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Q1

(i) $MSE = \dfrac{1}{m}\left(\displaystyle\sum_{i=1}^{m} \left(y_i - \left(a + \exp(x_i + b) \right) \right) \right)^2$

(ii) $\dfrac{\partial MSE}{\partial a} = \dfrac{-2}{m} \displaystyle\sum_{i=1}^{m} \left(y_i - \left(a + \exp(x_i + b) \right) \right)$

$\dfrac{\partial MSE}{\partial b} = \dfrac{-2}{m} \displaystyle\sum_{i=1}^{m} \left(y_i - \left(a + \exp(x_i + b) \right) \right) \left(\exp(x_i + b) \right)$

(iii) def batch_gradient Descent (X, Y, learning-rate, iterations)

     a = 0, b = 0

     for i in range (1, iterations):

        y_pred = a + exp (x + b)

        d_a = (-2/m) × sum (y - (y-pred))

        d-b = (-2/m) × sum (y - (y-pred)) × exp (x+b)

        a = a - learning-rate × (d_a)

        b = b - learning-rate × (d-b)

        return (a, b)

Q#2

$\{e\} = 8/10$

$\{b, d\} = 2/10$

$\{b, d, e\} = 2/10$

Q#3

A tree diagram rooted at node O with three branches labeled 1,4,7 ; 2,5,8 ; 3,6,9.

Labels on the tree:
- 1+3458
- 4+58
- 14+58
- 13+458
- 34+58
- 3+458
- 35+8

Branch labels: 1,4,7 ; 2,5,8 ; 3,6,9 ; 1,4,7 ; 3,69 ; 1,4,7 ; 2,58 ; 3,6,9 ; 1,4,7 ; 2,5,8 ; 3,69

Leaf nodes:
- L1 : {145} {178}
- 45+8 ; 45+8
- L5 : {168}
- L6 : {246} {278}
- L7 : {258} {289}
- L8 : {568}
- L9 : 346 379 678
- L11 : {356} {689}
- L12 : {361}

Lower subtree branches: 1,4,7 ; 2,58 ; 3,6,9
- L2 : 127 457
- L3 : 125 158 458
- L4 : 459 456 789
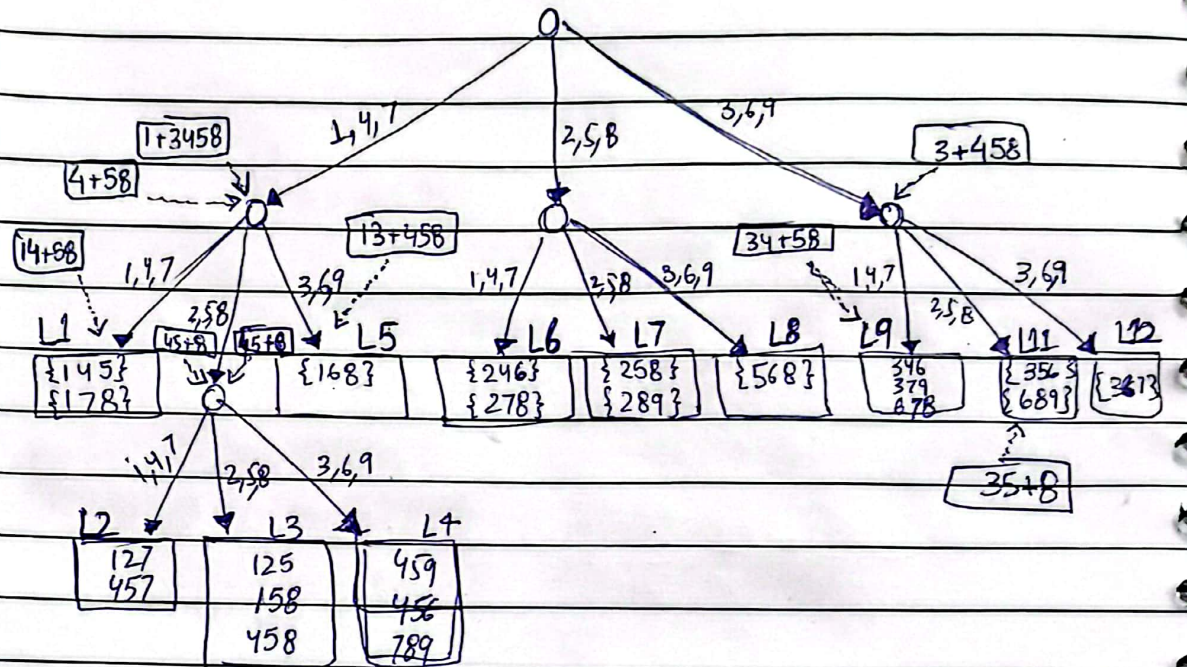
Transaction = { 1, 3, 4, 5, 8 }

level 1 = 1+ 3458
$$3+458$$
$$34 + 58$$
$$35 + 8$$

level 2 = 13+ 458
$$14 + 58$$
$$15 + 8$$

Nodes visited = L1, L3, L5, L9, L11

Q#1

items	support
a	5
b	6
c	5
d	9
e	6
a,b	3
a,c	2
a,d	4
a,e	4
b,c	3
b,d	6
b,e	4
c,d	4
c,e	2
d,e	6
a,b,c	1
a,b,d	2
a,b,e	2
a,c,d	1
a,c,e	1
a,d,e	4
b,c,d	2
b,c,e	1
b,d,e	4
c,d,e	2
ab,c,d	0
a,b,c,e	2

Tid	Items
1	a b e
2	b c d
3	a b d e
4	a c d e
5	b d e c
6	b e d
7	c d
8	a c b
9	a d e
10	b d

items	
a c d e	1
a b c d e	0
b c d e	1

threshold = 30%.

= 30% of 10

= 7

C — null

C   N   C   e   N
(a)   (b)   (c)   (d)   (e)

I   I   N   N   I   N   N   CM   I   C
(ab) (ac) (ad) (ae) (bc) (bd) (be) (cd) (ce) (de)

I   I   I   I   I   CM   I   CM   I   I
(abc) (abd) (abe) (acd) (ace) (ade) (bcd) (bce) (bde) (cde)

I   I   I   I   I
(abcd) (abce) (abde) (acde) (bcde)

I
(abcde)

I ⇒ infrequent sets

M ⇒ maximal frequent itemset

C ⇒ closed frequent itemset

N ⇒ maximal non closed frequent itemset.