

(39) a) No, because it seems that fields of the records are of fixed length.

b) i) Cancel Mary's ticket

Mask on deleted →

pid	number	date	price
789	165	07-01-2021	210
000	000	20-12-2020	170
789	321	15-12-2020	250
456	345	03-11-2020	190

first deleted record

1
789 165 07-01-2021 210
000 000 20-12-2020 170
789 321 15-12-2020 250
456 345 03-11-2020 190

ii) Cancel Peter's Ticket

next deleted record

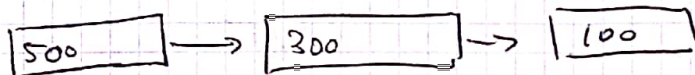
1
789 165 07-01-2021 210
000 3 20-12-2020 170
789 321 15-12-2020 250
000 000 03-11-2020 190

iii) Book a ticket for Mary ...

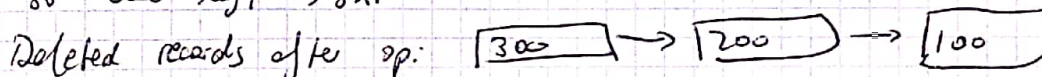
first deleted record

3
789 165 07-01-2021 210
123 321 23-12-2020 280
789 321 15-12-2020 250
000 000 — —

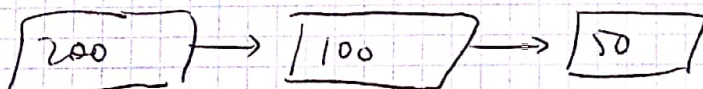
(40) Deletion: worst fit



a) Record of 300 bytes inserted → in deleted record of 500, so 200 left → sat



b) Record of 250 B inserted:



c) Record of 400 B: 200 → 100 → 50 inserted at the end

(42) b) 5 000 000 records, $\frac{400 \text{ Bytes}}{\text{record}}$

Records using a buffer of 400 000 B

So for each read we can take

$$\frac{400\,000 \text{ Bytes}}{\text{read}} \cdot \frac{1}{400 \text{ Bytes}} = 1000 \frac{\text{records}}{\text{read}}$$

$$\text{We need to read } 5\,000\,000 \text{ records} \cdot \frac{1 \text{ read}}{1000 \text{ records}} = 5000 \text{ reads}$$

$$\begin{aligned} \text{Seek + latency time} &= 5000 \cdot (\text{Avg. seek time}) && \text{in total} \\ &= 5000 \cdot 8 \text{ ms} = 40\,000 \text{ ms} \end{aligned}$$

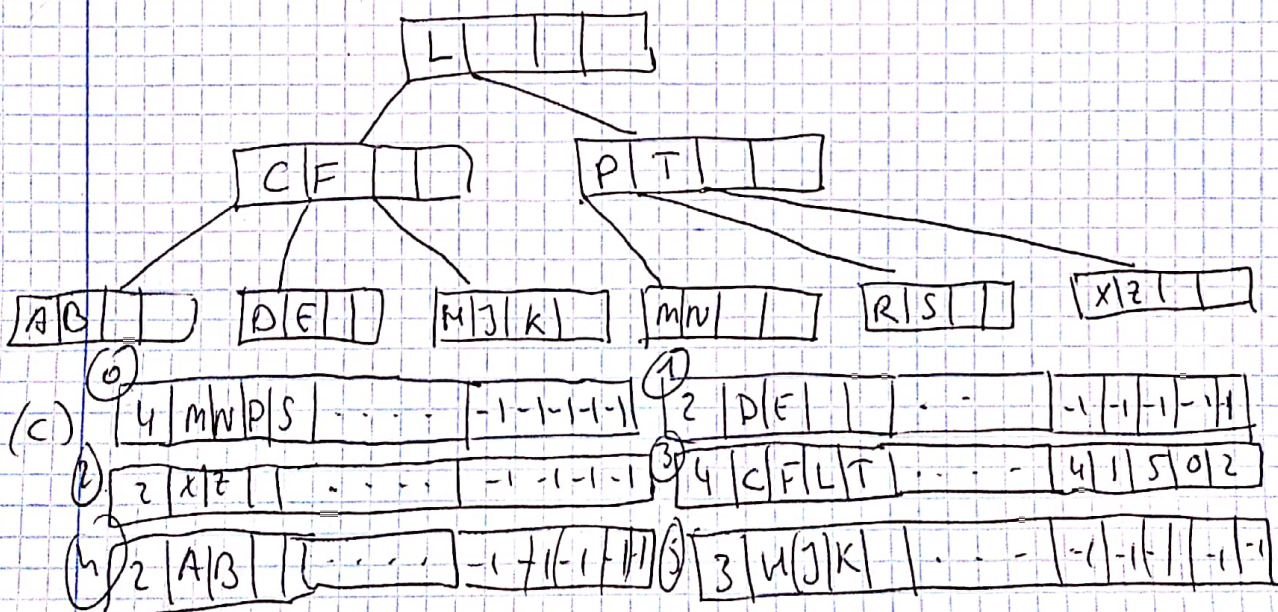
Transfer: (we can count the total)

$$\begin{aligned} 5\,000\,000 \text{ records} \cdot \frac{400 \text{ Bytes}}{\text{record}} \cdot \frac{\text{sector}}{1000 \text{ Bytes}} \cdot \frac{\text{track}}{500 \text{ sectors}} \cdot \frac{\text{minute}}{15000 \text{ tracks}} \\ \cdot \frac{3600 \text{ seconds}}{1 \text{ minute}} \cdot \frac{1000 \text{ ms}}{1 \text{ second}} = 960\,000 \text{ ms} \end{aligned}$$

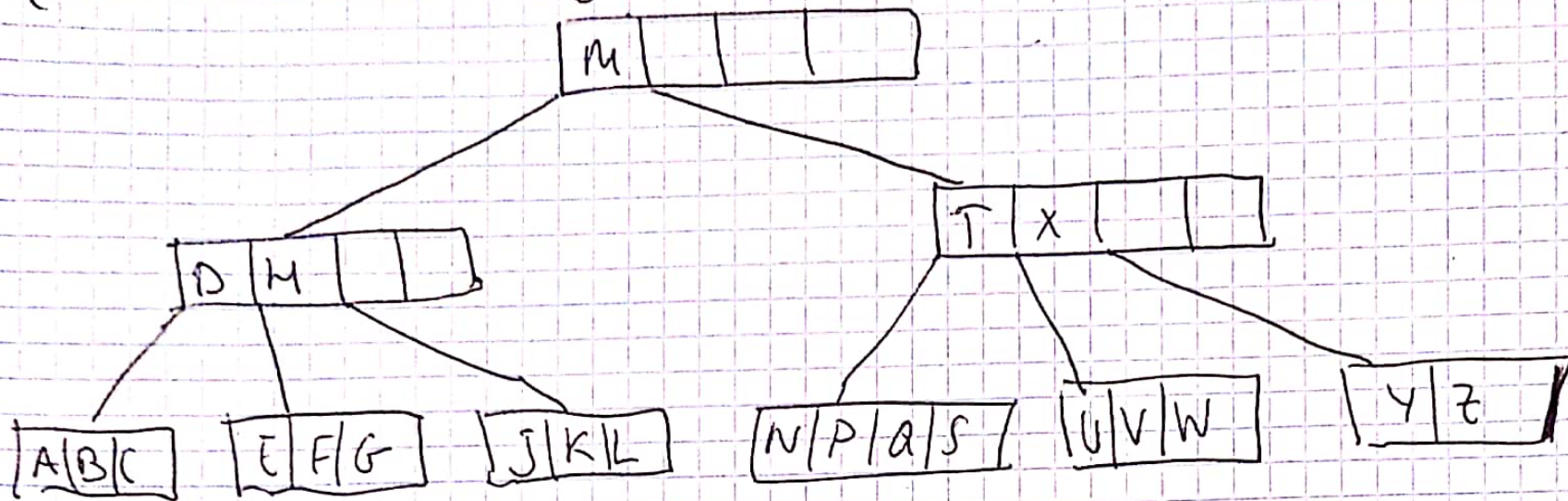
$$((\text{Seek} + \text{latency}) \text{ time}) + \text{Transfer} = 1\,000\,000 \text{ ms}$$

(51) After inserting 'R'.

$\begin{matrix} M & N & P & R & S \\ C & F & L & P & T \end{matrix}$



(53a) After insertion of 'x'



(61a) Nodes with height:

- 0 \rightarrow 1 Node
- 1 \rightarrow $k+1$ Nodes
- 2 \rightarrow $(k+1)^2$
- \vdots
- $h \rightarrow (k+1)^{h+1}$ Nodes

$$\begin{aligned}
 \text{Nodes} &= \sum_{i=0}^h (\text{Nodes with height } i) = \sum_{i=0}^h (k+1)^i = \frac{(k+1)^{h+1} - 1}{k+1 - 1} \\
 &= \frac{1}{k} \left((k+1)^{h+1} - 1 \right)
 \end{aligned}$$