



HUNGARIAN ALGORITHM

ISIS 2801

Hungarian algorithm

The Hungarian algorithm is used for assignment problems

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	Swipe	Wash	Clean
Alice	8	4	7
Bob	5	2	3
Carl	9	4	8

Which person should do which task to have the least total cost?

Brute force approach

The Hungarian algorithm is used for assignment problems

Try all possible assignments

	Swipe	Wash	Clean
Alice	8	4	7
Bob	5	2	3
Carl	9	4	8

Brute force approach

The Hungarian algorithm is used for assignment problems

Try all possible assignments

(A, S) (B, W) (C, C)
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$O(n!)$

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$O(n!)$ 🙅

Matrix reduction process

	Swipe	Wash	Clean
Alice	8	4	7
Bob	5	2	3
Carl	9	4	8

1. Subtract the smallest element of each row, to all elements in the row

Matrix reduction process

	Swipe	Wash	Clean
Alice	4	-	3
Bob	3	-	1
Carl	5	-	4

1. Subtract the smallest element of each **row**, to all elements in the **row**
2. Subtract the smallest element of each **column**, to all elements in the **column**

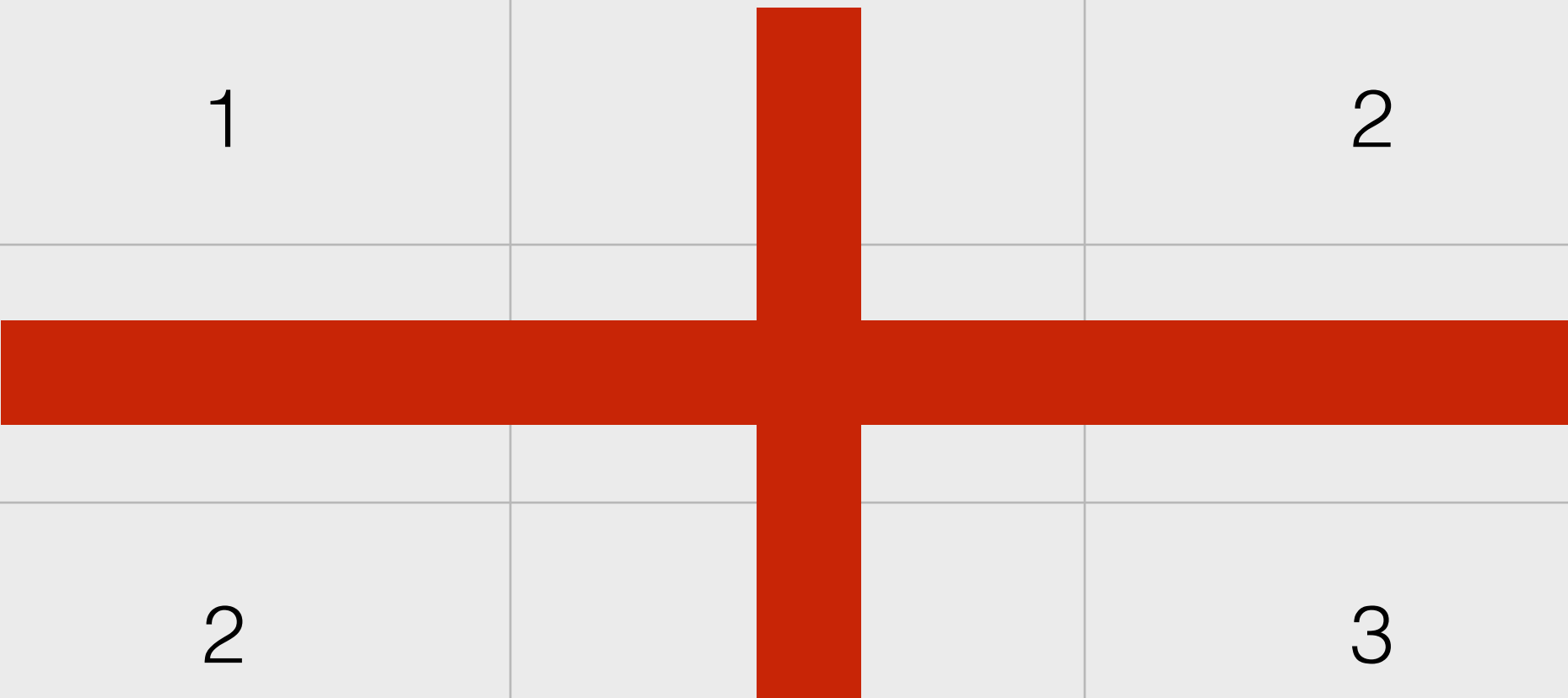
Matrix reduction process

	Swipe	Wash	Clean
Alice	1	-	2
Bob	-	-	-
Carl	2	-	3

1. Subtract the smallest element of each row, to all elements in the row
2. Subtract the smallest element of each **column**, to all elements in the **column**
3. Cover all zeros in the matrix using the minimum number of horizontal and vertical lines

Matrix reduction process

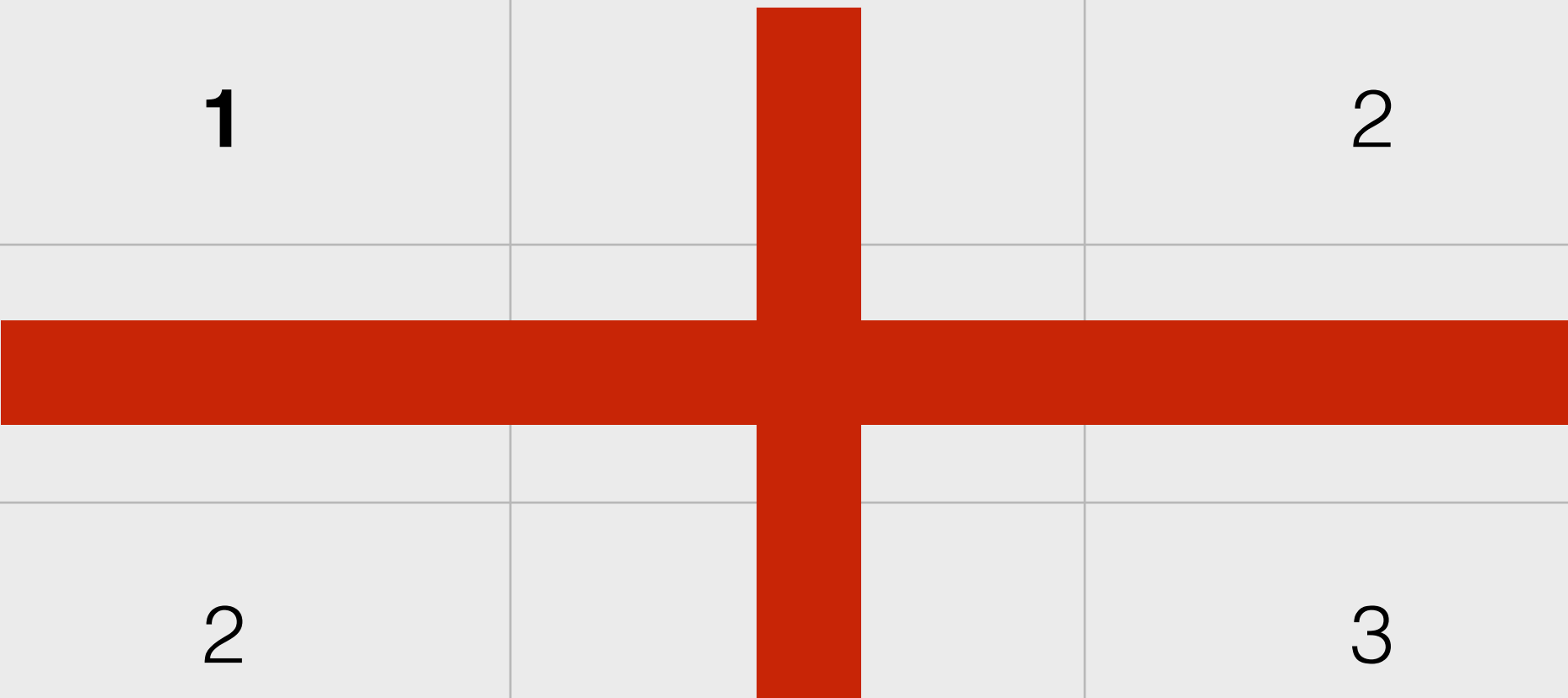
	Swipe	Wash	Clean
Alice	1		2
Bob			
Carl	2		3



1. Subtract the smallest element of each row, to all elements in the row
2. Subtract the smallest element of each column, to all elements in the column
3. Cover all zeros in the matrix using the minimum number of horizontal and vertical lines
4. If n lines cover the matrix, the remaining is the assignment

Matrix reduction process

	Swipe	Wash	Clean
Alice	1		2
Bob			
Carl	2		3



1. Subtract the smallest element of each row, to all elements in the row
2. Subtract the smallest element of each column, to all elements in the column
3. Cover all zeros in the matrix using the minimum number of horizontal and vertical lines
4. If n lines cover the matrix, the remaining is the assignment
5. If not, take the smallest entry, **subtract** it from every uncovered **row**, **add** it elements covered twice. go back to 3

Matrix reduction process

	Swipe	Wash	Clean
Alice	-	-	1
Bob	-	-	-
Carl	1	-	2

1. Subtract the smallest element of each row, to all elements in the row
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The assignment is chosen from the combination with the least cost

$(A, S) (B, C) (C, W)$

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$$O(n^3)$$

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$O(n^3)$ 😡