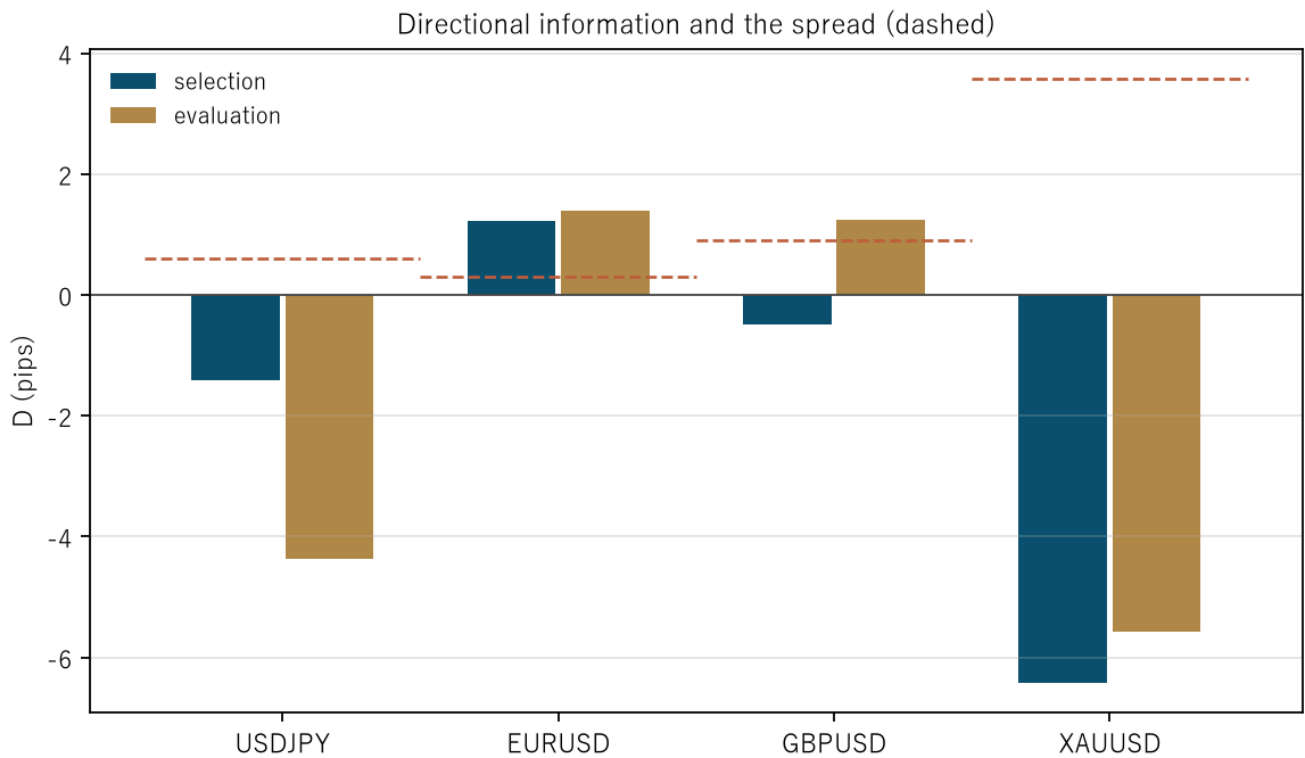


Figure 2: the bars are the directional information in the selection and evaluation periods; the dashed lines mark the spread. **The signs do not agree across instruments.**

9. Limitations

1. **Undecided cases are dropped.** Situations where neither edge was touched within 14 bars leave the measurement. The bias was handled by the baseline, but **the number dropped is not reported.**
2. **Removing the overlap leaves between 506 and 565 observations.** At that count even an effect several times the spread would not be visible.
3. **The session table is not corrected for overlap** (Observation 8.3). **The figure of six cannot be read as it stands.**
4. **Crosses of %D and %K are not treated.** A cross of two lines is not a question about position.
5. **Only one lattice is used.** Bars are fixed at one hour.
6. **The synthetic baseline uses independent normal increments.** Volatility clustering is not included. Part of the remainder of Section 4 may come from there, but that has not been measured.
7. **Four instruments over six years.** Nothing is said about other markets or other periods.

Conclusion

When %K passes 80, the share touching the upper edge first is **94.0897%**. More than nine in ten. But the mean position in those situations is **90.3830%**, so **the gap is only 3.7068 points**.

%K and the position did not differ once in 144,463 comparisons. They are the same expression under two names. So a touch rate riding on the position is exactly what should be expected.

On top of that, the amount by which price goes further than the position says was real. The median gap across twenty bins is **+1.0445 points**, separating from the random walk's **0.1001 to 0.1946**. **But against a position that itself runs from 9.6382% to 90.3830%, the remainder is more than an order of magnitude smaller**.

One thing separates the cases — when a rate is reported, whether the thing it is compared with is 50% or the position. Against 50% it looks like a gap of 44 points; against the position it is 3.7068.

And what this paper could measure is the reading that cuts %K at a threshold. **About crosses with %D, nothing is answered here**.

Data and reproduction

Data	Currency ticks from Dukascopy (agreement to the millisecond, bid and ask, verified from 2019 onward). Gold from Dukascopy
Period	2019–2024 (six years). Selection 2019–2021 / evaluation 2022–2024
Instruments	USDJPY, EURUSD, GBPUSD, XAUUSD
Bars	One hour, mid price, closing value of completed bars only. Bars with no ticks are not created
Verification	<code>検算/F006.py</code> (with <code>--zu</code> it also writes the figures). Every number in the text is taken from <code>検算/F006_output.txt</code>
Figures	<code>図/F006_zu1</code> , <code>図/F006_zu2</code> (png, svg, English versions)
Random seeds	Fixed at 0–19. Re-running gives the same values
Audit of the foundation	<code>_ツール/audit_bars.py</code> (look-ahead in the bars, daylight saving, the day boundary). The record is <code>_土台の検査.txt</code>

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