

# 1 The dictionary counts of two strings that we rotate cyclically after having appended \$.

BOSS\$, OSS\$B, SS\$B0, S\$BOS, \$BOS\$  
 POS\$, OS\$P, S\$PO, \$POS

We insert those strings into a trie to support efficient prefix searches, and each of them keeps track of the original rotated string: i.e., BOSS or POS.

Searching for B\$S corresponds to search for S\$B\$.

# 2.

| set              | $\pi_1(x) = x \bmod 11$ | $\pi_2(x) = 2x \bmod 11$ | $\pi_3(x) = 3x \bmod 11$ |
|------------------|-------------------------|--------------------------|--------------------------|
| A = {2, 3, 5, 7} | (2), 3, 5, 7            | 4, 6, 10, (3)            | 6, 9, (4), 10            |
| B = {1, 5}       | (1), 5                  | (2), 10                  | (3), 4                   |
| C = {5, 8, 9}    | (5), 8, 9               | 10, (5), 7               | 4, (2), 5                |

$$SK(A) = [2, 3, 4]$$

$$SK(B) = [1, 2, 3]$$

$$SK(C) = [5, 5, 2]$$

no shared component  
 so the approximated  
 Jaccard is  $\emptyset$  for all  
 pairs of sets.

#3

a)  $u = 29$   
 $n = 8$

$b = \lceil \log u \rceil = 5$   
 $w = \lceil \log \frac{u}{n} \rceil = 2$

← w →

|    |   |   |   |   |   |
|----|---|---|---|---|---|
| 3  | 0 | 0 | 0 | 1 | 1 |
| 5  | 0 | 0 | 1 | 0 | 1 |
| 8  | 0 | 1 | 0 | 0 | 0 |
| 10 | 0 | 1 | 0 | 1 | 0 |
| 11 | 0 | 1 | 0 | 1 | 1 |
| 18 | 1 | 0 | 0 | 1 | 0 |
| 24 | 1 | 1 | 0 | 0 | 0 |
| 28 | 1 | 1 | 1 | 0 | 0 |

$L = 11 \ 01 \ 00 \ 10 \ 11 \ 10 \ 00 \ 00$

$H = \underset{0}{10} \ \underset{1}{10} \ \underset{2}{110} \ \underset{3}{0} \ \underset{4}{10} \ \underset{5}{0} \ \underset{6}{10} \ \underset{7}{10}$

b)  $GAP(S) = (3, 2, 3, 2, 1, 7, 6, 4)$

$\gamma(1) = 1$

$\gamma(4) = 00100$

$\gamma(2) = 010$

$\gamma(6) = 00110$

$\gamma(3) = 011$

$\gamma(7) = 00111$

$\gamma(GAP(S)) = 011 \ 010 \ 011 \ 010 \ 1 \ 0011 \ 00110 \ 00100$

c)  $GAP(S)-BASE = (2, 1, 2, 1, 0, 6, 5, 3)$

PFOR-DELTA 10 01 10 01 00 11 11 11

EXCEPTIONS 6, 5, 3

d)

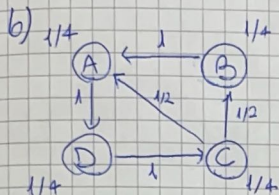
| NUM | 3-NIBBLE |
|-----|----------|
| 1   | 001      |
| 2   | 010      |
| 3   | 011      |
| 4   | 101000   |
| 6   | 101010   |
| 7   | 101011   |

$\Rightarrow 3\text{-NIBBLE}(GAP(S)) = 011 \ 010 \ 011 \ 010 \dots$   
 $\dots 001 \ 101011 \ 101010 \dots$   
 $\dots 101000$

#4

$$\text{GCD}(3A) = 1$$

d) YES BECAUSE THE MARKOV CHAIN IS IRREDUCIBLE AND APERIODIC



$$S = \{A, C\}$$

$$\alpha = 1/2$$

$$(i-d)/|S|$$

$$r(A) = \frac{1}{2} \left( \frac{1}{4} \cdot 1 + \frac{1}{4} \cdot \frac{1}{2} \right) + \frac{1}{2} \cdot \frac{1}{2} = \frac{7}{16}$$

$$r(B) = \frac{1}{2} \left( \frac{1}{4} \cdot \frac{1}{2} \right) = \frac{1}{16}$$

$$r(C) = \frac{1}{2} \left( \frac{1}{4} \cdot 1 \right) + \frac{1}{4} = \frac{3}{8}$$

$$r(D) = \frac{1}{2} \left( \frac{1}{4} \cdot 1 \right) = \frac{1}{8}$$

e) 
$$d(A) = h(B) + h(C) = 2 + 1 = 3$$

$$d(C) = h(D) = 2$$

$$h(A) = d(D) = 2$$

$$h(C) = d(A) + d(B) = 1 + 2 = 3$$