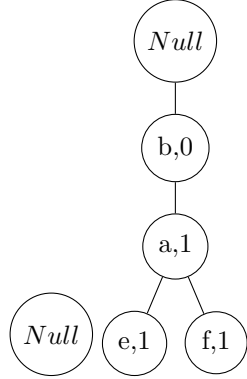

Algorithm 1 TruncateDatabase

Input: database D ; privacy budget ε_1 ;

Output: truncated database D'

- 1: Read D to get the Item Universe I , number of transactions n
 - 2: $z' = \text{EstimateDistribution}(D, \varepsilon_1, |I|)$
 - 3: Let l be the smallest integer such that $\sum_{i=1}^l z_i \geq 0.85$
 - 4: **for** each transaction t in D **do**
 - 5: add $t' = \text{RandomTruncate}(t, l)$ to D'
 - 6: **return** D'
 - 7: **function** ESTIMATEDISTRIBUTION(D, ε_1, n)
 - 8: Let $z = [z_1, z_2, z_3, \dots, z_{|I|}]$, where z_i is the number of transactions with cardinality i in D
 - 9: $z' = z + [Lap_1, Lap_2, Lap_3, \dots, Lap_{|I|}]$, where Lap_i is drawn i.i.d. from Laplace noise ($\frac{\Delta}{\varepsilon_1}$)
 - 10: **return** $\frac{z'}{n}$
 - 11: **function** RANDOMTRUNCATE(t, l)
 - 12: $t' = \text{Random Sample min}(|t|, l)$ item from t
 - 13: **return** t'
-



Algorithm 2 FrequentItemsAndMISTable

Input: database D' ; privacy budget ε_2 ; sensitivity Δ ; portion parameter β ; threshold λ

Output: Frequent 1-itemset F_1 ; MISTable M

```
1: for each transaction in  $D'$  do
2:   for each item  $X$  in transaction do
3:      $X.sup++$ 
4:   end for
5: end for
6: for each item  $X$  in  $I$  do
7:    $X.sup' = X.sup + Lap(\frac{\Delta}{\varepsilon_2})$ 
8:   add  $X$  and  $X.MIS = \max\{\beta * X.sup', \lambda\}$  to  $M$ 
9:   if  $X.sup' \geq X.MIS$  then
10:    add  $X$  to  $F$ 
11:   end for
12: return  $F_1; M$ 
```

Algorithm 3 NoisyFP-METree

Input: truncated database D' ; frequent 1-itemset F_1 ; MISTable M ; sensitivity Δ ; privacy budget ε_3 ;

Output: Frequent Itemsets F

```
1: for each transaction  $t'$  in  $D'$  do
2:   neglect items that are not in  $F_1$ 
3:   sort  $t'$  by  $M$  in ascending order
4: end for
5: create FPME root node  $r \leftarrow \emptyset$ 
6: for each  $t'$  in  $D'$  do
7:   for each item in  $t'$  do
8:     if no corresponding path in the tree then
9:       create a node with  $sup = Lap(\frac{\Delta}{\varepsilon_3})$ 
10:    end for
11:    increase the last node's  $sup$  by 1
12: end for
13: Update the tree, parent node's  $sup = \sum$  children's  $sup$ 
14: DFS Traversal on the FPMETree
15: if a node's  $sup \geq$  a node's  $MIS$  then
16:   add the node to  $F$ 
17: return  $F$ 
```
