

ALGORYTM

RABINA-KARPA

Wojciech Sosnowski

ALGORYTM RABINA-KARPA

DANE:

- TEKST
- WZORZEC
- ALFABET
- LICZBA PIERWSZA

WYNIK:

- MIEJSCE WYSTĄPIENIA WZORCA W TEKŚCIE

ZŁOŻONOŚĆ CZASOWA:

- $O(n + m)$

ALGORYTM RABINA-KARPA

WZORZEC

S	Z	O	S	A
---	---	---	---	---

TEKST

W		C	Z	A	S	I	E		S	U	S	Z	Y		S	Z	O	S	A		S	U	C	H	A	.
---	--	---	---	---	---	---	---	--	---	---	---	---	---	--	---	---	---	---	---	--	---	---	---	---	---	---

d = 128

q = 89

$h = d^{m-1} \% q$

ALGORYTM RABINA-KARPA

WZORZEC

S	Z	O	S	A
---	---	---	---	---

$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$

TEKST

W		C	Z	A	S	I	E		S	U	S	Z	Y		S	Z	O	S	A		S	U	C	H	A	.
---	--	---	---	---	---	---	---	--	---	---	---	---	---	--	---	---	---	---	---	--	---	---	---	---	---	---

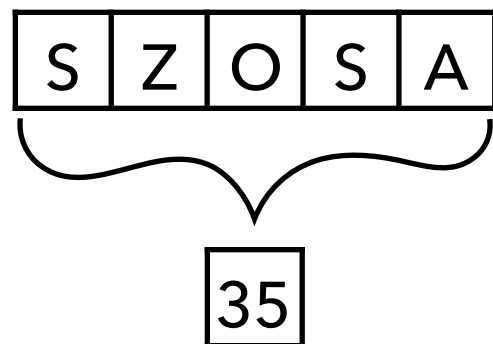
d = 128

q = 89

$h = d^{m-1} \% q$

ALGORYTM RABINA-KARPA

WZORZEC



$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$

$$p = W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))))$$

$$p = 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83))))$$

$$p = 22\,470\,191\,553 \% q$$

TEKST

W		C	Z	A	S	I	E		S	U	S	Z	Y		S	Z	O	S	A		S	U	C	H	A	.
---	--	---	---	---	---	---	---	--	---	---	---	---	---	--	---	---	---	---	---	--	---	---	---	---	---	---

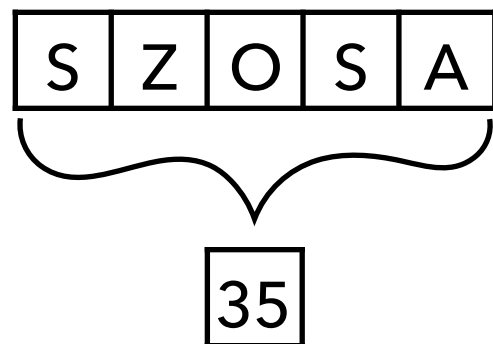
$$d = 128$$

$$q = 89$$

$$h = d^{m-1} \% q$$

ALGORYTM RABINA-KARPA

WZORZEC



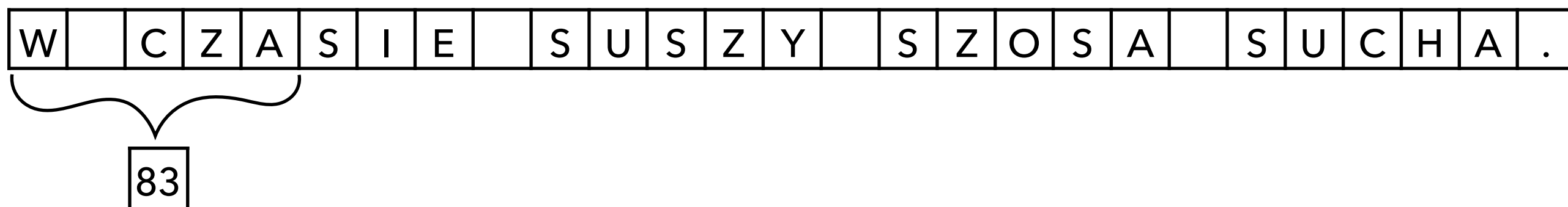
$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$

$$p = W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))))$$

$$p = 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83))))$$

$$p = 22\,470\,191\,553 \% q$$

TEKST



$$t_0 = T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))))$$

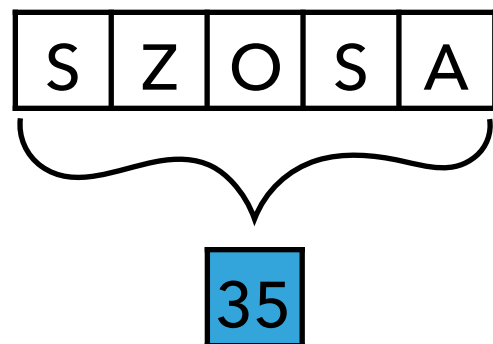
$$d = 128$$

$$q = 89$$

$$h = d^{m-1} \% q$$

ALGORYTM RABINA-KARPA

WZORZEC



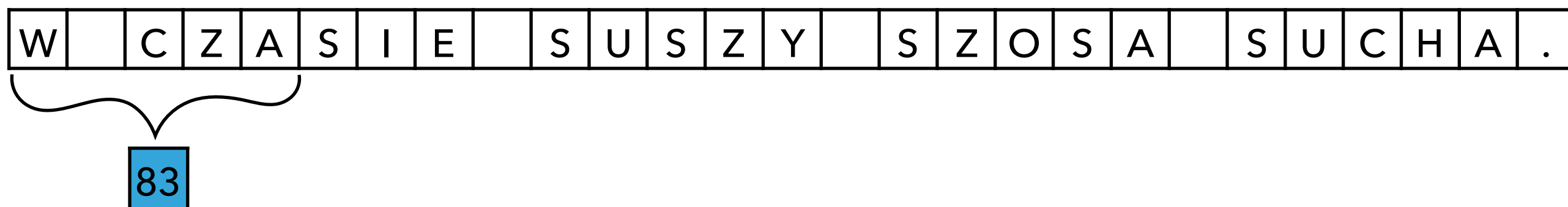
$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$

$$p = W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))))$$

$$p = 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83))))$$

$$p = 22\,470\,191\,553 \% q$$

TEKST



$$t_0 = T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))))$$

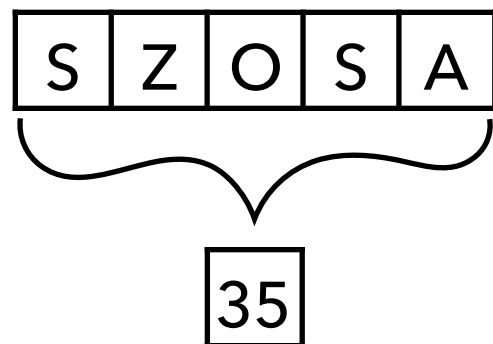
$$d = 128$$

$$q = 89$$

$$h = d^{m-1} \% q$$

ALGORYTM RABINA-KARPA

WZORZEC



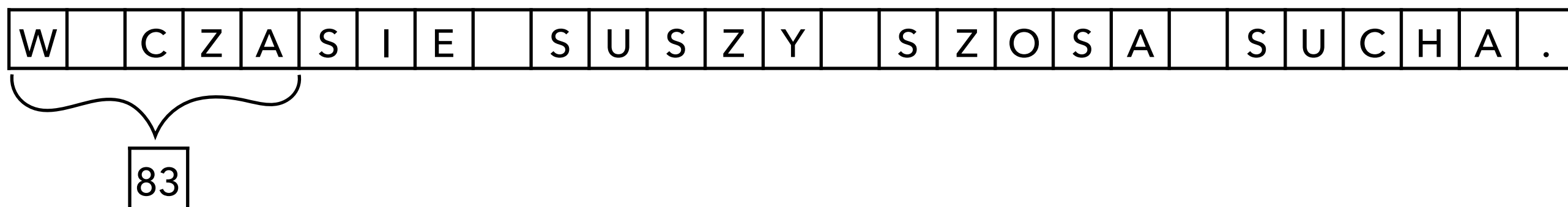
$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$

$$p = W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))))$$

$$p = 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83))))$$

$$p = 22\,470\,191\,553 \% q$$

TEKST



$$t_0 = T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))))$$

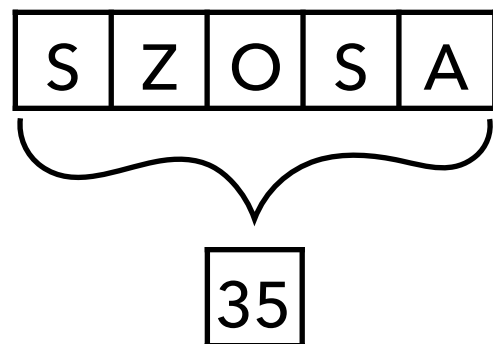
$$d = 128$$

$$q = 89$$

$$h = d^{m-1} \% q$$

ALGORYTM RABINA-KARPA

WZORZEC



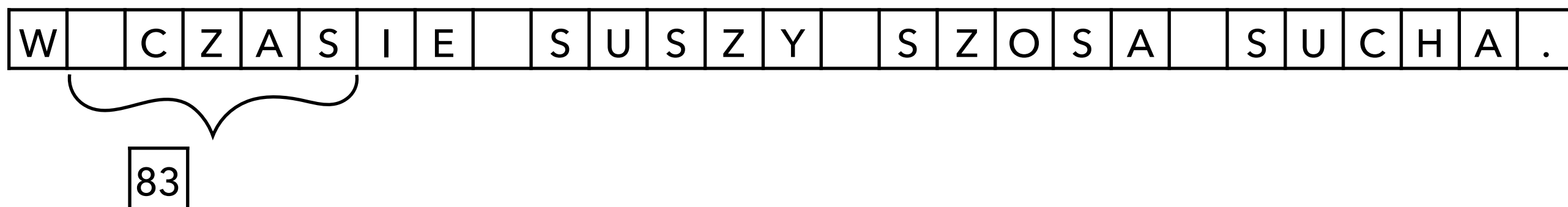
$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$

$$p = W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))))$$

$$p = 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83))))$$

$$p = 22\,470\,191\,553 \% q$$

TEKST



$$t_0 = T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))))$$

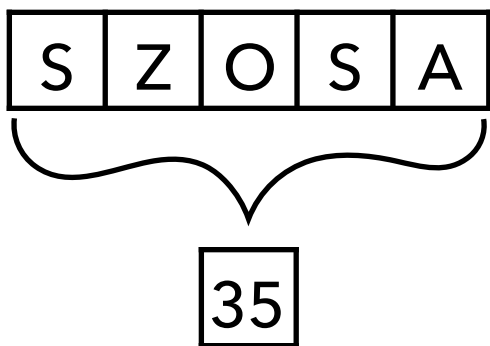
$$d = 128$$

$$q = 89$$

$$h = d^{m-1} \% q$$

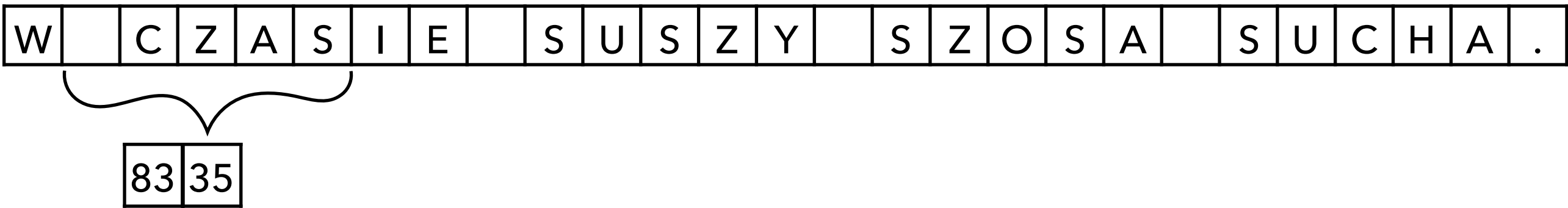
ALGORYTM RABINA-KARPA

WZORZEC



$$\begin{aligned} p &= S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0 \\ p &= W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0])))) \\ p &= 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83)))) \\ p &= 22\,470\,191\,553 \% q \end{aligned}$$

TEKST

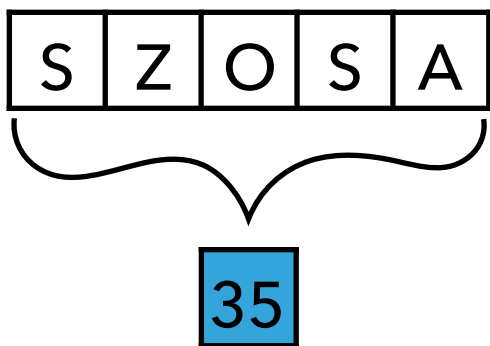


$$\begin{aligned} d &= 128 \\ q &= 89 \\ h &= d^{m-1} \% q \end{aligned}$$

$$\begin{aligned} t_0 &= T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0])))) \\ t_s &= d * (t_{s-1} - T[s] * h) + T[s + m] \% q \\ t_1 &= 128 * (t_0 - W * h) + S \% q \\ t_1 &= 128 * (t_0 - 87 * h) + 83 \% q \end{aligned}$$

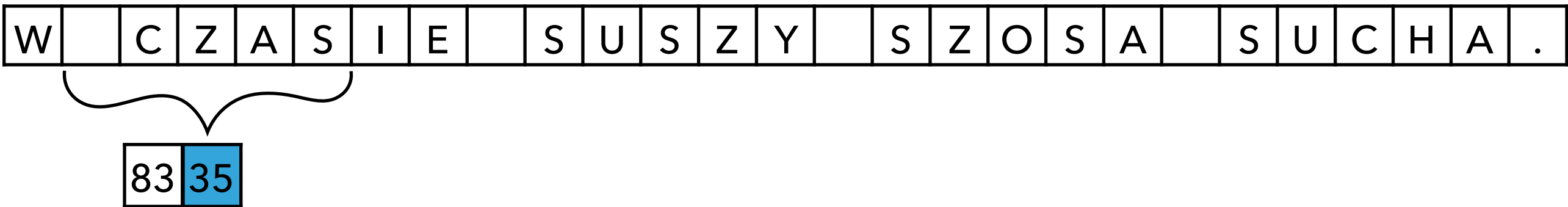
ALGORYTM RABINA-KARPA

WZORZEC



$$\begin{aligned} p &= S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0 \\ p &= W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0])))) \\ p &= 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83)))) \\ p &= 22\,470\,191\,553 \% q \end{aligned}$$

TEKST

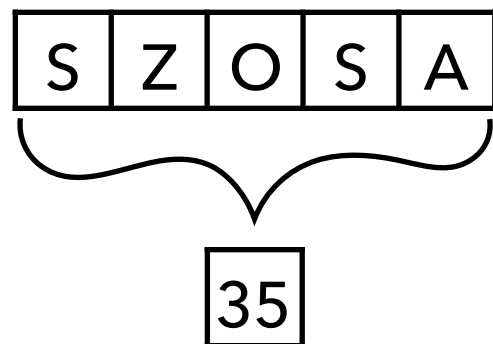


$$\begin{aligned} d &= 128 \\ q &= 89 \\ h &= d^{m-1} \% q \end{aligned}$$

$$\begin{aligned} t_0 &= T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0])))) \\ t_s &= d * (t_{s-1} - T[s] * h) + T[s + m] \% q \\ t_1 &= 128 * (t_0 - W * h) + S \% q \\ t_1 &= 128 * (t_0 - 87 * h) + 83 \% q \end{aligned}$$

ALGORYTM RABINA-KARPA

WZORZEC



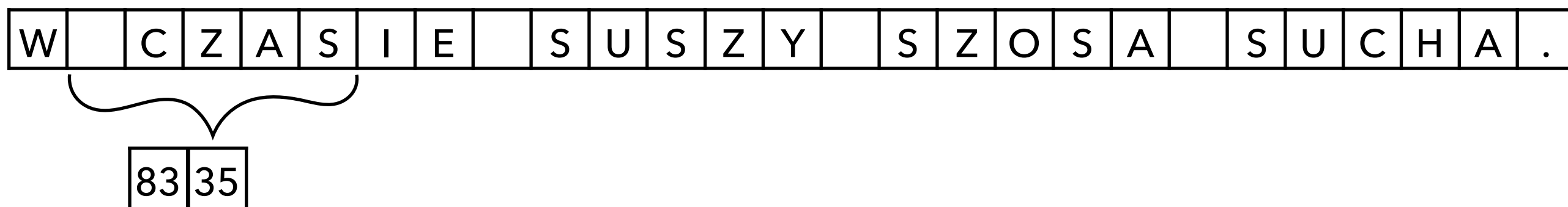
$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$

$$p = W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))))$$

$$p = 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83))))$$

$$p = 22\,470\,191\,553 \% q$$

TEKST



$$d = 128$$

$$q = 89$$

$$h = d^{m-1} \% q$$

$$t_0 = T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))))$$

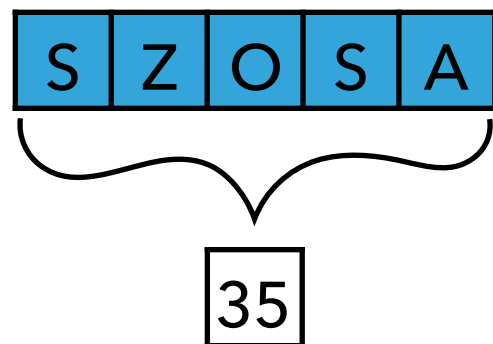
$$t_s = d * (t_{s-1} - T[s] * h) + T[s + m] \% q$$

$$t_1 = 128 * (t_0 - W * h) + S \% q$$

$$t_1 = 128 * (t_0 - 87 * h) + 83 \% q$$

ALGORYTM RABINA-KARPA

WZORZEC



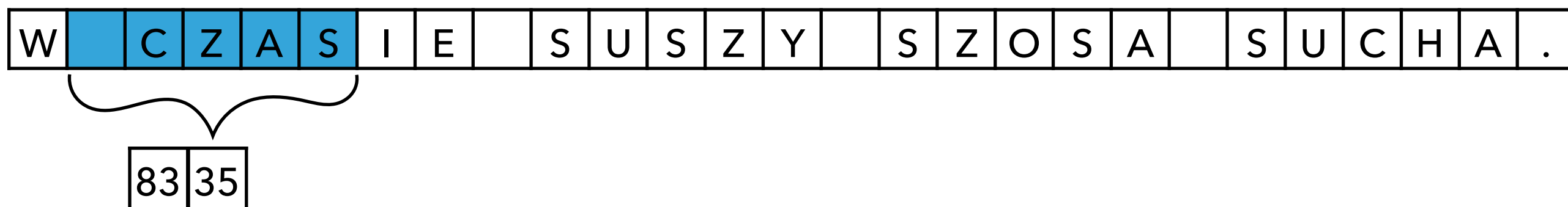
$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$

$$p = W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))))$$

$$p = 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83))))$$

$$p = 22\,470\,191\,553 \% q$$

TEKST



$$d = 128$$

$$q = 89$$

$$h = d^{m-1} \% q$$

$$t_0 = T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))))$$

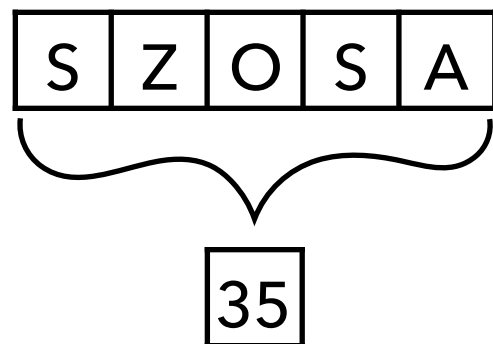
$$t_s = d * (t_{s-1} - T[s] * h) + T[s + m] \% q$$

$$t_1 = 128 * (t_0 - W * h) + S \% q$$

$$t_1 = 128 * (t_0 - 87 * h) + 83 \% q$$

ALGORYTM RABINA-KARPA

WZORZEC



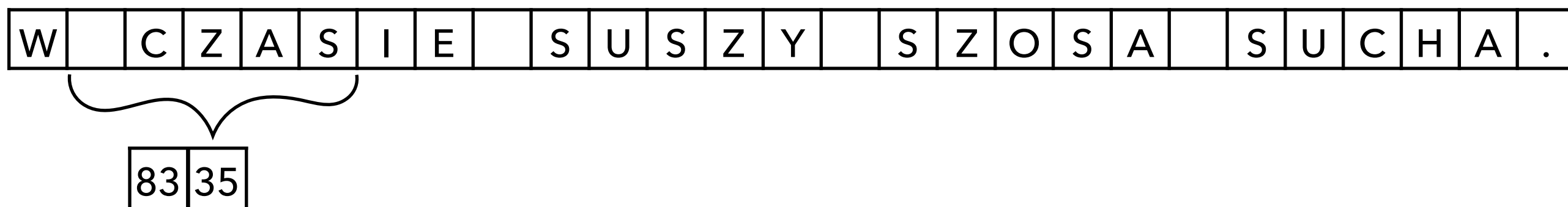
$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$

$$p = W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))))$$

$$p = 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83))))$$

$$p = 22\,470\,191\,553 \% q$$

TEKST



$$d = 128$$

$$q = 89$$

$$h = d^{m-1} \% q$$

$$t_0 = T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))))$$

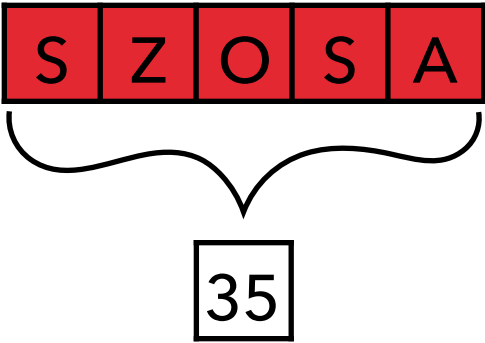
$$t_s = d * (t_{s-1} - T[s] * h) + T[s + m] \% q$$

$$t_1 = 128 * (t_0 - W * h) + S \% q$$

$$t_1 = 128 * (t_0 - 87 * h) + 83 \% q$$

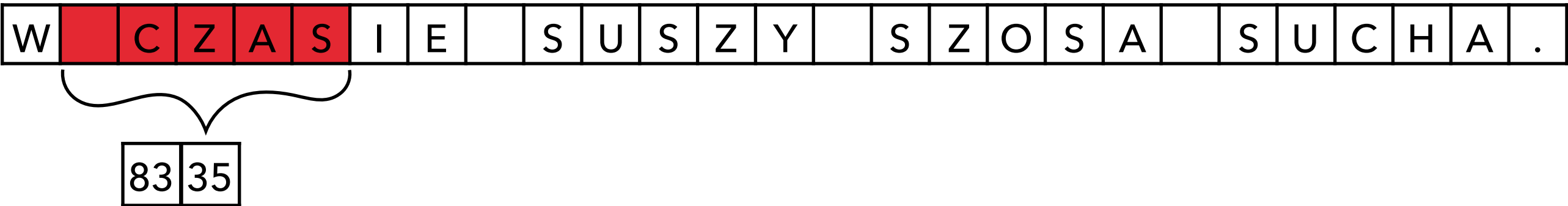
ALGORYTM RABINA-KARPA

WZORZEC



$$\begin{aligned} p &= S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0 \\ p &= W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))) \\ p &= 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83)))) \\ p &= 22\,470\,191\,553 \% q \end{aligned}$$

TEKST

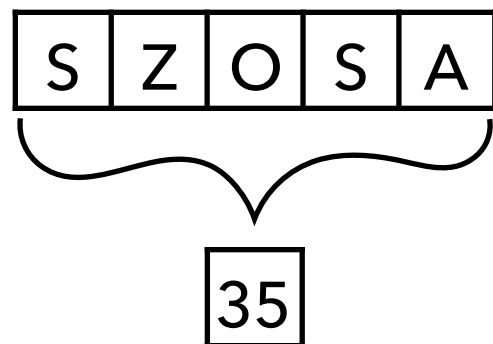


$$\begin{aligned} d &= 128 \\ q &= 89 \\ h &= d^{m-1} \% q \end{aligned}$$

$$\begin{aligned} t_0 &= T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))) \\ t_s &= d * (t_{s-1} - T[s] * h) + T[s + m] \% q \\ t_1 &= 128 * (t_0 - W * h) + S \% q \\ t_1 &= 128 * (t_0 - 87 * h) + 83 \% q \end{aligned}$$

ALGORYTM RABINA-KARPA

WZORZEC



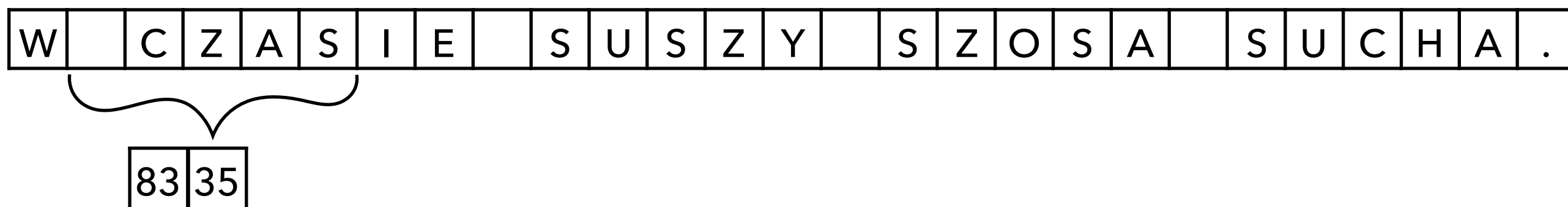
$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$

$$p = W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))))$$

$$p = 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83))))$$

$$p = 22\,470\,191\,553 \% q$$

TEKST



$$d = 128$$

$$q = 89$$

$$h = d^{m-1} \% q$$

$$t_0 = T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))))$$

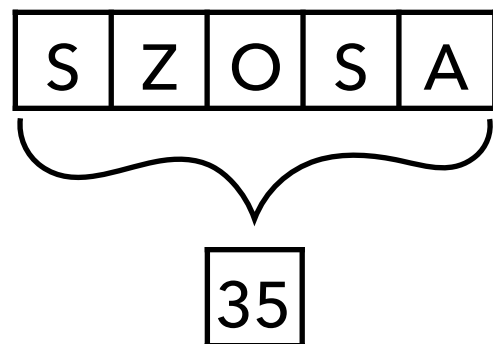
$$t_s = d * (t_{s-1} - T[s] * h) + T[s + m] \% q$$

$$t_1 = 128 * (t_0 - W * h) + S \% q$$

$$t_1 = 128 * (t_0 - 87 * h) + 83 \% q$$

ALGORYTM RABINA-KARPA

WZORZEC



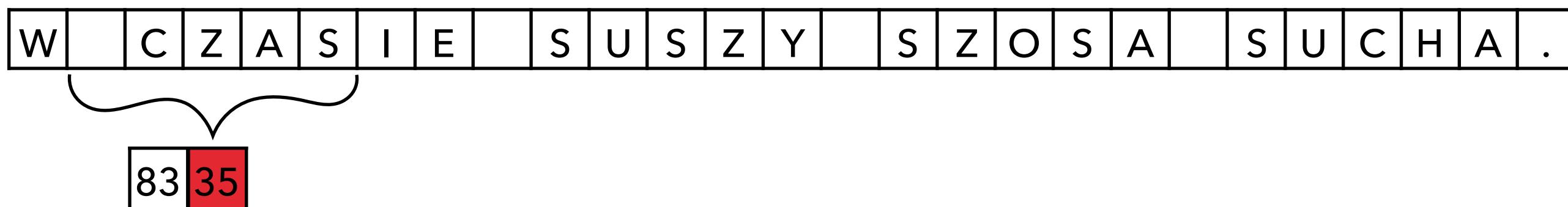
$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$

$$p = W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))))$$

$$p = 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83))))$$

$$p = 22\,470\,191\,553 \% q$$

TEKST



$$d = 128$$

$$q = 89$$

$$h = d^{m-1} \% q$$

$$t_0 = T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))))$$

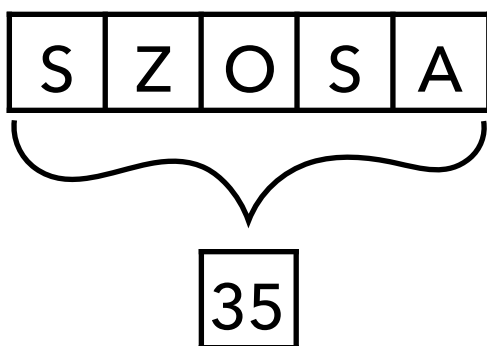
$$t_s = d * (t_{s-1} - T[s] * h) + T[s + m] \% q$$

$$t_1 = 128 * (t_0 - W * h) + S \% q$$

$$t_1 = 128 * (t_0 - 87 * h) + 83 \% q$$

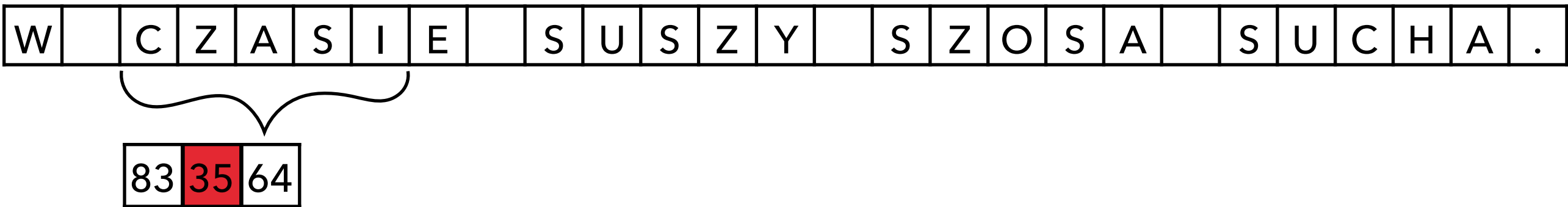
ALGORYTM RABINA-KARPA

WZORZEC



$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$
$$p = W[m - 1] + d*(W[m - 2] + d*(W[m - 3] + \dots d*(W[1] + d*(W[0]))))$$
$$p = 65 + 128*(83 + 128*(79 + 128*(90 + 128*(83))))$$
$$p = 22\,470\,191\,553 \% q$$

TEKST

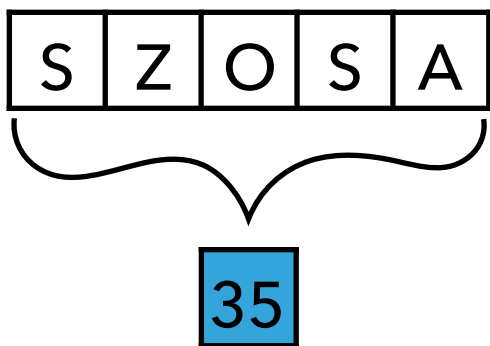


$d = 128$ $q = 89$ $h = d^{m-1} \% q$

$$t_0 = T[m - 1] + d*(T[m - 2] + d*(T[m - 3] + \dots d*(T[1] + d*(T[0]))))$$
$$t_s = d*(t_{s-1} - T[s] * h) + T[s + m] \% q$$
$$t_1 = 128*(t_0 - W * h) + S \% q$$
$$t_1 = 128*(t_0 - 87 * h) + 83 \% q$$

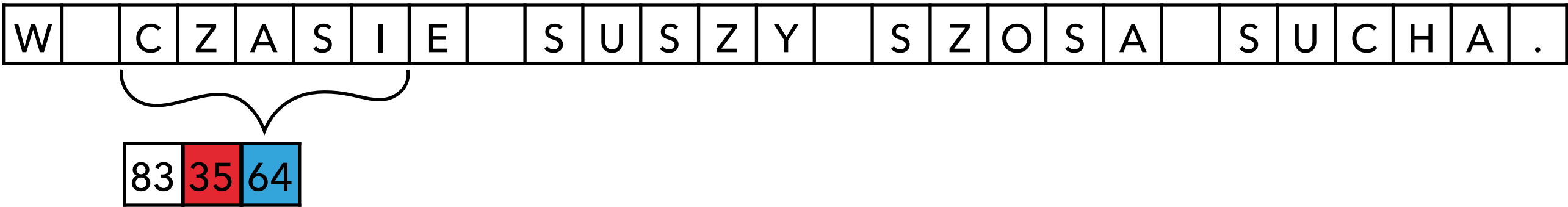
ALGORYTM RABINA-KARPA

WZORZEC



$$\begin{aligned} p &= S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0 \\ p &= W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0])))) \\ p &= 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83)))) \\ p &= 22\,470\,191\,553 \% q \end{aligned}$$

TEKST

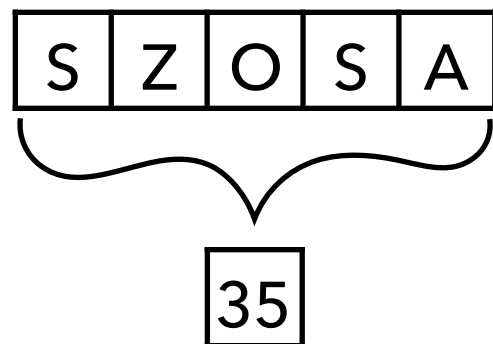


$$\begin{aligned} d &= 128 \\ q &= 89 \\ h &= d^{m-1} \% q \end{aligned}$$

$$\begin{aligned} t_0 &= T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0])))) \\ t_s &= d * (t_{s-1} - T[s] * h) + T[s + m] \% q \\ t_1 &= 128 * (t_0 - W * h) + S \% q \\ t_1 &= 128 * (t_0 - 87 * h) + 83 \% q \end{aligned}$$

ALGORYTM RABINA-KARPA

WZORZEC



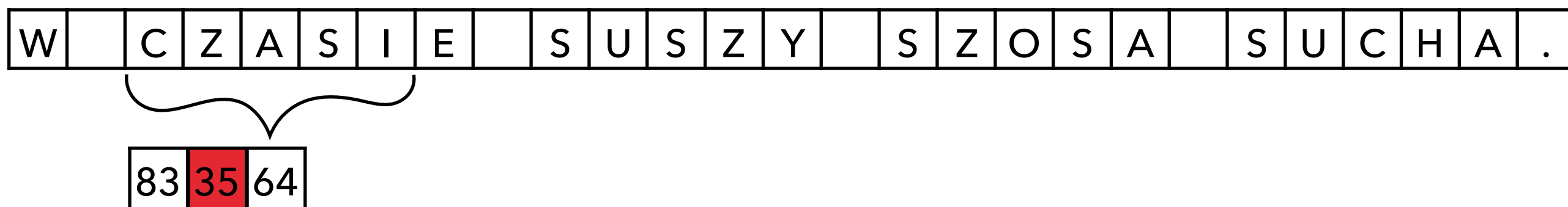
$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$

$$p = W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))))$$

$$p = 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83))))$$

$$p = 22\,470\,191\,553 \% q$$

TEKST



$$d = 128$$

$$q = 89$$

$$h = d^{m-1} \% q$$

$$t_0 = T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))))$$

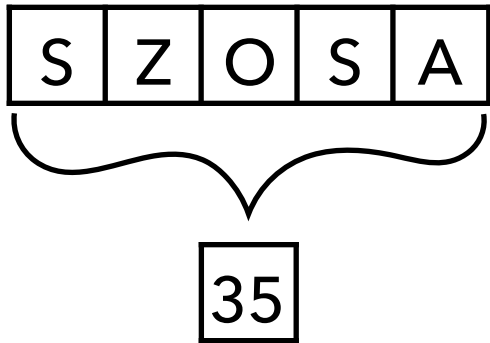
$$t_s = d * (t_{s-1} - T[s] * h) + T[s + m] \% q$$

$$t_1 = 128 * (t_0 - W * h) + S \% q$$

$$t_1 = 128 * (t_0 - 87 * h) + 83 \% q$$

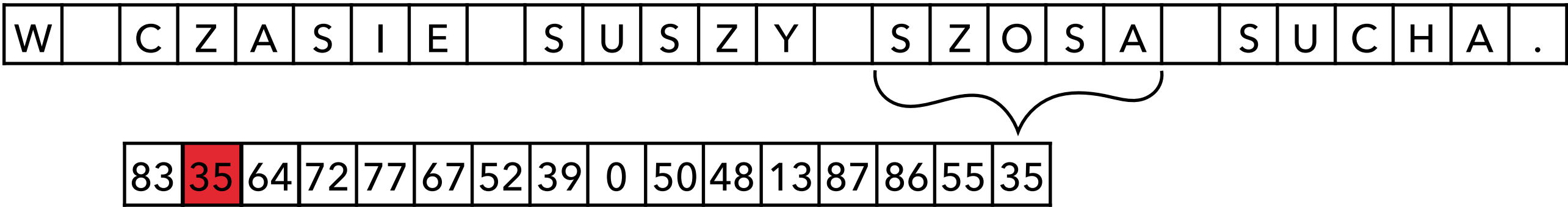
ALGORYTM RABINA-KARPA

WZORZEC



$$\begin{aligned} p &= S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0 \\ p &= W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))) \\ p &= 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83)))) \\ p &= 22\,470\,191\,553 \% q \end{aligned}$$

TEKST

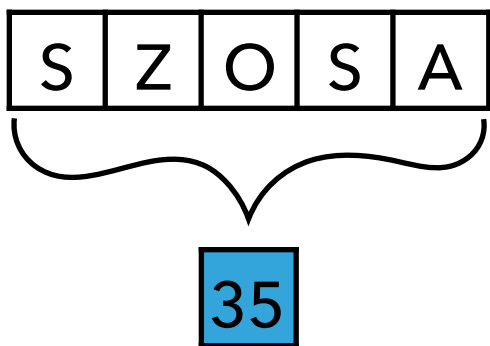


$$\begin{aligned} d &= 128 \\ q &= 89 \\ h &= d^{m-1} \% q \end{aligned}$$

$$\begin{aligned} t_0 &= T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))) \\ t_s &= d * (t_{s-1} - T[s] * h) + T[s + m] \% q \\ t_1 &= 128 * (t_0 - W * h) + S \% q \\ t_1 &= 128 * (t_0 - 87 * h) + 83 \% q \end{aligned}$$

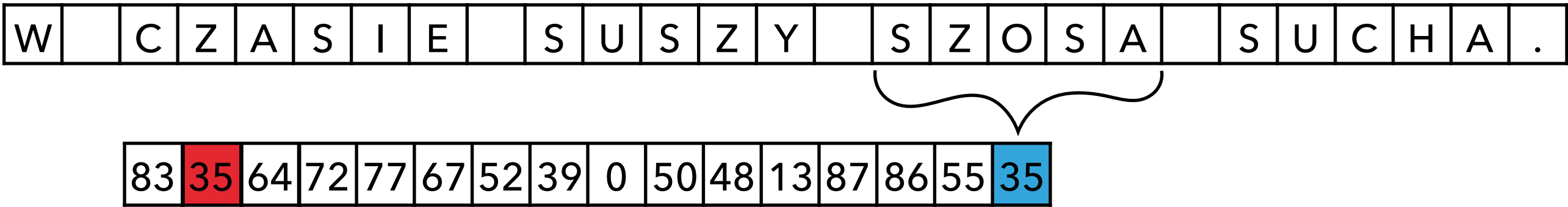
ALGORYTM RABINA-KARPA

WZORZEC



$$\begin{aligned} p &= S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0 \\ p &= W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0])))) \\ p &= 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83)))) \\ p &= 22\,470\,191\,553 \% q \end{aligned}$$

TEKST

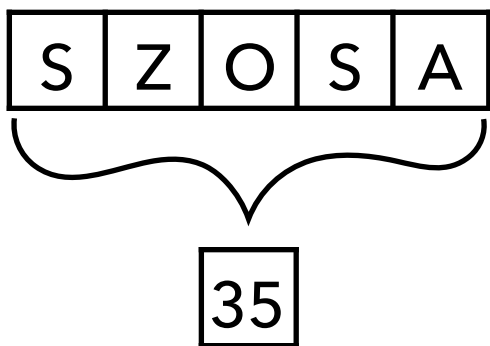


$$\begin{aligned} d &= 128 \\ q &= 89 \\ h &= d^{m-1} \% q \end{aligned}$$

$$\begin{aligned} t_0 &= T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0])))) \\ t_s &= d * (t_{s-1} - T[s] * h) + T[s + m] \% q \\ t_1 &= 128 * (t_0 - W * h) + S \% q \\ t_1 &= 128 * (t_0 - 87 * h) + 83 \% q \end{aligned}$$

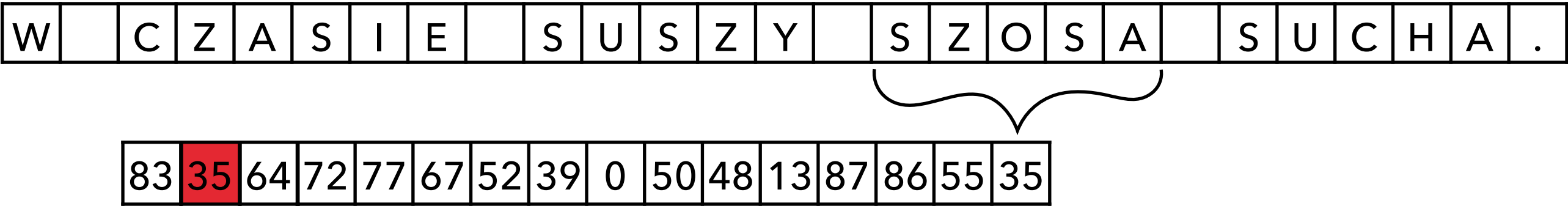
ALGORYTM RABINA-KARPA

WZORZEC



$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$
$$p = W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))))$$
$$p = 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83))))$$
$$p = 22\,470\,191\,553 \% q$$

TEKST

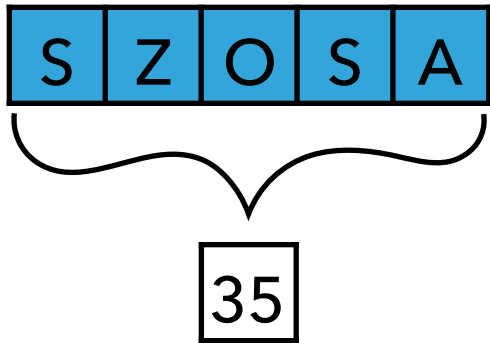


$d = 128$ $q = 89$ $h = d^{m-1} \% q$

$$t_0 = T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))))$$
$$t_s = d * (t_{s-1} - T[s] * h) + T[s + m] \% q$$
$$t_1 = 128 * (t_0 - W * h) + S \% q$$
$$t_1 = 128 * (t_0 - 87 * h) + 83 \% q$$

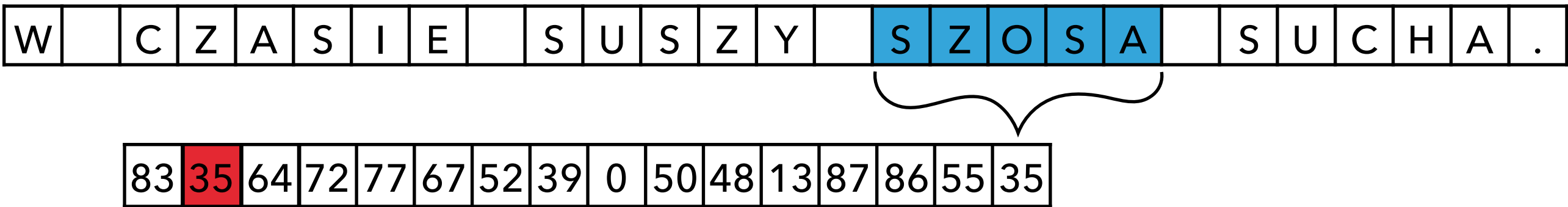
ALGORYTM RABINA-KARPA

WZORZEC



$$\begin{aligned} p &= S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0 \\ p &= W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))) \\ p &= 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83)))) \\ p &= 22\,470\,191\,553 \% q \end{aligned}$$

TEKST

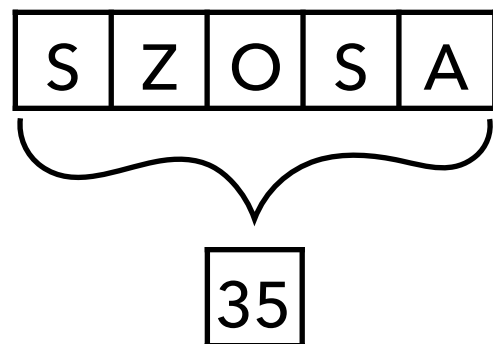


$$\begin{aligned} d &= 128 \\ q &= 89 \\ h &= d^{m-1} \% q \end{aligned}$$

$$\begin{aligned} t_0 &= T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))) \\ t_s &= d * (t_{s-1} - T[s] * h) + T[s + m] \% q \\ t_1 &= 128 * (t_0 - W * h) + S \% q \\ t_1 &= 128 * (t_0 - 87 * h) + 83 \% q \end{aligned}$$

ALGORYTM RABINA-KARPA

WZORZEC



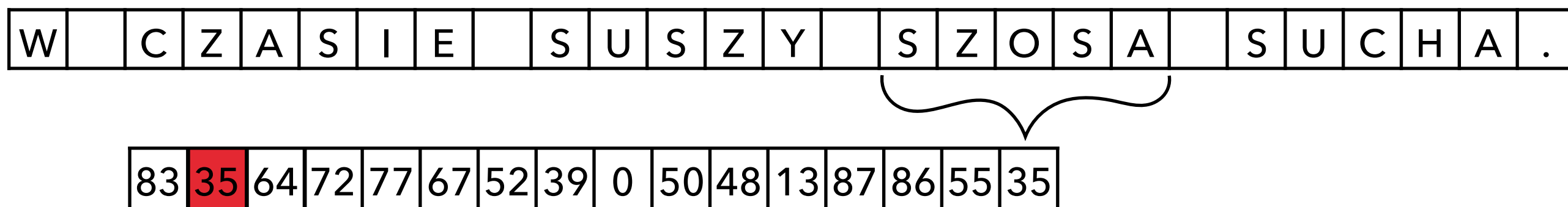
$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$

$$p = W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))))$$

$$p = 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83))))$$

$$p = 22\,470\,191\,553 \% q$$

TEKST



$$d = 128$$

$$q = 89$$

$$h = d^{m-1} \% q$$

$$t_0 = T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))))$$

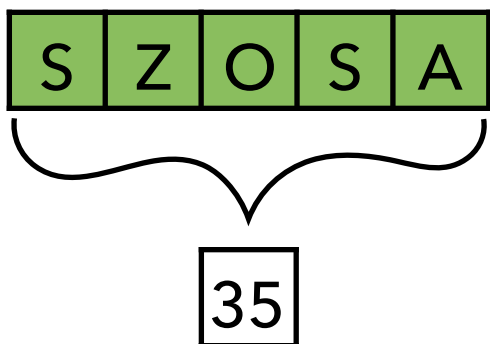
$$t_s = d * (t_{s-1} - T[s] * h) + T[s + m] \% q$$

$$t_1 = 128 * (t_0 - W * h) + S \% q$$

$$t_1 = 128 * (t_0 - 87 * h) + 83 \% q$$

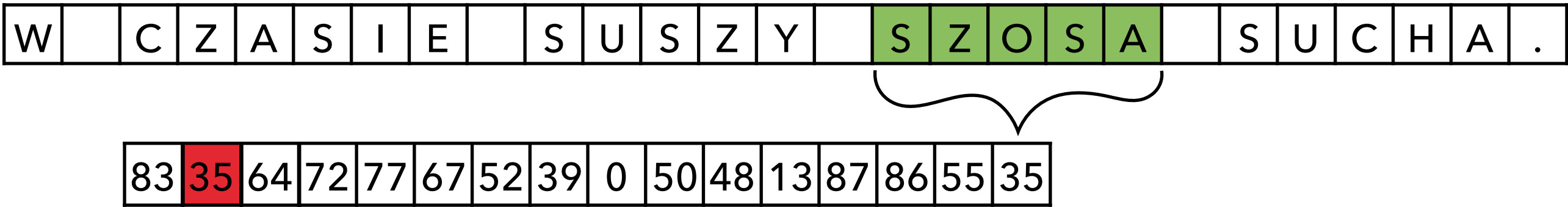
ALGORYTM RABINA-KARPA

WZORZEC



$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$
$$p = W[m - 1] + d*(W[m - 2] + d*(W[m - 3] + \dots d*(W[1] + d*(W[0]))))$$
$$p = 65 + 128*(83 + 128*(79 + 128*(90 + 128*(83))))$$
$$p = 22\,470\,191\,553 \% q$$

TEKST

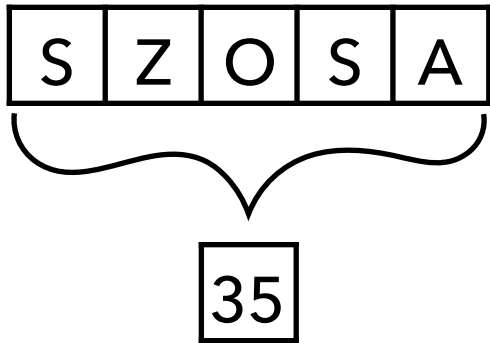


$d = 128$ $q = 89$ $h = d^{m-1} \% q$

$$t_0 = T[m - 1] + d*(T[m - 2] + d*(T[m - 3] + \dots d*(T[1] + d*(T[0]))))$$
$$t_s = d*(t_{s-1} - T[s] * h) + T[s + m] \% q$$
$$t_1 = 128*(t_0 - W * h) + S \% q$$
$$t_1 = 128*(t_0 - 87 * h) + 83 \% q$$

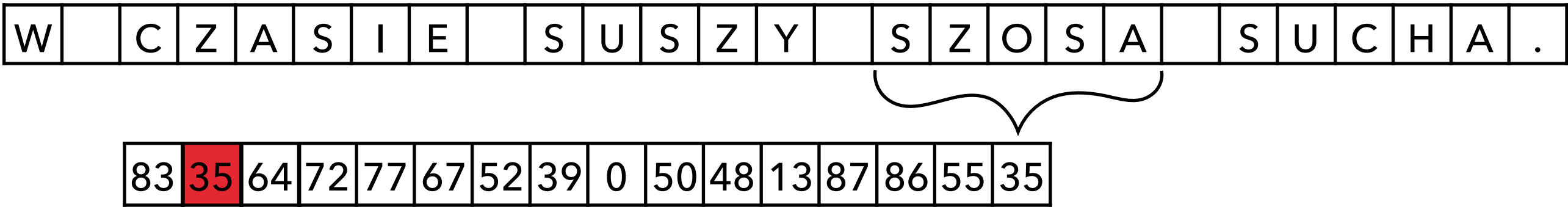
ALGORYTM RABINA-KARPA

WZORZEC



$$\begin{aligned} p &= S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0 \\ p &= W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))) \\ p &= 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83)))) \\ p &= 22\,470\,191\,553 \% q \end{aligned}$$

TEKST

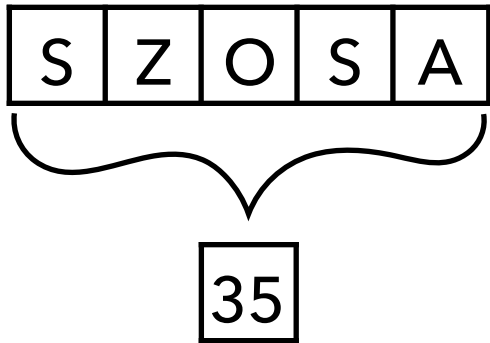


$$\begin{aligned} d &= 128 \\ q &= 89 \\ h &= d^{m-1} \% q \end{aligned}$$

$$\begin{aligned} t_0 &= T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))) \\ t_s &= d * (t_{s-1} - T[s] * h) + T[s + m] \% q \\ t_1 &= 128 * (t_0 - W * h) + S \% q \\ t_1 &= 128 * (t_0 - 87 * h) + 83 \% q \end{aligned}$$

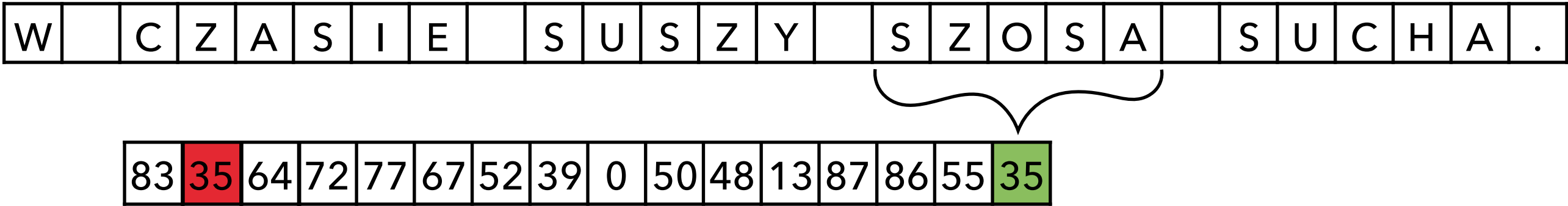
ALGORYTM RABINA-KARPA

WZORZEC



$$\begin{aligned} p &= S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0 \\ p &= W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))) \\ p &= 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83)))) \\ p &= 22\,470\,191\,553 \% q \end{aligned}$$

TEKST

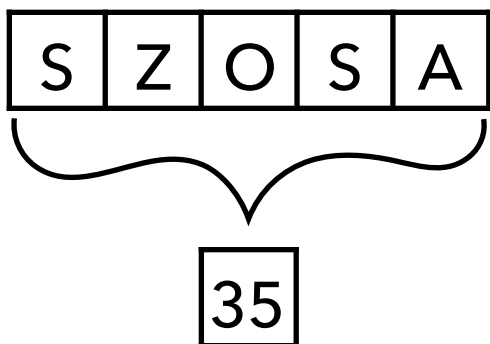


$$\begin{aligned} d &= 128 \\ q &= 89 \\ h &= d^{m-1} \% q \end{aligned}$$

$$\begin{aligned} t_0 &= T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))) \\ t_s &= d * (t_{s-1} - T[s] * h) + T[s + m] \% q \\ t_1 &= 128 * (t_0 - W * h) + S \% q \\ t_1 &= 128 * (t_0 - 87 * h) + 83 \% q \end{aligned}$$

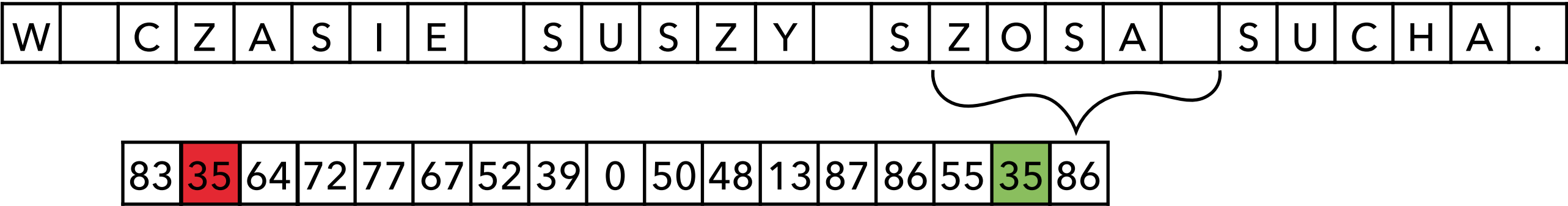
ALGORYTM RABINA-KARPA

WZORZEC



$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$
$$p = W[m - 1] + d*(W[m - 2] + d*(W[m - 3] + \dots d*(W[1] + d*(W[0]))))$$
$$p = 65 + 128*(83 + 128*(79 + 128*(90 + 128*(83))))$$
$$p = 22\,470\,191\,553 \% q$$

TEKST

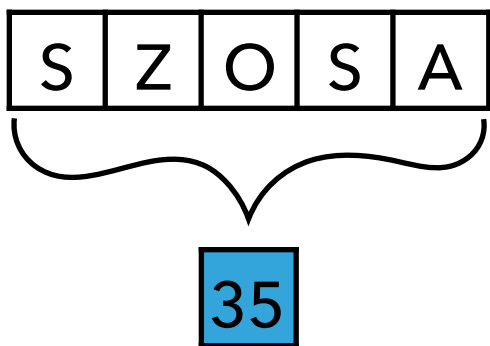


$d = 128$ $q = 89$ $h = d^{m-1} \% q$

$$t_0 = T[m - 1] + d*(T[m - 2] + d*(T[m - 3] + \dots d*(T[1] + d*(T[0]))))$$
$$t_s = d*(t_{s-1} - T[s] * h) + T[s + m] \% q$$
$$t_1 = 128*(t_0 - W * h) + S \% q$$
$$t_1 = 128*(t_0 - 87 * h) + 83 \% q$$

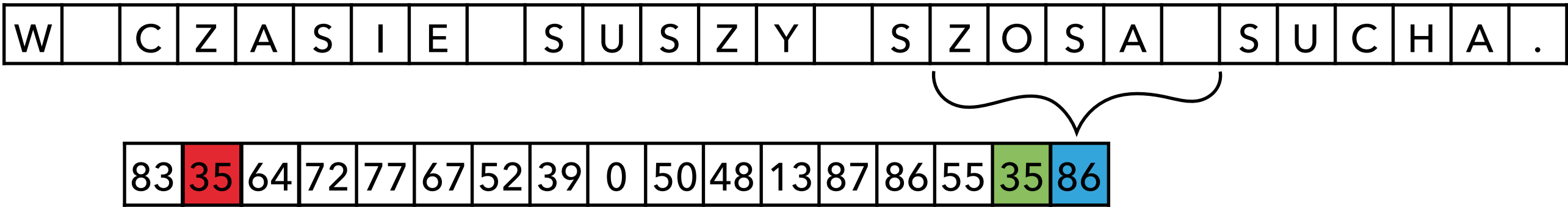
ALGORYTM RABINA-KARPA

WZORZEC



$$\begin{aligned} p &= S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0 \\ p &= W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))) \\ p &= 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83)))) \\ p &= 22\,470\,191\,553 \% q \end{aligned}$$

TEKST

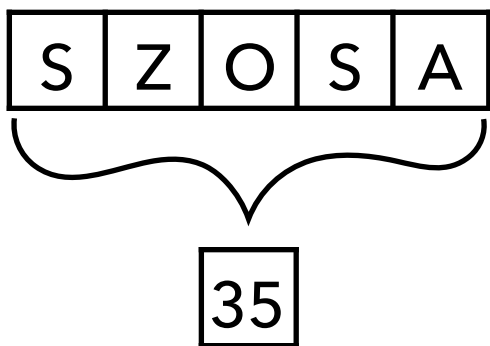


$$\begin{aligned} d &= 128 \\ q &= 89 \\ h &= d^{m-1} \% q \end{aligned}$$

$$\begin{aligned} t_0 &= T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))) \\ t_s &= d * (t_{s-1} - T[s] * h) + T[s + m] \% q \\ t_1 &= 128 * (t_0 - W * h) + S \% q \\ t_1 &= 128 * (t_0 - 87 * h) + 83 \% q \end{aligned}$$

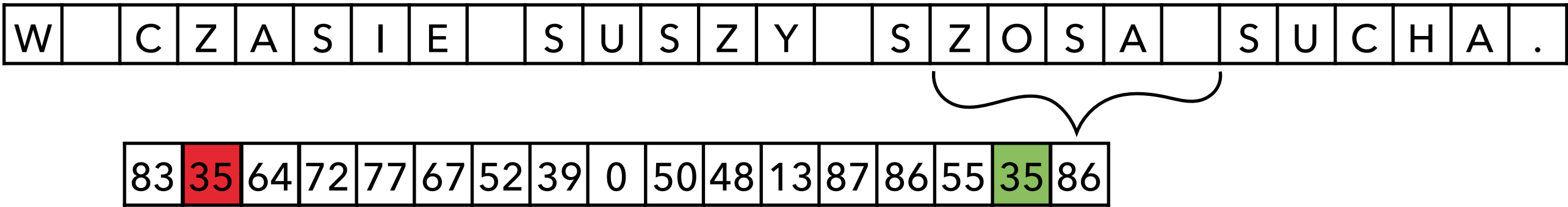
ALGORYTM RABINA-KARPA

WZORZEC



$$\begin{aligned} p &= S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0 \\ p &= W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0])))) \\ p &= 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83)))) \\ p &= 22\,470\,191\,553 \% q \end{aligned}$$

TEKST

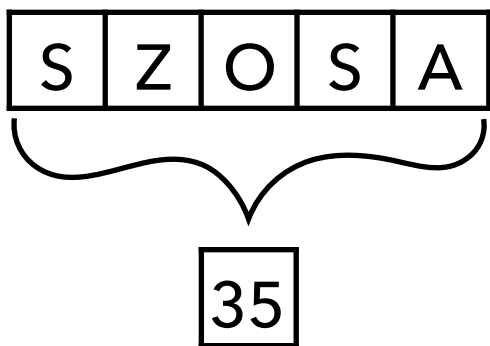


$$\begin{aligned} d &= 128 \\ q &= 89 \\ h &= d^{m-1} \% q \end{aligned}$$

$$\begin{aligned} t_0 &= T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0])))) \\ t_s &= d * (t_{s-1} - T[s] * h) + T[s + m] \% q \\ t_1 &= 128 * (t_0 - W * h) + S \% q \\ t_1 &= 128 * (t_0 - 87 * h) + 83 \% q \end{aligned}$$

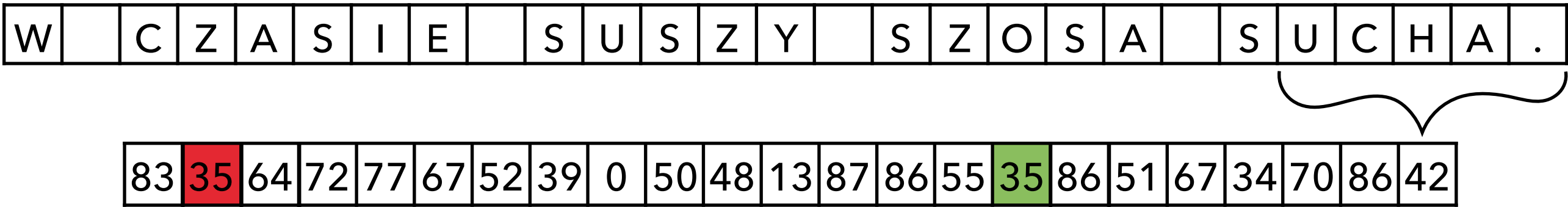
ALGORYTM RABINA-KARPA

WZORZEC



$$\begin{aligned} p &= S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0 \\ p &= W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))) \\ p &= 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83)))) \\ p &= 22\,470\,191\,553 \% q \end{aligned}$$

TEKST

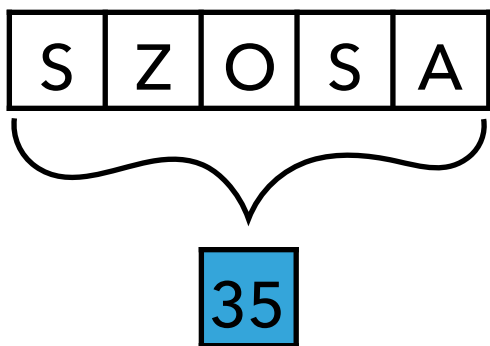


$$\begin{aligned} d &= 128 \\ q &= 89 \\ h &= d^{m-1} \% q \end{aligned}$$

$$\begin{aligned} t_0 &= T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))) \\ t_s &= d * (t_{s-1} - T[s] * h) + T[s + m] \% q \\ t_1 &= 128 * (t_0 - W * h) + S \% q \\ t_1 &= 128 * (t_0 - 87 * h) + 83 \% q \end{aligned}$$

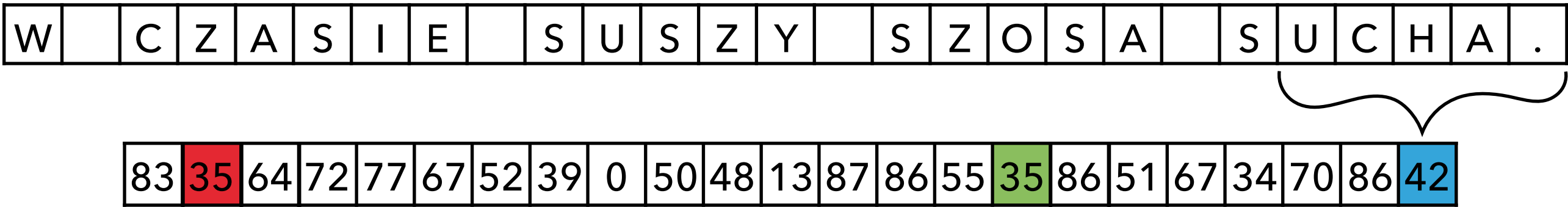
ALGORYTM RABINA-KARPA

WZORZEC



$$\begin{aligned} p &= S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0 \\ p &= W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))) \\ p &= 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83)))) \\ p &= 22\,470\,191\,553 \% q \end{aligned}$$

TEKST

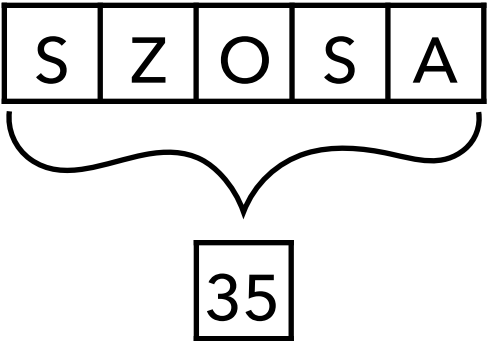


$$\begin{aligned} d &= 128 \\ q &= 89 \\ h &= d^{m-1} \% q \end{aligned}$$

$$\begin{aligned} t_0 &= T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))) \\ t_s &= d * (t_{s-1} - T[s] * h) + T[s + m] \% q \\ t_1 &= 128 * (t_0 - W * h) + S \% q \\ t_1 &= 128 * (t_0 - 87 * h) + 83 \% q \end{aligned}$$

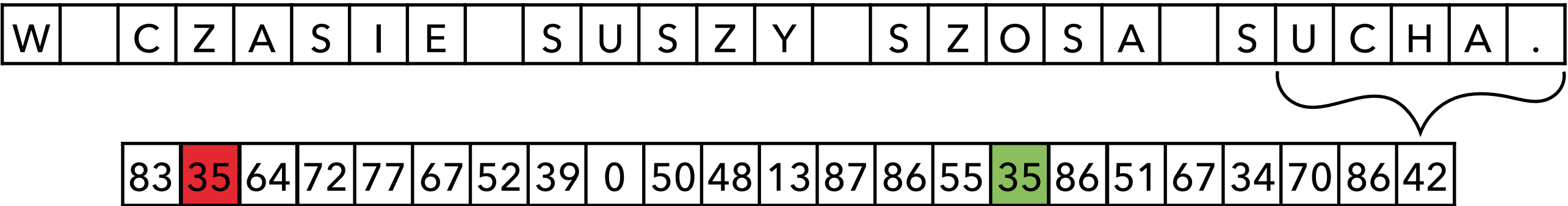
ALGORYTM RABINA-KARPA

WZORZEC



$$p = S * 128^4 + Z * 128^3 + O * 128^2 + S * 128^1 + A * 128^0$$
$$p = W[m - 1] + d * (W[m - 2] + d * (W[m - 3] + \dots d * (W[1] + d * (W[0]))))$$
$$p = 65 + 128 * (83 + 128 * (79 + 128 * (90 + 128 * (83))))$$
$$p = 22\,470\,191\,553 \% q$$

TEKST



$d = 128$ $q = 89$ $h = d^{m-1} \% q$

$$t_0 = T[m - 1] + d * (T[m - 2] + d * (T[m - 3] + \dots d * (T[1] + d * (T[0]))))$$
$$t_s = d * (t_{s-1} - T[s] * h) + T[s + m] \% q$$
$$t_1 = 128 * (t_0 - W * h) + S \% q$$
$$t_1 = 128 * (t_0 - 87 * h) + 83 \% q$$

ZŁOŻONOŚĆ CZASOWA

	Rabin-Karp(T, P, d, q)
1	$n \leftarrow \text{length}[T]$
1	$m \leftarrow \text{length}[P]$
1	$h \leftarrow d^{m-1} \bmod q$
1	$p \leftarrow 0$
1	$t \leftarrow 0$
	for $i \leftarrow 1$ to m
m	do $p \leftarrow (d * p + P[i]) \bmod q$
m	do $t \leftarrow (d * t + T[i]) \bmod q$
	for $s \leftarrow 0$ to $n-m$
1	do if $p = t$
1	then if $P[1..m] = T[s+1..s+m]$
1	then wypisz s
1	if $s < n-m$
$n - m$	then $t \leftarrow (d * (t - T[s] * h) + T[s+m]) \bmod q$
<hr/>	
$O(n + m)$	