COMP9318

17S1 Assignment1

Data Warehousing and Data Mining

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Q1: The tuples in the complete data cube of R in a tabular form:

Location	Time	Item	SUM(quality)
Sydney	2005	PS2	1400
Sydney	2006	PS2	1500
Sydney	2006	Wii	500
Melbourne	2005	Xbox 360	1700
Sydney	2005	ALL	1400
Sydney	2006	ALL	2000
Melbourne	2005	ALL	1700
Sydney	ALL	PS2	2900
Sydney	ALL	Wii	500
Melbourne	ALL	Xbox 360	1700
ALL	2005	PS2	1400
ALL	2006	PS2	1500
ALL	2006	Wii	500
ALL	2005	Xbox360	1700
Sydney	ALL	ALL	3400
Melbourne	ALL	ALL	1700
ALL	2005	ALL	3100
ALL	2006	ALL	2000
ALL	ALL	PS2	2900
ALL	ALL	Wii	500
ALL	ALL	XBOX360	1700
ALL	ALL	ALL	5100

Q2: The SQL statement:

```
SELECT Location, Time, Item, SUM(Quality) FROM Sales(R)
GROUP BY Location, Time, Item
UNION ALL

SELECT Location, Time, ALL, SUM(Quality) FROM Sales(R)
GROUP BY Location, Time
UNION ALL

SELECT Location, ALL, Item, SUM(Quality) FROM Sales(R)
GROUP BY Location, Item
UNION ALL

SELECT ALL, Time, Item, SUM(Quality) FROM Sales(R)
GROUP BY Time, Item
UNION ALL
```

```
SELECT Location, ALL , ALL , SUM(Quality) FROM Sales(R)
    GROUP BY Location
    UNION ALL
 SELECT ALL , Time,    ALL, SUM(Quality) FROM Sales(R)
    GROUP BY Time
    UNION ALL
 SELECT ALL, ALL, Item, SUM(Quality) FROM Sales(R)
    GROUP BY Item
    UNION ALL
SELECT ALL, ALL, ALL, SUM(Quality) FROM Sales(R)
    UNION ALL
```

Q3: Due to the SQL statements , we only need to find the cells of data cube in aggregate condition, so the result tabular is :

Location	Time	Item	SUM(Quality)
Sydney	2006	ALL	2000
Sydney	ALL	PS2	2900
Sydney	ALL	ALL	3400
ALL	2005	ALL	3100
ALL	2006	ALL	2000
ALL	ALL	PS2	2900
ALL	ALL	ALL	5100

Q4：

The cube contains totally 22 cells ,so the function should be 1 to 1 function so that it can contain all the cells with unique array index :

We assume Function = x * Location + y * Time + z* item (x, y ,z >=1),then we look at the last five rows (0,0,0),(0,0,1),(0,0,2),(0,0,3),(0,1,0) etc. What we want is to give an appropriate x, y ,z to represent index, then we assume (0 , 0 ,0)= 0 (0, 0, 1) =1 (0,0 ,2) =2 ,(0,0,3) =3 ,(0,1 ,0) = 4 , we can get y = 4 an z = 1, then we should give x an appropriate number to enlarge the index size . the maximum of 4*time + Item = 4*2 +3 =11 , so if x =12, the function seems satisfy the requests.

So the function : 12 * Location + 4* time + 1* item

The last final

Location	Time	Item	SUM(quality)	Function
1	1	1	1400	17
1	2	1	1500	21
1	2	3	500	23
2	1	2	1700	30
1	1	0	1400	16
1	2	0	2000	20

2	1	0	1700	28
1	0	1	2900	13
1	0	3	500	15
2	0	2	1700	26
0	1	1	1400	5
0	2	1	1500	9
0	2	3	500	11
0	1	2	1700	6
1	0	0	3400	12
2	0	0	1700	24
0	1	0	3100	4
0	2	0	2000	8
0	0	1	2900	1
0	0	3	500	3
0	0	2	1700	2
0	0	0	5100	0

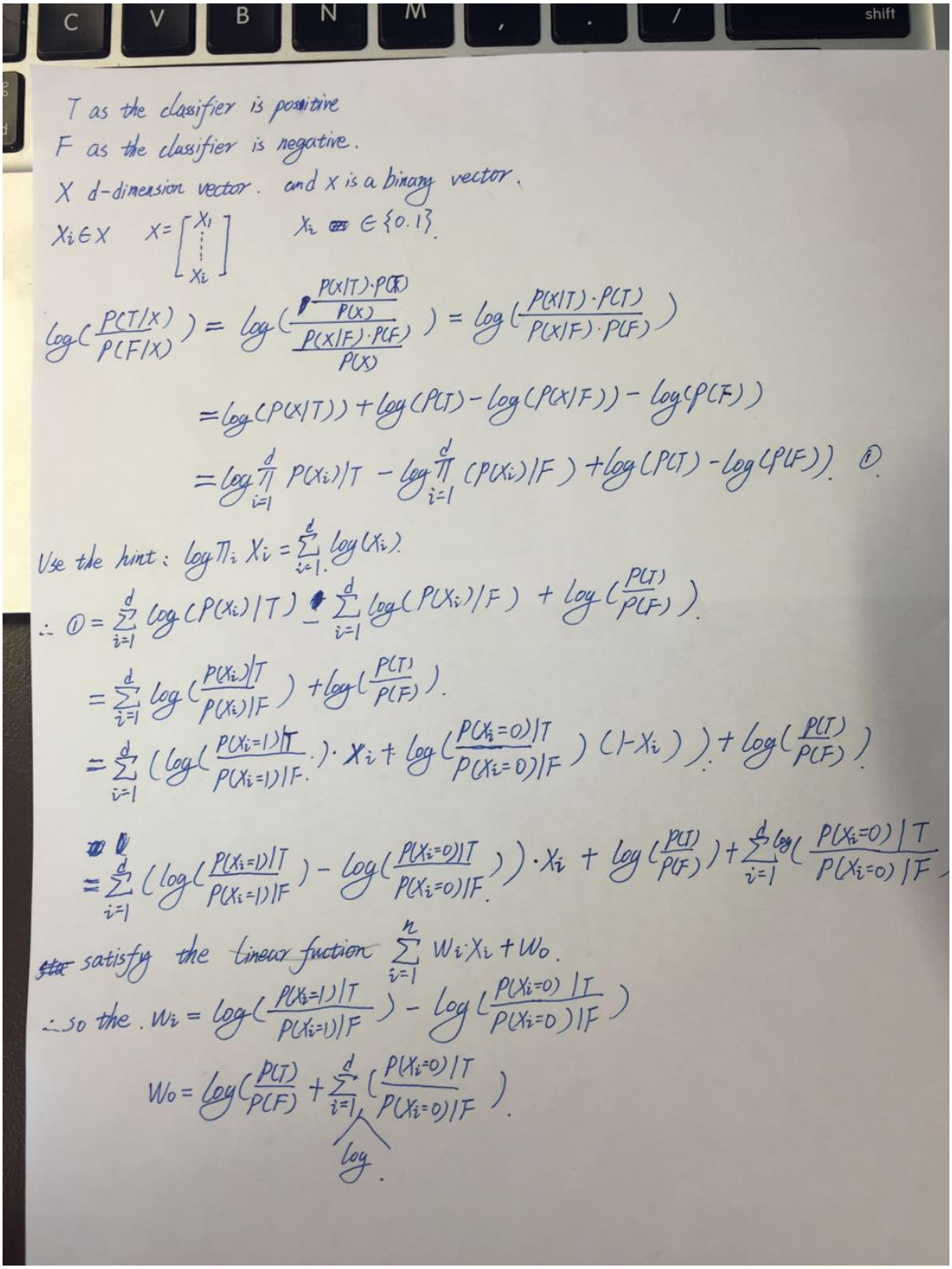
The index result satisfy the 1 to 1 request, the maximum index is 30 and the total number is 22 , only 8 cells are not used . so this function works

So the result :

Index	SUM（Quality）
0	5100
1	2900
2	1700
3	500
4	3100
5	1400
6	1700
8	2000
9	1500
11	500
12	3400
13	2900
15	500
17	1400
20	2000
21	1500
23	500
24	1700
26	1700
28	1700
30	1700

2:In Naïve Bayes classifier, the connection bet ween two can be expressed by log-odds(logit) , so we assume the log-odds function, and if the log-odds function is larger than 0 , we define the classifier positive , otherwise if the log-odds function is smaller than 0 , we define the classifier negative.

so as the function in the function: we get the result W



Q2 ： In this question, we only contains the those four situation
P(x=0|y=0) ,P(x=0|y =1), P(x=1 | y=0),P(x = 1 | y=1)

Naïve Bayes uses relatively strict conditional independent hypothesis. Each condition must be independent. Naïve Bayes generate the model so that it need less model than logistic regression ,In this question , the complexity of naïve Bayes is O(log(n))
Logistic Regression judge the model . Each condition do not need to be independent. LR method need to continuously adjust the arguments to satisfy the function distribution ,then training to get an optimal model under the existing data set. So each attributes are learned together, the complexity of Logistic Regression is O(n)
So Naïve Bayes is much easier than Logistic Regression

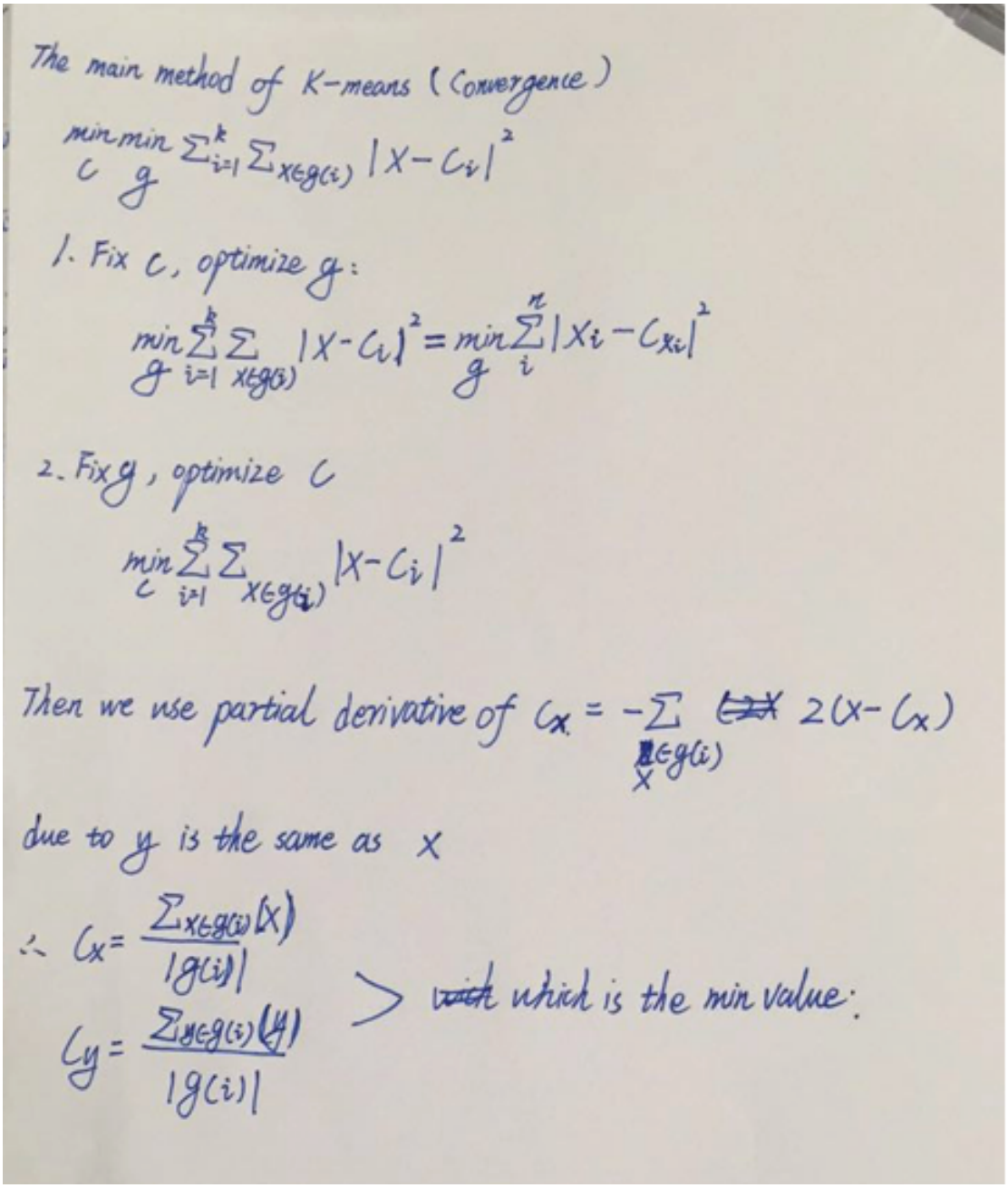
3: Q3(1):

```
Data: D is a dataset of n d-dimensional points; k is the number of clusters.
1 Initialize k centers C = [c1, c2, . . . , ck];
2 canStop ← false;
3 while canStop = false do
4     Initialize k empty clusters G = [g1, g2, . . . , gk];
5     for each data point p ∈ D do
6           cx ← NearestCenter(p, C);
7           gcx .append(p);
8           canStop = true
9     for each group g ∈ G do
10          temp   = ci
11          ci ← ComputeCenter(g);
12          if   ci != temp:
13                canStop = False;
14 return G
```

Q3.(2):

First of all, in line 6 (cx ← NearestCenter(p, C);) , it proved that each point are classified to the nearest cluster. Each classifier choose the minimal dist^2(p,c) to classify so the cost in this step is reduced .

In line 9 (ci ← ComputeCenter(g)); line 9 computes the new center point of each C . In this situation, all the points have been re-classified and already found the nearest Current center. It is obvious that it can not increase the cost.
The what we need to do is as that function:



the C(x ,y) is the min value of new centers which is converged by K-means at the end of each iteration

Q3 (3)

Due to Q2 we can find the cost never increase at the end of each iteration , so the function is Monotonically decreasing and we also proved its convergence, so that it must have a lower bound and it must has local minimal.