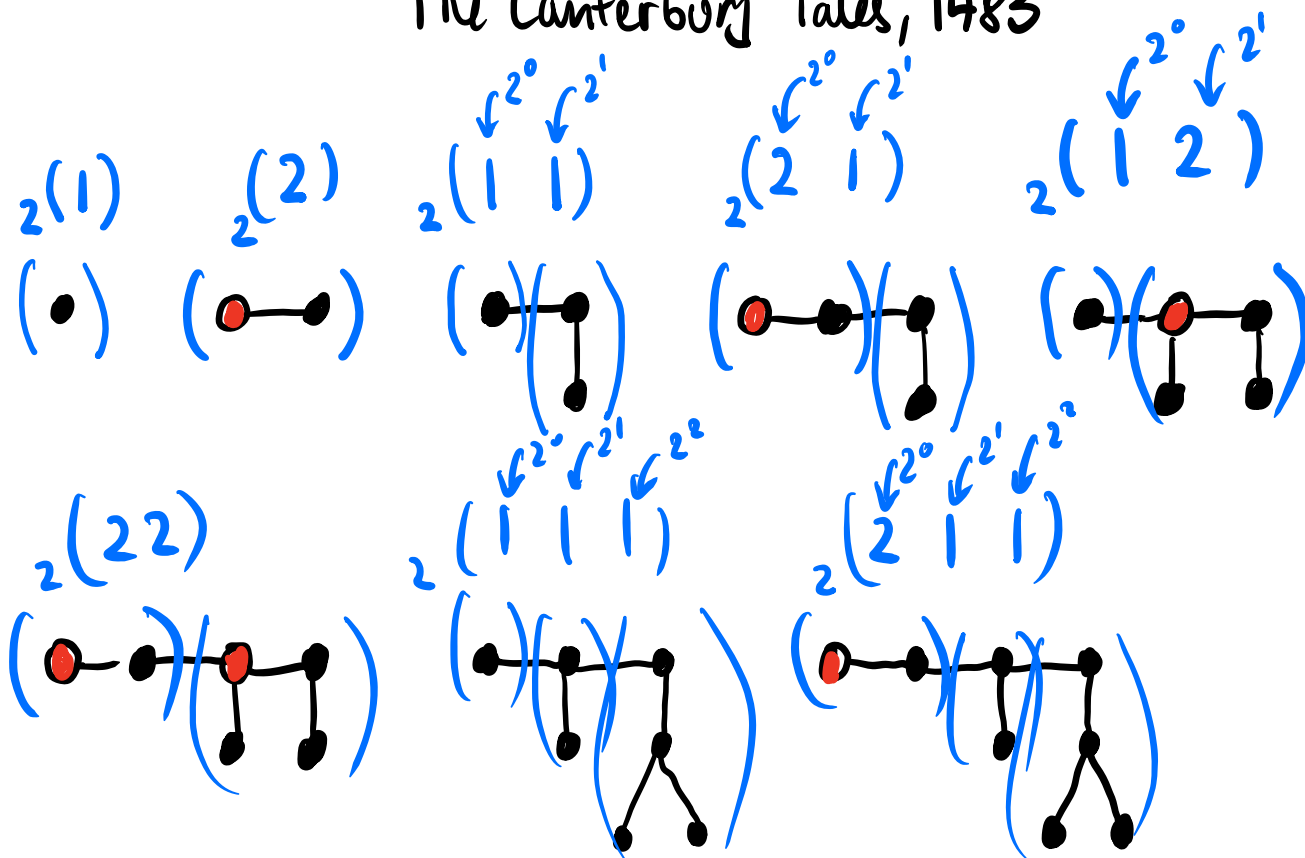


LECTURE 13 : Red-Black Trees II

"For he would rather have at his bed's head
Some twenty books, all bound in black or red,
Of Aristotle and his philosophy
Than rich robes, fiddle, or gay psalttery."

— Geoffrey Chaucer
The Canterbury Tales, 1483



$$\begin{aligned} (b_{n-1} \dots b_0)_2 &= {}_2(b_0 \dots b_{n-1}) \\ &= \sum_{i=0}^{n-1} b_i 2^i \end{aligned}$$

> data Digit a = One a (RBTREE a)

> | Two a (RBTREE a) a (RBTREE a)

> incr :: a → RBTREE a → [Digit a] → [Digit]

> incr x t [] = [One x t]

> incr x t (One y u : ps)

> = Two x t ^{RBTREE a} y u : ps



> incr x t (Two y u z v : ps)

> = One x t : incr y (NB u z v) ps

> add x ps = incr x E ps

> fromList :: [a] → RBTREE a

> fromList[†] xs = foldl hmk E (foldr add xs)

> link :: RBTme a → Digit a → RBTme a
 > link l (One x t) = N B l x t
 > link l (Two x t y u)
 > =
 > N B (N R l x t) y u

import Debug.Trace

trace :: String → a → a