

13.2 (a)

Let say we are given the text:

T: a b e d a b c

P: a b c

First we consider the length of the pattern in text

T: a b e d a b c
P: a b c = 34

Now we first calculate the Hash of the pattern assuming

a \rightarrow 1 and let's say our prime is 3
b \rightarrow 2
e \rightarrow 3

To calculate the hash of the ~~pattern~~^{text} we do it as follows

a b e

$$1 + 2 \cdot 3^1 + 5 \cdot 3^2 = 52$$

Now we

compare the hash of the text and the pattern. If the hash of the text & pattern is the same then we ~~can confirm~~ it could be a spurious hit.

Meaning the pattern might not match therefore we iterate each

check if there is a match.
In our case,

$$34 \neq 52$$

Therefore we need to "roll"
forward meaning removing the
hash of the previous and adding
the hash of the next character.
This is done recursively till
a match is found or the
loop ends.

Formula for finding hash of next
character

$$\text{new hash} = X + \text{prime}^{m-1} \times \text{val}(\text{new char})$$

eg. Now we find the hash of
a b e d

① Subtract the hash of a $(52-1) \Rightarrow \underline{51}$

② divide by the prime $\frac{51}{3}$

③ Add value of next character $17 + 4$

④ Multiply 4 by $3^{m-1} = 4 \cdot 3^2$

$$17 + 4 \cdot 3^2 \Rightarrow 53$$

Now series $53 \neq 34$
see continued rolling

P: a b c $\Rightarrow 34$

T: a b e d a b c

$$26 - 5 = \frac{21}{3} = 7 + 2 \cdot 3^2$$

$$= 7 + 18 = 25$$

since $26 \neq 34$

T: a b e p l a b c

$$25 - 5 = \frac{21}{3} = 7 + 3 \cdot 3^2 = 34$$

$$= 7 + 18 = 25 \neq 34$$

T a b e d a b c

$$25 - 4 = \frac{21}{3} = 7 + 3 \cdot 3^2 = 7 + 27$$

$$= 34$$

$$34 = 34$$

Pattern matches flash
Now we just compare the
substring and pattern and the
index returns 4, the starting
point of the match.