

Exercise 1

We create two dictionaries: one is  $S'$ , the other consists of all  $S$ 's strings from which we removed one char.

$$D_1 = S'$$

$$D_2 = \left\{ \begin{array}{cccccccccccc} \text{at} & \text{bt} & \text{ba} & \text{it} & \text{bt} & \text{bi} & \text{et} & \text{bt} & \text{be} & \text{of} & \text{st} & \text{bu} \\ \text{original string} \Rightarrow & \text{bot} & \text{bet} & \text{bat} & \text{bit} & \text{bit} & \text{bit} & \text{bet} & \text{bet} & \text{bet} & \text{bt} & \text{bt} & \text{bt} \end{array} \right\}$$

Searching for  $P$  with 1-error means to perform the following queries over  $D_1$  and  $D_2$ :

- ) Search  $P$  in  $D_1 \equiv$  exact search  $\Rightarrow$  best  $\notin S'$
- ) Search  $P$  in  $D_2 =$  if  $P$  equals a  $S$ 's string from which we removed one char.  $\Rightarrow \{ \}$
- ) Search  $P^{-1}$  in  $D_1 \equiv$  if  $P$  equals one string of  $S'$  except one char removed from  $P$  (or, added in that string).

$$P^{-1} = \text{est}, \text{bst}, \text{bes}, \text{bet} \Rightarrow \text{bet} \in D_1$$

- ) search  $P^{-1}$  in  $D_2 \equiv$  if  $P$  equals a string of  $S'$  except for a mismatch.

$P^{-1} \notin D_2$ , as indeed  $D_2$  consists of strings of 2 chars whereas  $P^{-1}$  consists of strings of 3 chars.

## Exercise 2

$$\# \text{ integers encoded} = \# 1 \text{ in } H \Rightarrow 8$$

$$\# \text{ bits used} = \frac{|L|}{8} + \log_2(\# 0 \text{ in } H) = 2 + 3 = 5$$

Decompress the 4<sup>th</sup> integer:

the 4<sup>th</sup> group of 2 bits in  $L \Rightarrow 01$

position of the 4<sup>th</sup> one -  $\# 0$  before that position

$L \Rightarrow 8 - 4 = 4 \Rightarrow 100$  because we have to represent it in 3 bits.

The number is:  $10001 = 16 + 1 = 17$

## Exercise 3 (rsync)

$$F_{\text{old}} = \frac{\text{CANE} \_ \text{GATTO} \_ \text{ORSO}}{h_1 \quad h_2 \quad h_3 \quad h_4 \quad h_5} \quad B = 3$$

$h_1, h_2, h_3, h_4, h_5$

$\rightarrow$  scan  $F_{\text{new}}$  searching for those hashes

$$F_{\text{new}} = \text{KATTO} \_ \text{CANE} \_ \text{GAS}$$

$\rightarrow$  M  $h_3$  O  $h_1$   $h_2$  A S

# Exercice 3 (7 points)

$$F_{\text{new}} = \frac{\text{MATTOLCANĒUGAS\$}}{h_1 \quad h_2 \quad h_3 \quad h_4 \quad h_5}$$

$h_1, h_2, h_3, h_4, h_5$

$$F_{\text{old}} = \frac{\text{CANĒUGATTOLORSO}}{h_3 \quad h_4 \quad h_2}$$

send 01110

$$\text{grip}(\text{TOLCANĒUG} \mid \text{MATAS\$}) = \langle 0, 0, M \rangle$$
$$\langle 6, 1, T \rangle$$
$$\langle 2, 1, S \rangle$$
$$\langle 0, 0, \$ \rangle$$