

ESERCIZIO 1

Reservoir Sampling (S)

Creare $R[1, m] = S[1, m]$

$j = m + 1$
for each next item in S {

$h = \text{Rand}(1, j)$

if $(h \leq m)$

set $R[h] = S[j]$

$j++$

}

Return R

La probabilità di estrazione dei random sample dalla sequenza n è pari a $\frac{m}{n}$

Consideriamo un caso base in cui abbiamo $m = n$ ovvero nel Reservoir Sampling ci vanno tutti gli elementi dello stream, in questo caso ogni elemento può essere selezionato con probabilità $\frac{m}{n} = 1$.

Se consideriamo il caso indifferente, siamo allo

step $n-1$ e vogliamo passare allo step n .
 Quindi calcoliamo la probabilità di avere
 in R un elemento $S[j]$ allo step n

$$P(S[j] \text{ in } R \text{ all step } n) = P(S[j] \text{ in } R \text{ all step } n-1) \cdot$$

$$(P(S[n] \text{ non viene preso}) + P(S[n] \text{ preso}) \cdot P(S[j] \text{ non viene eliminato}))$$

$$= \frac{m}{n-1} \cdot \left(\left(1 - \frac{m}{n}\right) + \frac{m}{n} \cdot \frac{n-1}{m} \right)$$

$$= \frac{m}{n-1} \cdot \frac{n-1}{n} = \frac{m}{n}$$

ESERCIZIO 4

D disk

M memory

B = page size.

La complessità in termini di I/O nel multi-
 way Merge sort è

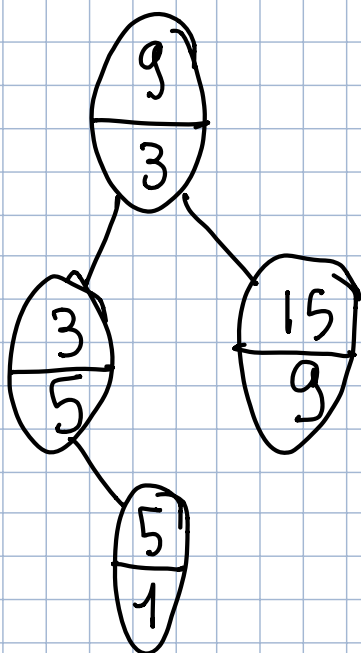
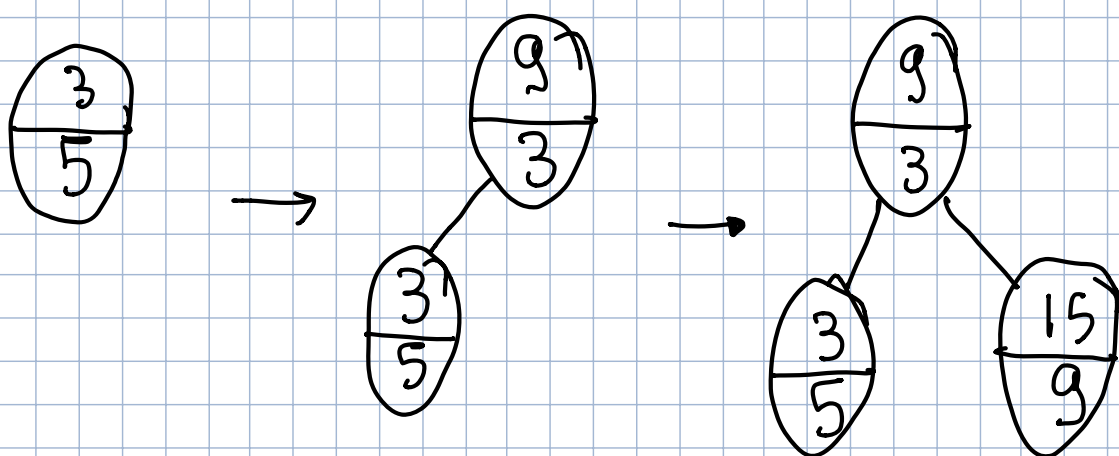
$$O\left(\frac{n}{B} \lg_{\frac{M}{B}} \frac{n}{B}\right)$$

E peggio ridurre M a \sqrt{M} ?

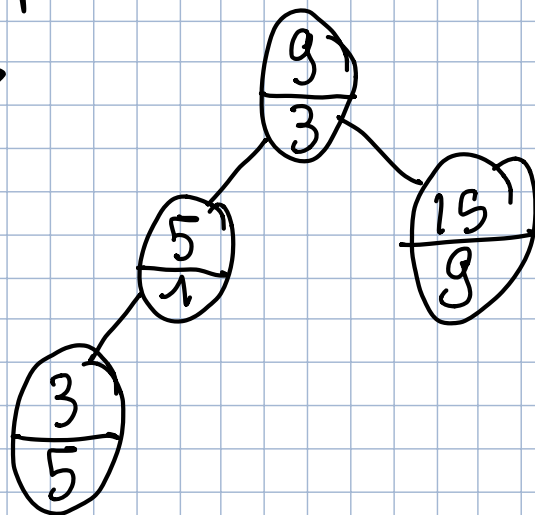
B a \sqrt{B} ?

Secondo me è peggio se ridurremo M
forse influisce di più sullo \log base
del logaritmo ???

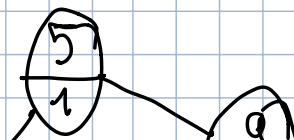
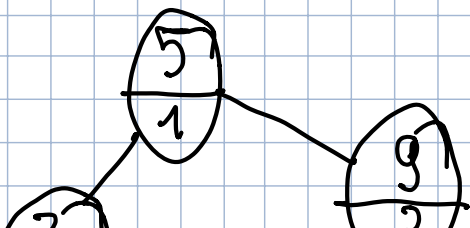
ESERCIZIO 3

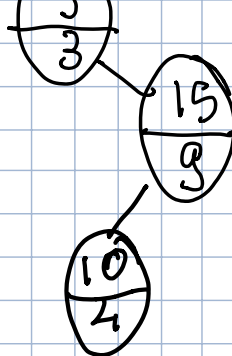
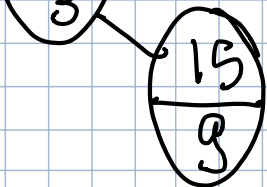
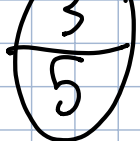


Devo fare la rotazione perché $\frac{5}{1}$
è presente nel root node:

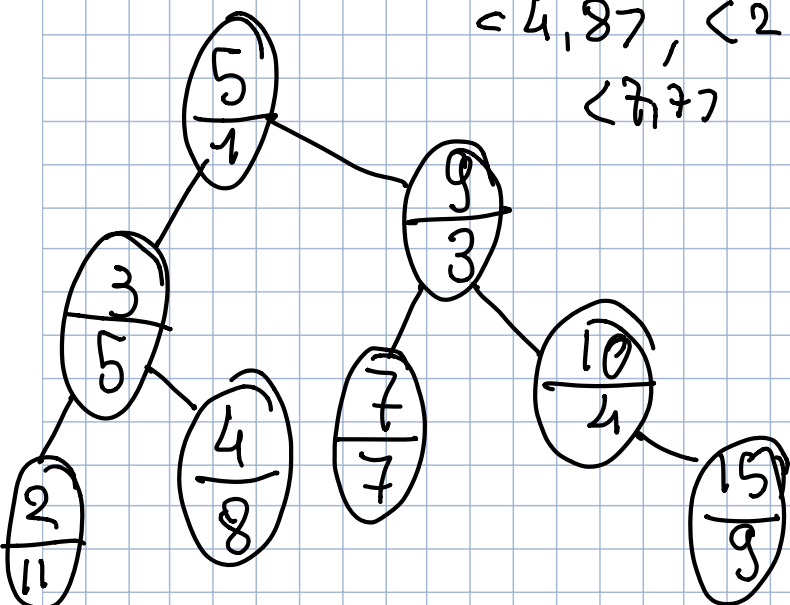


Insere $\langle 10, 4 \rangle$

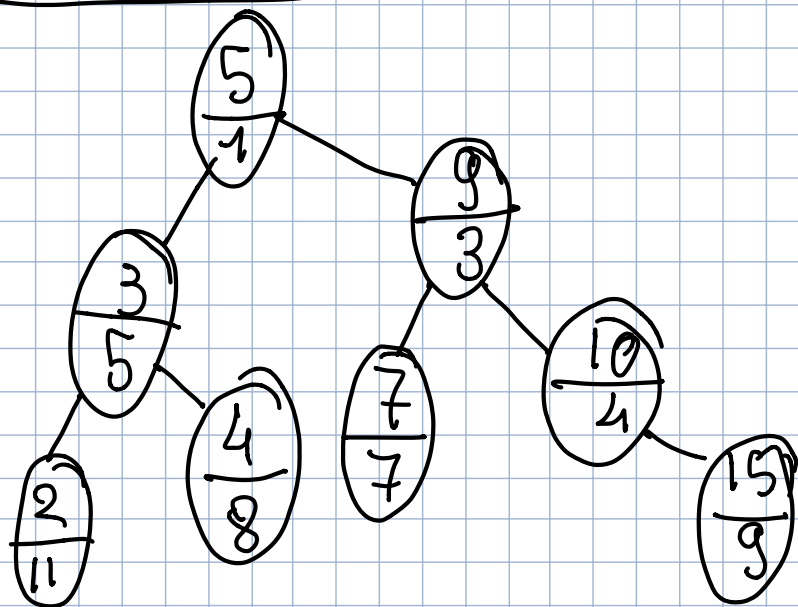




Rotazione e inserimento
 $<4, 87, <2, 11>$
 $<7, 7>$



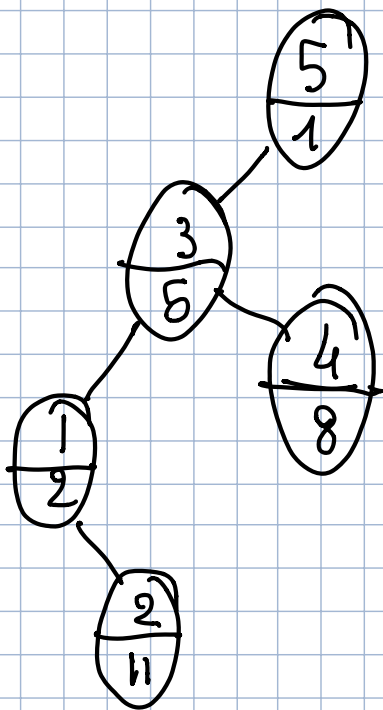
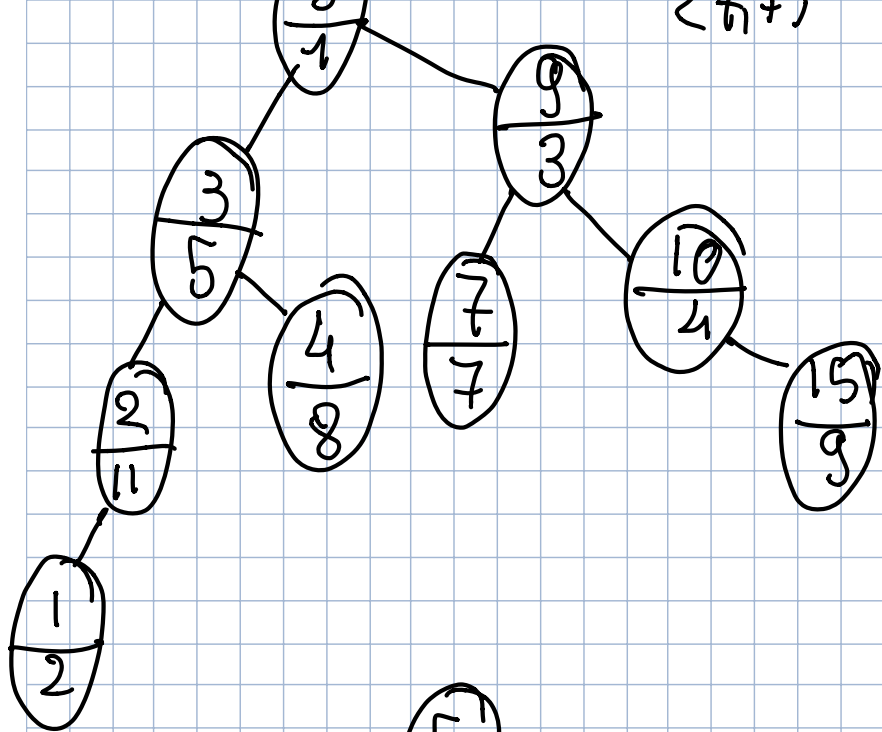
Albero finale



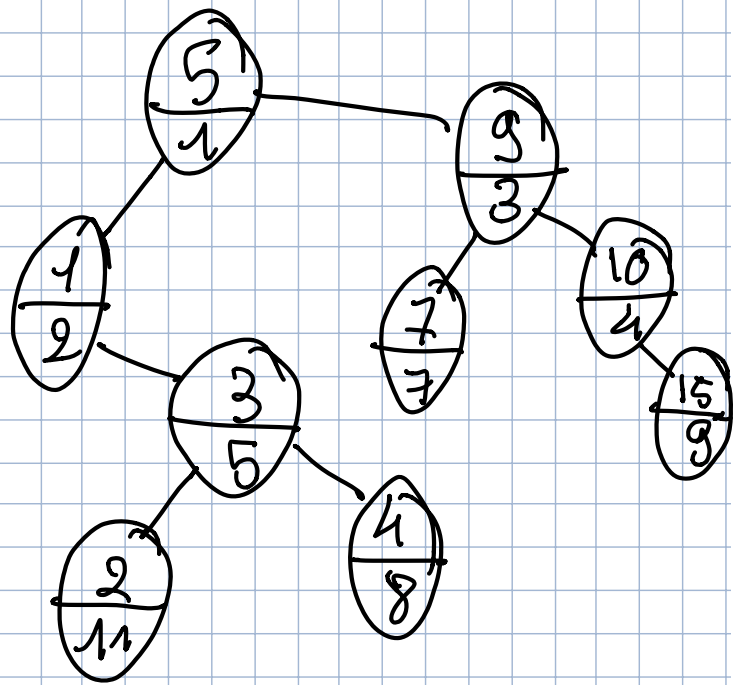
Inserimento di $<1, 27>$



$<4, 87, <2, 11>$
 $<7, 7>$

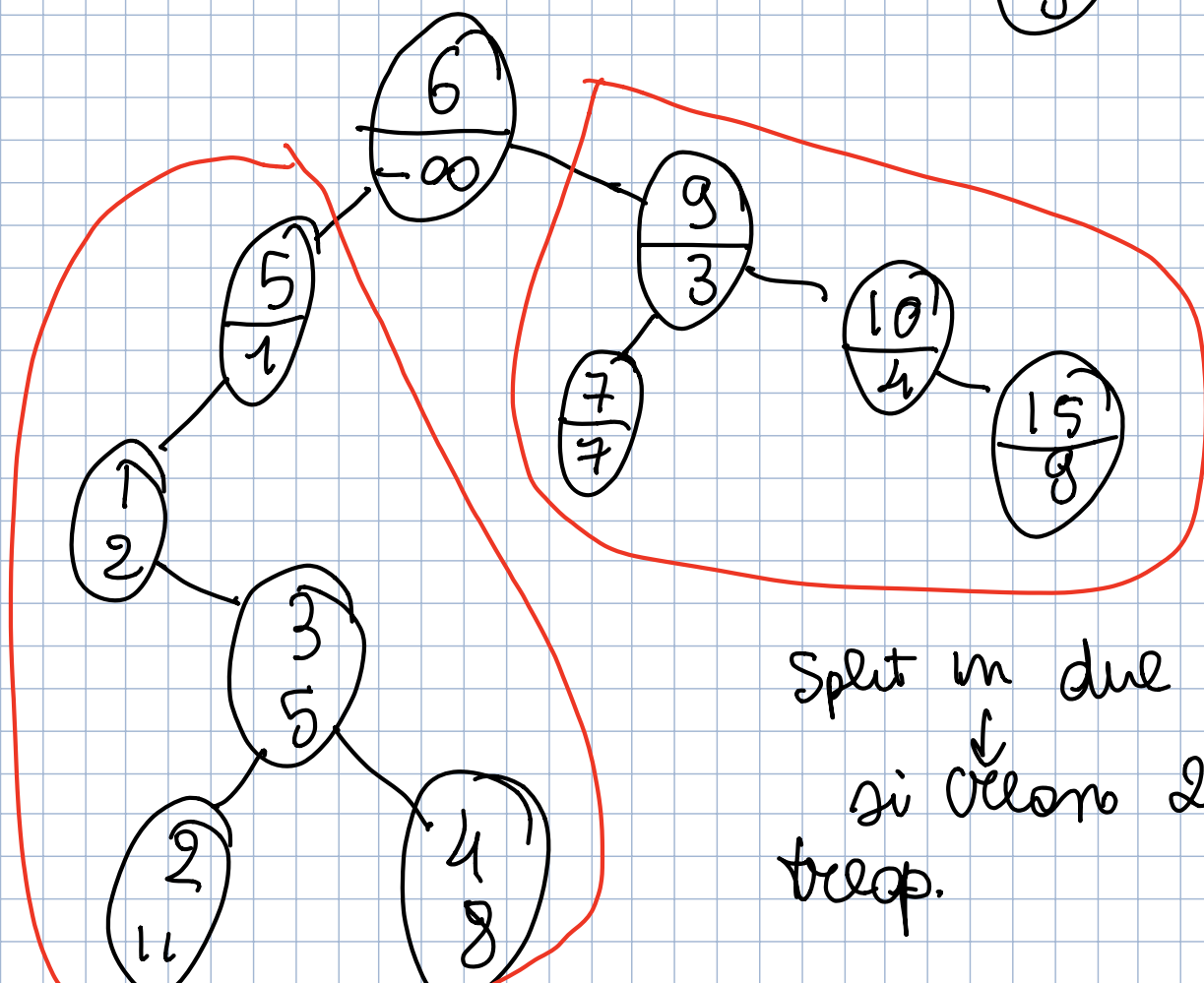
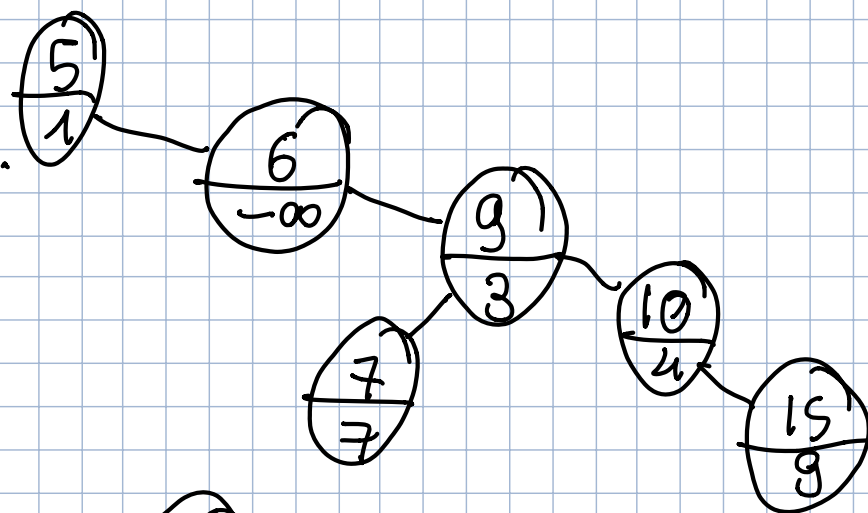
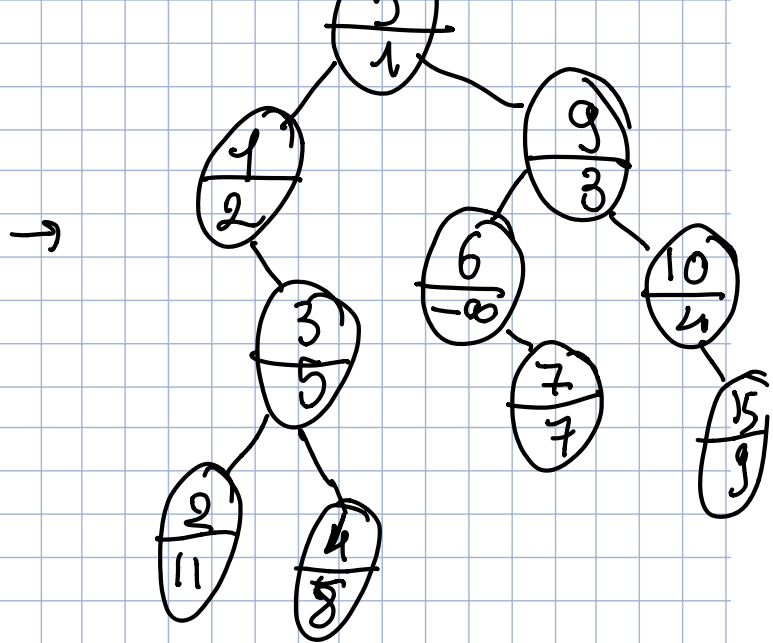
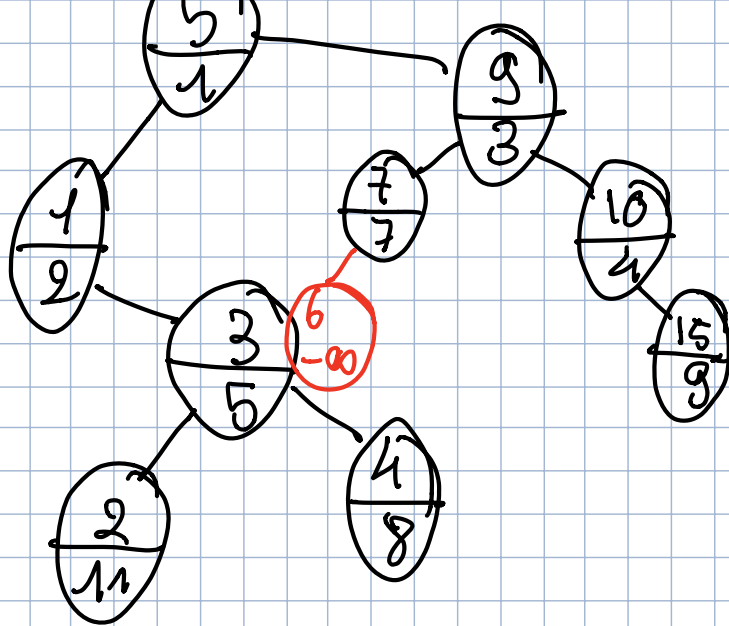


→



Split sulla chiave 6:

La chiave 6 non c'è quindi la inseriamo con parentesi
 $-\infty$: $< 6, -\infty >$. In questo modo
 6 va nel nodo Root e poi si può
 fare lo split.



Split in due
 ↓
 si creano 2
 tree.

