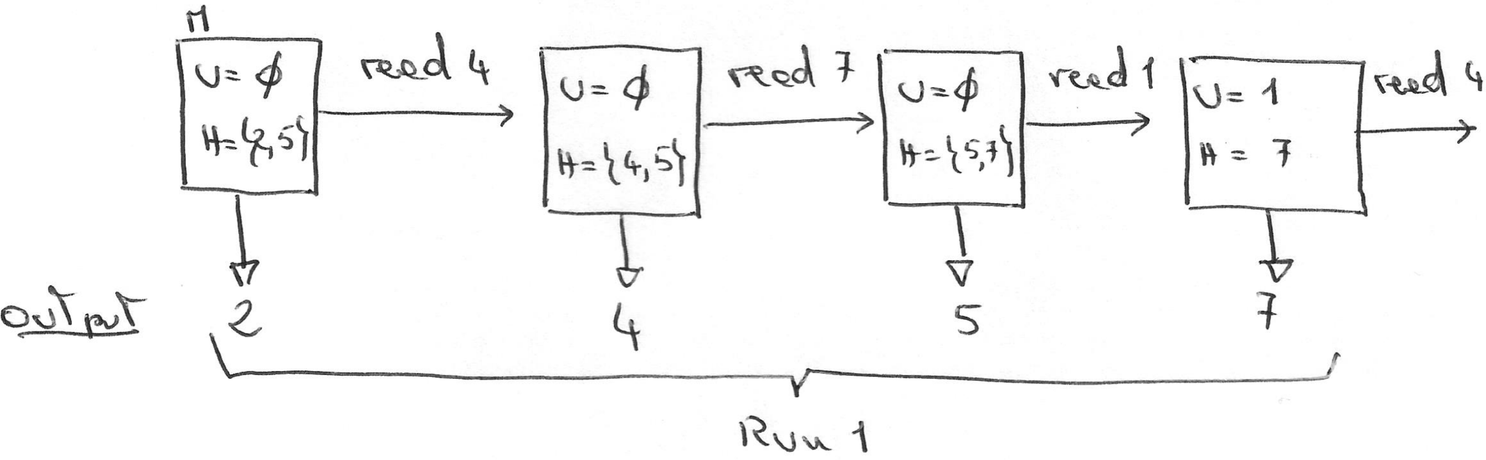
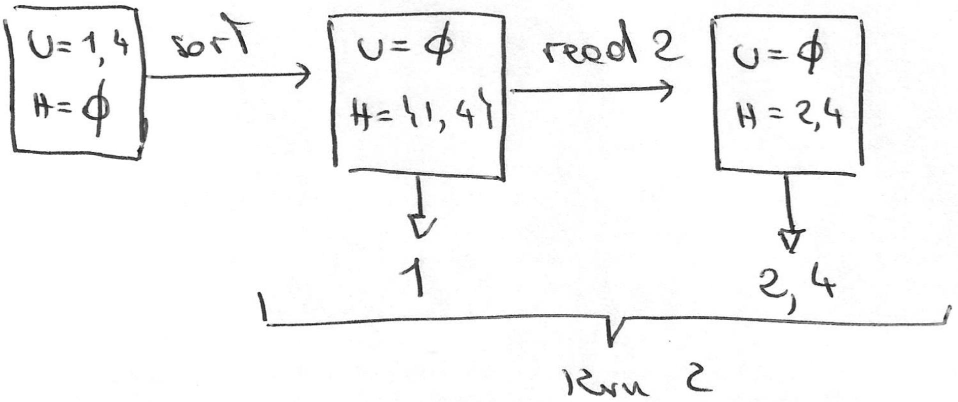
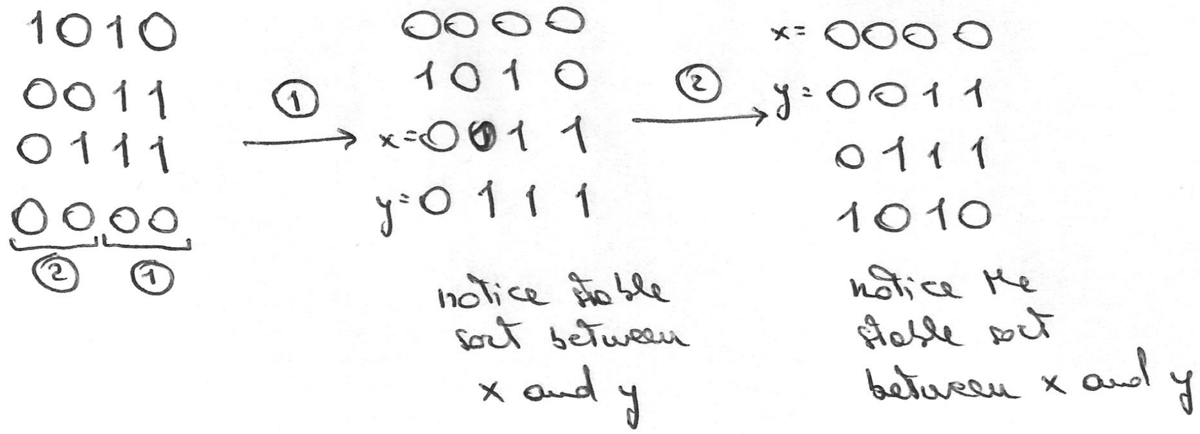
Solutions

Ex 1. The memory is able to fit 2 integers.





Ex 2. b = 2, so we sort via Counting Sort over two bits hence σ = 4



Ex 3 Let us pick the middle string as the pivot.

R, 1

zoo
zoa
boa
Pivot → bbat
abi
bus
tio
hat

$R_<, 1 \Rightarrow$ abi

$R_=, 2 \Rightarrow$ boa
bbat ← pivot
bus

$R_>, 1 \Rightarrow$ zoo
zoa ← pivot
tio
hat

$R_<, 2 \Rightarrow \phi$

$R_=, 3 \Rightarrow$ bat

(*) $R_>, 2 \Rightarrow$ boa
bus

$R_<, 1 \Rightarrow$ hat

$R_=, 2 \Rightarrow$ zoo
zoa
tio

(**) $R_>, 1 \Rightarrow \phi$

(*) $(R_>, 2)$

pivot → boa
bus

$(R_<, 2) \Rightarrow \phi$
$(R_=, 3) \Rightarrow$ boa
$(R_>, 2) \Rightarrow$ bus

(**)

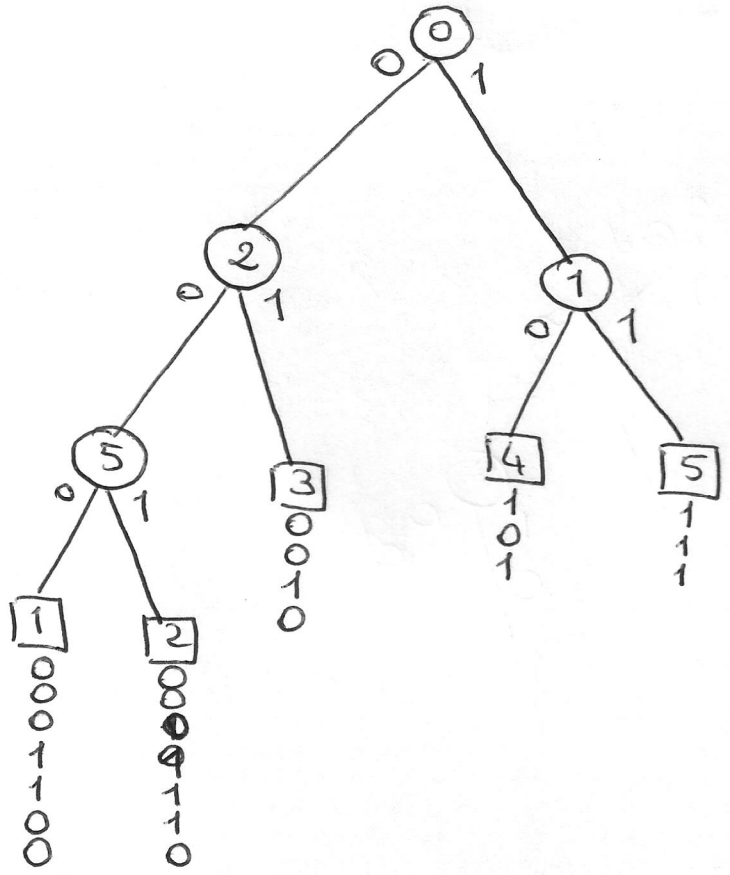
$(R_=, 2)$

zoo
pivot → zoa
tio

$(R_<, 2) \Rightarrow$ tio
$(R_=, 3) \Rightarrow$ zoo ← pivot
zoa

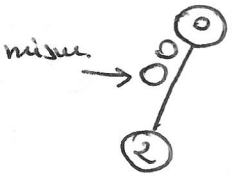
$(R_<, 3) \Rightarrow$ zoa
$R_=, 4 \Rightarrow$ zoo
$R_>, 3 \Rightarrow \phi$

Ex 4



To search for P1 = 010000
↑ ↑ ↑ then are the checked ones

we end up at leaf [1], where we compute LCP = 1 and we discover P1 > [1] so the lexicographic position is between [3] and [4] because we go to the right of edge



since the mismatch lies on this edge and P1 has 1 whereas the edge has 0.

To search for P2 = 0101 we end up at node (5)
↑ ↑

we then choose an arbitrary leaf, i.e. [2], compute LCP = 1 and is end up again at the same edge as above, with the same comparison. So that also P2 lies btw [3] and [4].

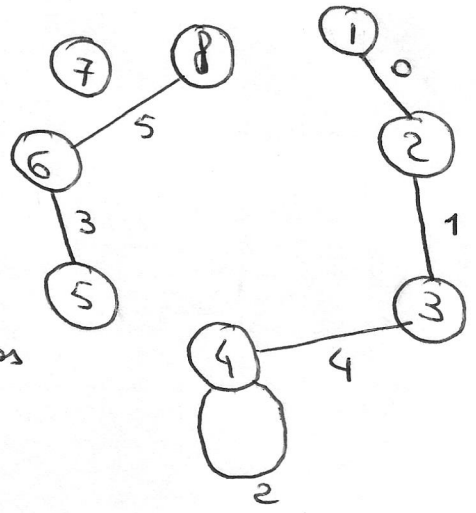
Ex 5

	0	1	2	3	4	5
$S =$	(aa,	ab,	bb,	bc,	ca,	db)
h_1	1	2	4	6	3	8
h_2	2	3	4	5	4	6

$m = 6$

$m = 11$

I have not drawn the nodes for 9 ÷ 10, ϕ because they do not occur as h_1/h_2 values.



the graph is cyclic because of the self-loop at node 4, so the algorithm stops and creates a new pair of hash functions h_1 and h_2.

For the sake of presentation, let us assume to substitute the self loop with an edge (4) —2— (7) by hypothizing that the new $h_1' = h_1$ for all strings except that $h_1'(bb) = 7$ and $h_2' = h_2$.

In this case we would compute:

t	1	2	3	4	5	6	7	8
$g(t)$	0	0	1	3	0	3	/ 5	2

$n = 6$

The values $g(0), g(9), g(10)$ can be assigned arbitrarily because they do not occur as h_1/h_2 values

because $g(4) + g(7) \equiv 2 \bmod 6$