Compute Prefix Function Example

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q	1	2	3	4	5	6	7
P[q]	a	b	a	b	a	c	a
π[q]	0	0	1	2	3	0	1

```
COMPUTE-PREFIX-FUNCTION (P)
1   m = length(P)
2   let pi [1.. m] be a new array
3   pi [1] = 0
4   k = 0
5   for q = 2 to m
6       while k > 0 and P [k+1] != P[q]
7             k =pi [k]
8       if P [k+1] == P[q]
9             k =k+1
10      pi [q] =k
11  return pi
```

(1)

for $q = 1$, $\pi[q] = 0$

for $q = 2$, $K = 0$ $\therefore$ $K > 0$ is false and

$P[K+1] = P[1] = a$, $P[q] = P[2] = b$

$\therefore P[K+1] \neq P[q]$

$\therefore \pi[q] \leftarrow K$

i.e $\pi[2] \leftarrow 0$

q	1	2	3	4	5	6	7
P[q]	a	b	a	b	a	c	a
π[q]	0	0					

for $q = 3$, $K = 0$ $\therefore$ $K > 0$ is false, then we compute

$P[K+1] = P[1] = a$, $P[q] = P[3] = a$

Here $P[K+1] = P[q]$

$\therefore K = K+1 = 0+1 = 1$

and $\pi[q] \leftarrow K$

i.e $\pi[3] \leftarrow 1$

```
5   for q = 2 to m
6       while k > 0 and P [k+1] != P[q]
7             k =pi [k]
8       if P [k+1] == P[q]
9             k =k+1
10      pi [q] =k
```

q	1	2	3	4	5	6	7
P[q]	a	b	a	b	a	c	a
π[q]	0	0	1				

for $q = 4$, $K = 1$, so $K > 1$ then we compute

$P[K+1] = P[1+1] = P[2] = b$, $P[q] = P[4] = b$

Here $P[K+1] = P[q]$

$\therefore K > 0$ and $P[K+1] = P[q]$ is true

$\therefore K \leftarrow K+1$

$K \leftarrow 1+1$

$K \leftarrow 2$

and $\pi[q] \leftarrow K$

$\therefore \pi[4] \leftarrow 2$

q	1	2	3	4	5	6	7
P[q]	a	b	a	b	a	c	a
π[q]	0	0	1	2			

for $q = 5$, $K = 2$

So $K > 0$ is true, Now we compute

$P[K+1] = P[2+1] = P[3] = q$

$P[q] = P[5] = q$

Here $P[K+1] \neq P[q]$ is false

But $P[K+1] = P[q]$ is true

$\therefore K \leftarrow K+1$

$K \leftarrow 2+1 \leftarrow 3$

and $\pi[q] \leftarrow K$

$\therefore \pi[5] \leftarrow 3$

q	1	2	3	4	5	6	7
P[q]	a	b	a	b	a	c	q
π[q]	0	0	1	2	3		

for $q = 6$, $K = 3$

$K > 0$ is true

$P[K+1] = P[3+1] = P[4] = b$

$P[q] = P[6] = c$

Here $P[K+1] \neq P[q]$ is true

$\therefore K \leftarrow \pi[k]$

i.e $K \leftarrow \pi[3]$

$K \leftarrow 1$

```
5   for q = 2 to m
6       while k > 0 and P [k+1] != P[q]
7           k =pi [k]
8       if P [k+1] == P[q]
9           k =k+1
10      pi [q] =k
```

Now check for $K=1$ which is > 0, lets compute

$P[K+1] = P[1+1] = P[2] = b$

$P[q] = P[6] = c$

again $P[K+1] \neq P[q]$ is true

$\therefore K \leftarrow \pi[K] \leftarrow \pi[1] \leftarrow 0$

$\therefore K \leftarrow 0$

Now, check for K = 0

so at q = 6 , Now K = 0

so K > 0 is false , let check

P[K+1] = P[0+1] = P[1] = a

P[q] = P[6] = c

∴ P[K+1] = P[q] is also false, then

π[q] ← K

∴ π[6] ← 0

q	1	2	3	4	5	6	7
P[q]	a	b	a	b	a	c	q
π[q]	0	0	1	2	3	0	

for q = 7 , K = 0

i.e K > 0 is false, lets compute

P[K+1] = P[1] = a

P[q] = P[7] = q

Here P[K+1] = P[q] is true

∴ K ← K+1

K ← 0+1 ← 1

and π[q] ← K

∴ π[7] ← 1

```
5   for q = 2 to m
6       while k > 0 and P [k+1] != P[q]
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```

q	1	2	3	4	5	6	7
P[q]	a	b	a	b	a	c	q
π[q]	0	0	1	2	3	0	1