

AGE	→ 3,4	$\log_4 4/2 = 1$
BEST	→ 1	$\log_4 4/1 = 2$
FOOLISHNESS	→ 4	$\log_4 4/1 = 2$
IT	→ 1,3	$\log_4 4/2 = 1$
OF	→ 1,2,3,4	$\log_4 4/4 = 0$
THE	→ 1,2,3,4	$\log_4 4/4 = 0$
TIMES	→ 1,2	$\log_4 4/2 = 1$
WAS	→ 1,3	$\log_4 4/2 = 1$
WISDOM	→ 3	$\log_4 4/1 = 2$
WORST	→ 2	$\log_4 4/1 = 2$

	D1	D2	D3	D4	q	
AGE	○	○	1x1	1x1	1x1	$D1 \cdot q = 2^2 + 1^2 = 4 + 1 = 5$
BEST	1x2	○	○	○	1x2	$D2 \cdot q = 1^2 = 1$
FOOLISHNESS	○	○	○	1x2	○	$D3 \cdot q = 1^2 = 1$
IT	1x1	○	1x1	○	○	$D4 \cdot q = 1^2 = 1$
OF	1x0	1x0	1x0	1x0	○	
THE	1x0	1x0	1x0	1x0	○	
TIMES	1x1	1x1	○	○	1x1	
WAS	1x1	○	1x1	○	○	
WISDOM	○	○	1x2	○	○	
WORST	○	1x2	○	○	○	SO D1 IS THE MOST SIMILAR DOC TO q

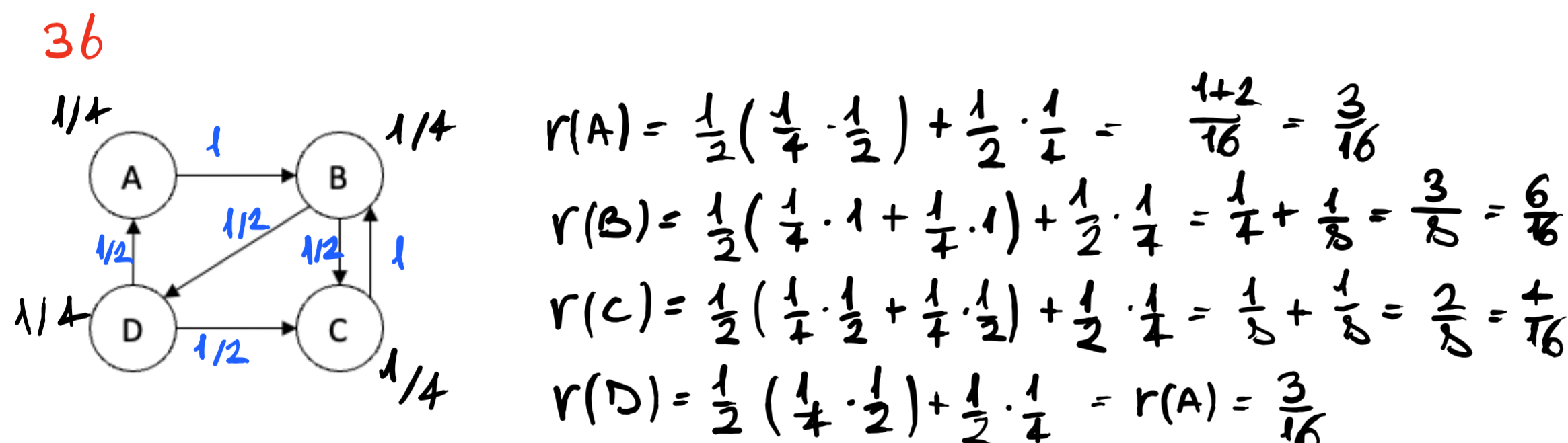
2a
 $S' = 1, 3, 1, 5, 6, 3, 4$
 1 011 1 00101 00110 011 00100

2b
 $U = 24$ $b = \lceil \log_2 U \rceil = 5$
 $N = 7$ $w = \lceil \log_2 \frac{U}{N} \rceil = 2$
 $z = b - w = 3$

1	0	0	0	0	1	
4	0	0	1	0	0	$L = 01\ 00\ 01\ 10\ 00\ 11\ 11$
5	0	0	1	0	1	
10	0	1	0	1	0	$H = \begin{matrix} 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 10 & 110 & 10 & 0 & 110 & 10 & 0 & 0 \end{matrix}$
16	1	0	0	0	0	
19	1	0	0	1	1	
23	1	0	1	1	1	$\underbrace{\hspace{2cm}}_{\text{SUPERFLUOUS OK TO DROP}}$

2c
 S' - BASE: 0, 2, 0, 4, 5, 2, 3 ESCAPE = 11
 00 10 00 11 11 10 11
 EXCEPTIONS: 4, 5, 3

3a
 YES BECAUSE THE GRAPH IS IRREDUCIBLE AND APERIODIC ($\text{GCD}(2,3)=1$)



3c

$r(A) = \frac{1}{2}(\frac{1}{4} \cdot \frac{1}{2}) = \frac{1}{16}$
 $r(B) = \frac{1}{2}(\frac{1}{4} \cdot 1 + \frac{1}{4} \cdot 1) = \frac{1}{4} = \frac{4}{16}$
 $r(C) = \frac{1}{2}(\frac{1}{4} \cdot \frac{1}{2} + \frac{1}{4} \cdot \frac{1}{2}) = \frac{1}{8} = \frac{2}{16}$
 $r(D) = \frac{1}{2}(\frac{1}{4} \cdot \frac{1}{2}) + \frac{1}{2} = \frac{1}{16} + \frac{1}{2} = \frac{9}{16}$

4a

$t_2 \rightarrow 1, 5, 7, 10, 21$	UB] SUM IS 3.5 > $\theta = 3.3$, SO THE PIVOT IS 5. SUM OF UBs OF LISTS CONTAINING 5 IS 3.5, SO WE COMPUTE THE FULL SCOPE OF 5
$t_1 \rightarrow 3, 4, 5, 6, 7, 20, 22$	2	
$t_3 \rightarrow 5, 7, 11, 20, 22$	1	
$t_4 \rightarrow 7, 8, 10, 11, 14$	0.5	
	1.2	

4b

$t_2 \rightarrow 1, 5, 7, 10, 21$	UB] PIVOT IS STILL 5. WE DON'T COMPUTE ITS FULL SCOPE BECAUSE THE SUM OF THE LOCAL UPPER BOUNDS OF THE BLOCKS CONTAINING IT IS 3.2 < θ
$t_1 \rightarrow 3, 4, 5, 6, 7, 20, 22$	2	
$t_3 \rightarrow 5, 7, 11, 20, 22$	1	
$t_4 \rightarrow 7, 8, 10, 11, 14$	0.5	
	1.2	

4c
 WE SKIP THE BLOCK IN t_1 BECAUSE 5 IS THE SMALLEST RIGHTMOST DOCID ACROSS ALL BLOCKS, AND 5 IS SMALLER THAN THE DOC 7 POINTED BY t_4 (NOTICE WE WOULD HAVE MOVED t_1 TO DOC 6 ANYWAY, SO THE SKIPPING OF THE BLOCK DID NOT PRUNE ANY EXTRA DOC)

5
 SEE BOOK, SECTION 7.1.6

6
 SEE BOOK, SECTION 21.3