XI'AN JIAOTONG-LIVERPOOL UNIVERSITY

西交利物浦大学

REMOTE CLOSE BOOK

EXAMANSWER SUBMISSION

COVER SHEET

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Programme	information and computing science	
Module Title	Big Data Analytics	
Module Code	INT 303	
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Signature 王孜哲 Zizhe Wang Date 2023/1/5

Q1

(a)

<1> missing data: we have two solution: deletion or imputation.

~~When the data without some value~~

When the number of data without some value is overcome the number of data with full value, we should use deletion to process data.

~~Whe~~ In other situations, we consider ~~three~~ ways for ~~imputation.~~ ~~missing~~ imputation.

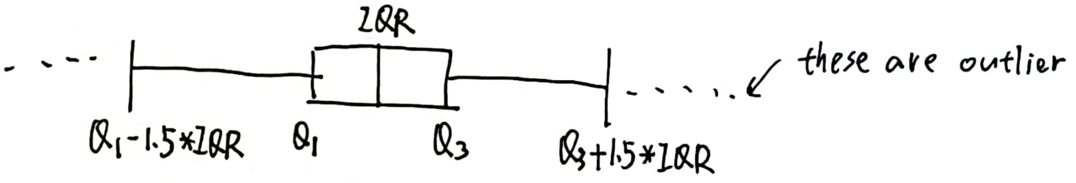
~~missing~~ ① regression imputation

② simple imputation

③ KNN imputation

④ piority Knoledge of this area

<2> ~~data st~~ Outlier valnes: we use IQR:



we draw box chart to delete them

<3> data standardization ~~isson~~ issues

~~we use min-Max scaler~~, ~~we~~

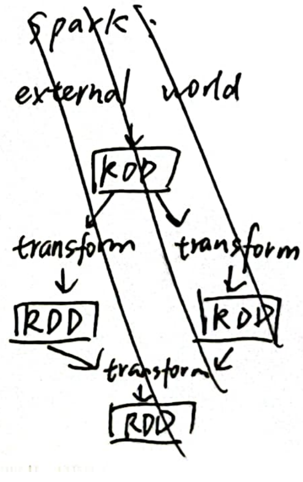
$$S = \frac{\sqrt{\sum_{i=0}^{n}(x_i-\bar{x})^2.}}{n-1}$$

(b) Spark is higher level of Hadoop, Hadoop is constructed by Mapreduce and HDFS.

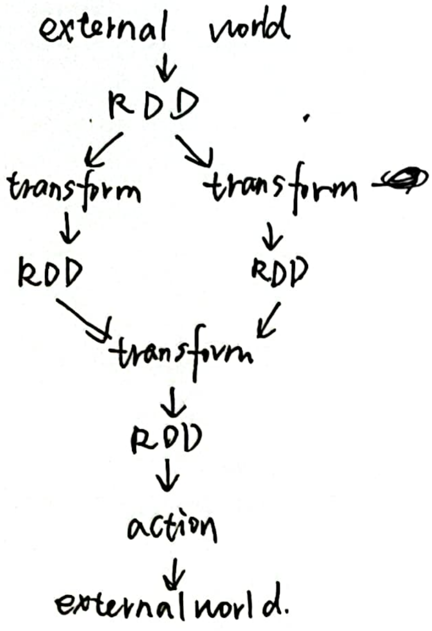
① Mapreduce have three main component:

map, join value by key, redeuce

②. Hadoop have chunk node, master node and client server ~~while~~.



③. spark :

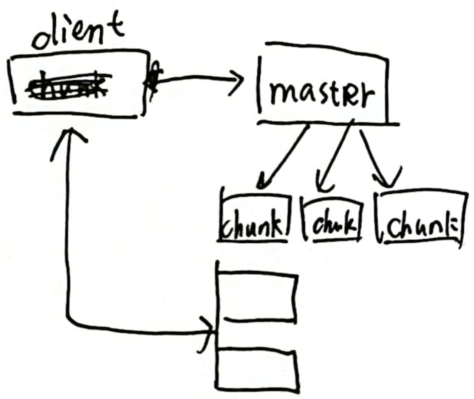


spark use memory , but Hadoop use disk.

transform : join , distinct , union and so on.

action : count , save and so on.

Hardoop infrastructure :



client ask master node and find chunk , then chunk return data to client .

(c). ~~skl~~ sklearn , numpy , pandas ,

Q2. a. 4 2 1

(b).

$$N = \begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{2} \\ 1/\sqrt{2} & -1/\sqrt{2} \\ 0 & 0 \end{bmatrix} \begin{bmatrix} 4 & 0 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{2} & 0 \\ 1/\sqrt{2} & -1/\sqrt{2} & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 2\sqrt{2} & \sqrt{2} \\ 2\sqrt{2} & -\sqrt{2} \\ 0 & 0 \end{bmatrix} \begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{2} & 0 \\ 1/\sqrt{2} & -1/\sqrt{2} & 0 \end{bmatrix} = \begin{bmatrix} 3 & 1 & 0 \\ 1 & 3 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

N singular value decomposition :

$$N = U\Sigma V^T = \begin{bmatrix} 2\sqrt{2} & \sqrt{2} \\ 2\sqrt{2} & -\sqrt{2} \\ 0 & 0 \end{bmatrix} \begin{bmatrix} 4 & 0 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{2} & 0 \\ 1/\sqrt{2} & -1/\sqrt{2} & 0 \end{bmatrix}$$

(c)

reconstruction error ⇒

~~$= \sqrt{(3-\frac{1}{\sqrt{2}})^2 + (1-\frac{1}{\sqrt{2}})^2 + (1-\frac{1}{\sqrt{2}})^2 + (1\cdot}$~~

$$= \sqrt{(3-3)^2+(1-1)^2+0^2+(1-1)^2+(3-3)^2+(0-0)^2+(0-0)^2+(0-0)^2+(0-1)^2}$$

$$= 1$$

Q3.

(a) Student A is correct. Because it is obrious that if we split data into training and test sets, the min and max value should be different in these two sets. if we not do the normalize togther, the scale standard will be different on each sets. it will result in some error.

(b)

(i). $A = 3 \quad B = 4 \quad C = 4$

(ii) $A = a \quad B = 12.0 \quad C = 12.0$

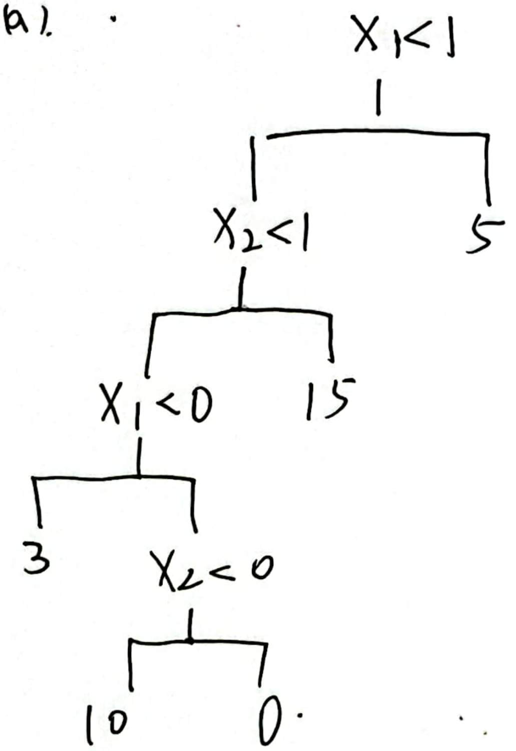
(iii) $a = 13.0 \quad b = 12.3$

(iiii) ~~histogram~~ pie ~~chart~~ chart

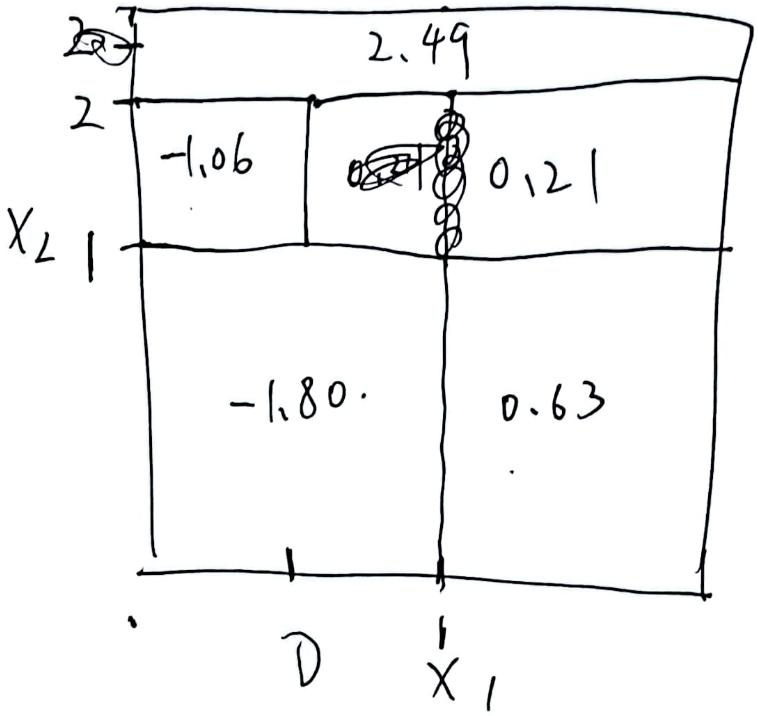
13

Q4

(a).



(b).



Q5

(a). False. We must reduce after all the mappers finished, or we will get wrong number of key-value pairs.

(b) False. Sort and Group should before the reducer.

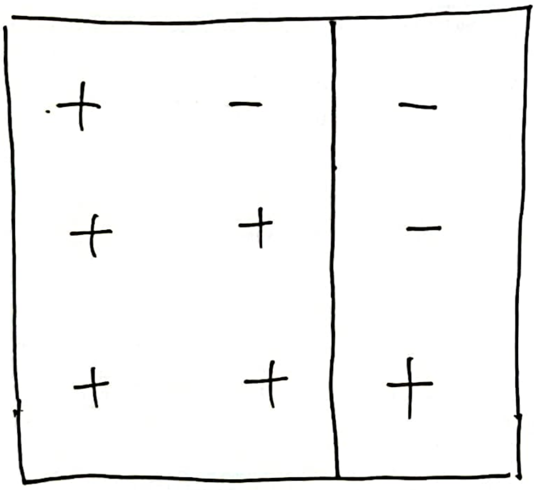
(c) False. ~~it doesn't matter~~ ;it doesn't matter.

(d) False. It up to the request of reducer.

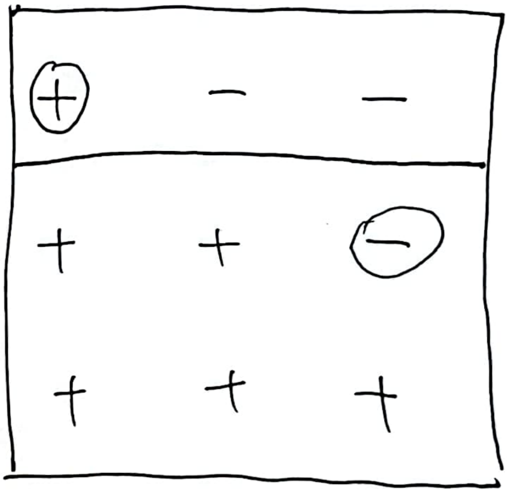
Q6.

(a).

i).



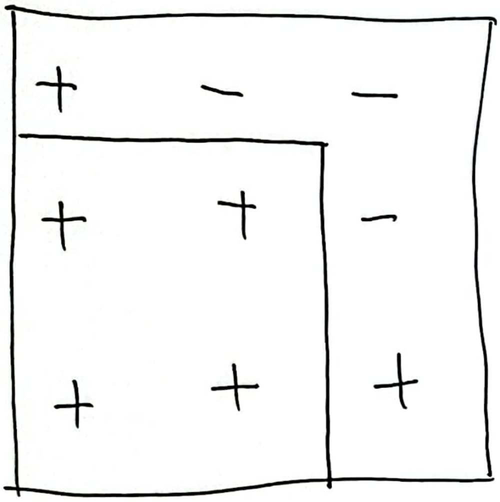
ii)



the wrong classification point's weight will increase.

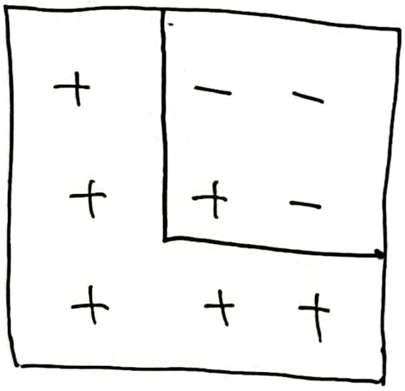
In the first iteration, the "−" in (1, 2) position has increased its weight, so in 2 iteration, it must be classified in right way, the same to "+" in (3,3) position

(iii)

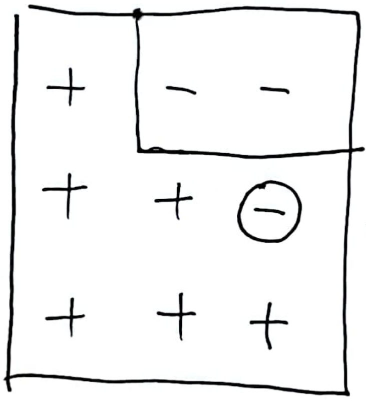


(b)

(i)



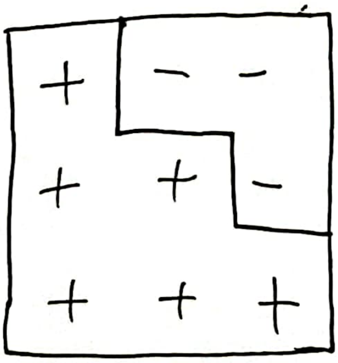
(ii)



the wrong classification point's weight will increase.

In the first iteration, the "+" in (2,2) position has increased its weight, so in 2 iteration, it must be classified in right way.

iii)



Consider the weight of position (2,2) and position (2,3) has increased, and "–" in (2,3) has increased more, so this "–" must be classified in right way.

Q7.

(a) Reader 1 : mean = 1.5 ~~similarity~~

Reader 2 : mean = $\frac{3+1}{2} = 2$ similarity (1,2) = $\frac{-0.5}{\sqrt{1+1}\cdot\sqrt{(\frac{1}{2})^2+(\frac{1}{2})^2}} = -0.5 = -\sqrt{\frac{\cancel{5}}{10}}$

Reader 3 : mean = 1 ~~similarity (1,3)~~ = ~~$\sqrt{1}$~~ similarity = 0

Reader 4 : mean = $\frac{2+1}{2} = 1.5$ similarity (1,4) = $\frac{0.5\times-0.5}{\sqrt{0.5^2+(-0.5)^2}\cdot\sqrt{0.5^2+(-0.5)^2}} = \frac{-\frac{1}{4}}{\frac{1}{4}}$

Reader 5 : mean = $\frac{0+3}{2} = 1.5$ similarity (1,5) = $\frac{-0.5\times1.5}{\sqrt{(0.5)^2+(0.5)^2}\sqrt{(-1.5)^2+(1.5)^2}}$ $= -1$

$$= \frac{-\frac{3}{4}}{\frac{\sqrt{10}}{4}} = -\frac{3}{\sqrt{10}} = -\sqrt{\frac{9}{10}}$$

~~sim~~ sim(1,3) > sim(1,2) > sim(1,5) > sim(1,4)

most similar : reader 3 and reader 2 .

$$\therefore \quad \frac{1.0\times0+3.0\times(-0.5)}{0+(-0.5)} = \frac{-1.5}{-0.5} = 3 .$$

∴ Book1 for reade 1 is rating 3.0.

(b),

	r1	r2	r3	r4	r5
book 1	?	3.0	1.0	2.0	0.0
book 2	2.0	1.0		1.0	
book 3	1.0				3.0

$$\begin{array}{c|ccccc} & r_1 & r_2 & r_3 & r_4 & r_5 \\ \hline & & 1.5 & -0.5 & 0.5 & -1.5 \\ & \frac{8}{3} & -\frac{1}{3} & & -\frac{1}{3} & \\ & -1 & & & & 1 \end{array}$$

∴ book 1 mean = $\frac{3+1+2+0}{4} = \frac{6}{4} = 1.5$ ~~sim~~

book 2 mean = $\frac{2+1+1}{3} = \frac{4}{3}$

book 3 mean = $\frac{1+3}{2} = 2$

sim (1,2) = $\frac{1.5\times(-\frac{1}{3})+(0.5)\times(-\frac{1}{3})}{\sqrt{\frac{1}{9}+\frac{1}{9}+\frac{64}{9}}\cdot\sqrt{(\frac{3}{2})^2\cdot(\frac{1}{2})^2\cdot(\frac{1}{4})\cdot(\frac{3}{2})^2}}$

~~sim (1,3) =~~

sim(1,3) = $\frac{-1.5\times1}{\sqrt{1^2+1^2}\sqrt{(1.5)^2+(0.5)^2+(0.5)^2+(-1.5)^2}} = \frac{-1.5}{2} = -0.75$ = 0 sim(1,2) > sim(1,3)

∴ rating D.0