

MSD 460 Fall 2023

Tutorial 1

Rank Order Clustering Method

1. For each row of the machine/part matrix (M/P/M) read the pattern of cell entries as a binary word. Rank the rows by decreasing binary value. Equal values stay in same order.
2. Ask if newly ranked rows in the matrix are the same as previous order? – Yes (STOP) No (continue)
3. Re-form the M/P/M with rows in new descending order. Now rank the columns by decreasing binary word weight. Columns of equal weight are left where they are
4. Are current column weights the same as current column order? Yes (STOP), No (continue)
5. Re-form the matrix column order per rank order (highest to left) and return to #1.

Example

		Part 'Number'					
		2^5	2^4	2^3	2^2	2^1	2^0
Machine ID	X	1	2	3	4	5	6
	A			1		1	
	B		1	1			
	C	1			1		
	D		1	1		1	
	E	1				1	1

Step 1:

		Part Numbers						
		1	2	3	4	5	6	
Machine ID	B. Wt:							
	A			①		①		$2^3 + 2^1 = 10$ ⑤
	B		1	1				$2^4 + 2^3 = 24$ ④
	C	1			1			$2^5 + 2^2 = 36$ ②
	D		1	1		1		$2^4 + 2^3 + 2^1 = 26$ ③
	E	1				1	1	$2^5 + 2^2 + 2^0 = 37$ ①

Step 2: Must Reorder!

Step 3:

		Part Number					
B. WT.		①	2	3	④	5	6
2^4	E	1			1		1
2^3	C	1			1		
2^2	D		1	1		1	
2^1	B		1	1			
2^0	A			1		1	
		$2^4 + 2^3 = 24$ ①	$2^2 + 2^1 = 6$ ⑤	$2^2 + 2^1 + 2^0 = 7$ ④	$2^4 + 2^3 = 24$ ②	$2^2 + 2^0 = 5$ ⑥	$2^4 = 16$ ③

Step 4: Must Reorder

Back at Step 1:

Great Cluster Result!

		Part Number						
		1	4	6	3	2	5	
B Wt:		2^5	2^4	2^3	2^2	2^1	2^0	
Machine ID	E	1	1	1				56
	C	1	1					48
	D							7
	B							6
	A							5

Order stays the same: STOP!

TABLE 18.6(a) First Iteration (Step 1) in the Rank-order Clustering Technique Applied to Example 18.1

Binary values		2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	Decimal Equivalent	
		Parts										
Machines		A	B	C	D	E	F	G	H	I		Rank
2^6	1	1			1				1		290	1
2^5	2					1				1	17	7
2^4	3			1		1				1	81	5
2^3	4		1				1				136	4
2^2	5	1							1		258	2
2^1	6			1						1	65	6
2^0	7		1				1	1			140	3

TABLE 18.6(b) Second Iteration (Steps 3 and 4) in the Rank-order Clustering Technique Applied to Example 18.1

Parts

Machines	A	B	C	D	E	F	G	H	I	Binary values
1										2^6
5										2^5
7										2^4
4										2^3
3										2^2
6										2^1
2										2^0
Decimal equivalent Rank	96 ①	24 ④	6 ⑧	64 ③	5 ⑨	24 ⑤	16 ⑥	96 ②	7 ⑦	

TABLE 18.6(c) Solution of Example 18.1

Machines		Parts								
		2^8 A	2^7 H	2^6 D	2^5 B	2^4 F	2^3 G	2^2 I	2^1 C	2^0 E
448	1	1	1	1						
384	5	1	1							
56	7				1	1	1			
48	4				1	1				
7	3						1	1	1	
6	6						1	1		1
5	2						1			1

Bottleneck Parts and machines

Step 4

	A	B	D	H	I	G	C	F	E
4	1	1	1						
2	1	1		1	1	1			
7	1		1				1		
8		1		1	1			1	
6		1		1	1				
1			1				1		1
3				1		1		1	
5							1		1
Rank	1	2	3	4	5	6	7	8	9

