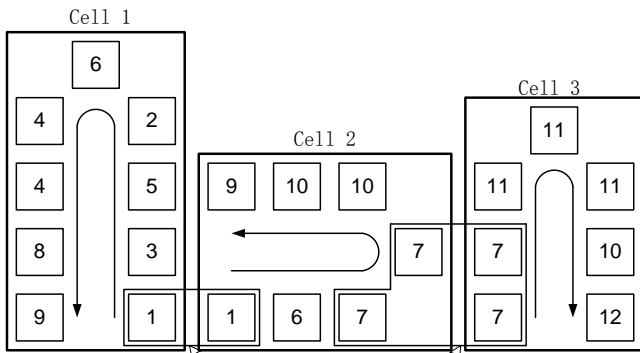
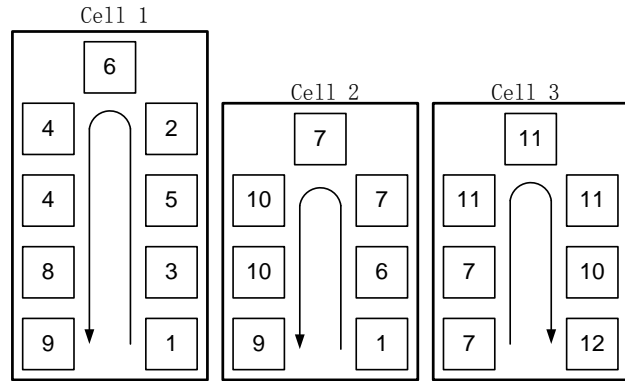
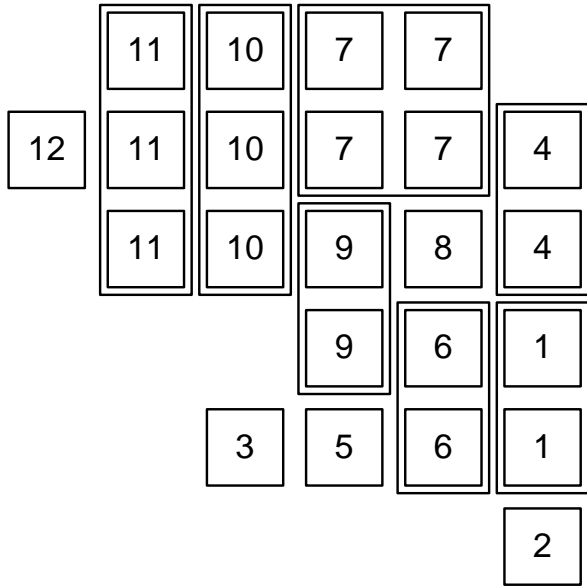
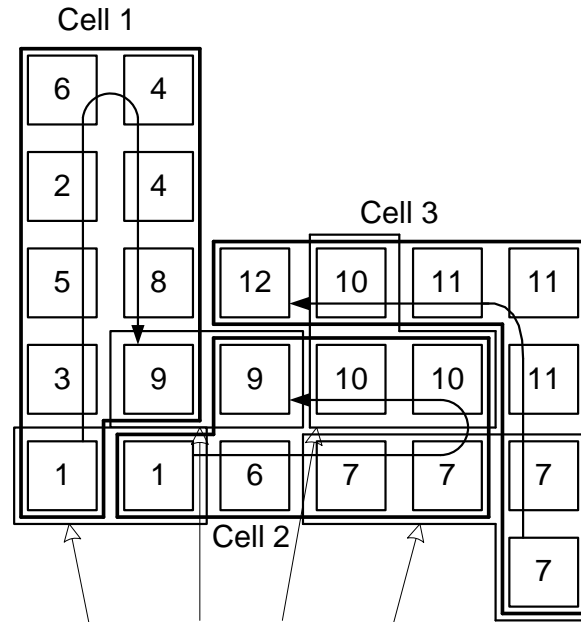


Design of a Cellular Layout for an Entire Facility

Layout Options for Jobshops

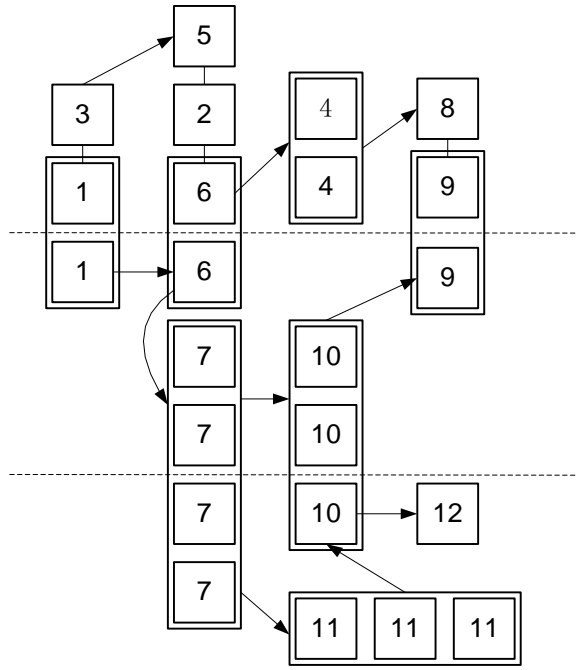


Functional Groups of Machines

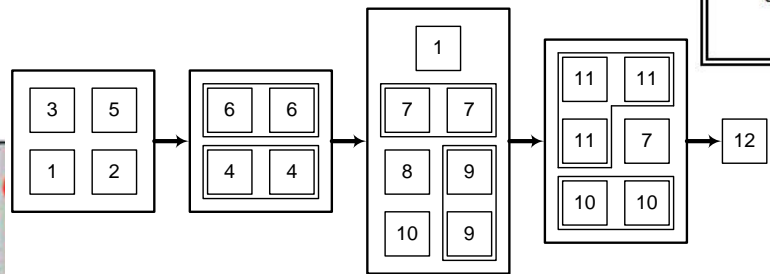
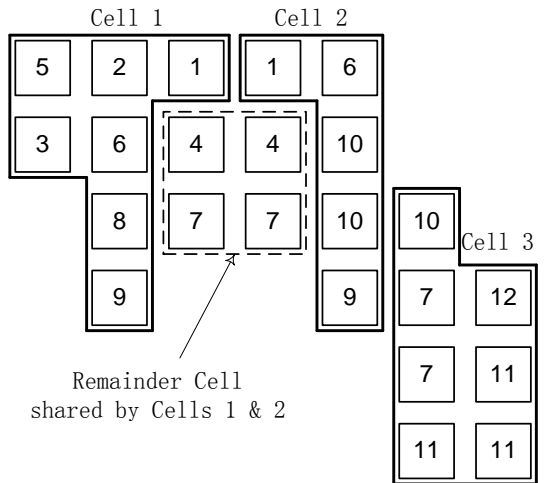
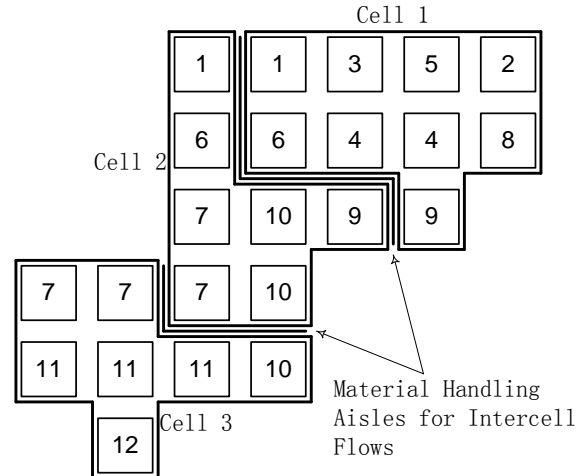


Functional Groups of Machines

Layout Options for Jobshops (contd.)



Part Numbers	Cell Composition
12, 13, 17, 19	
14, 15, 16	
10	
1, 4	
2, 3	
18	
5, 6	
7, 11	
8, 9	



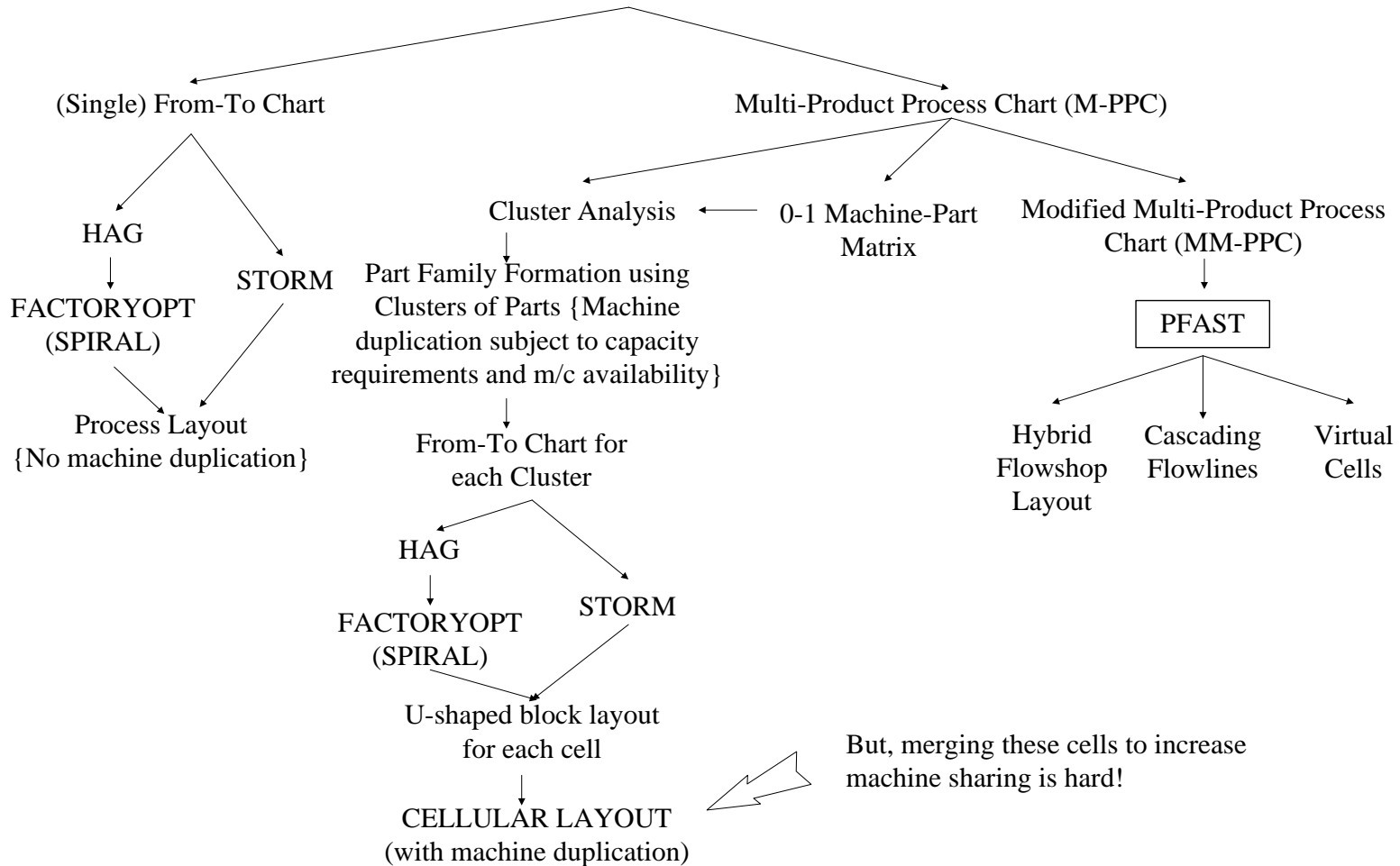
Facility Layout using PFA

P-Q-\$ Analysis

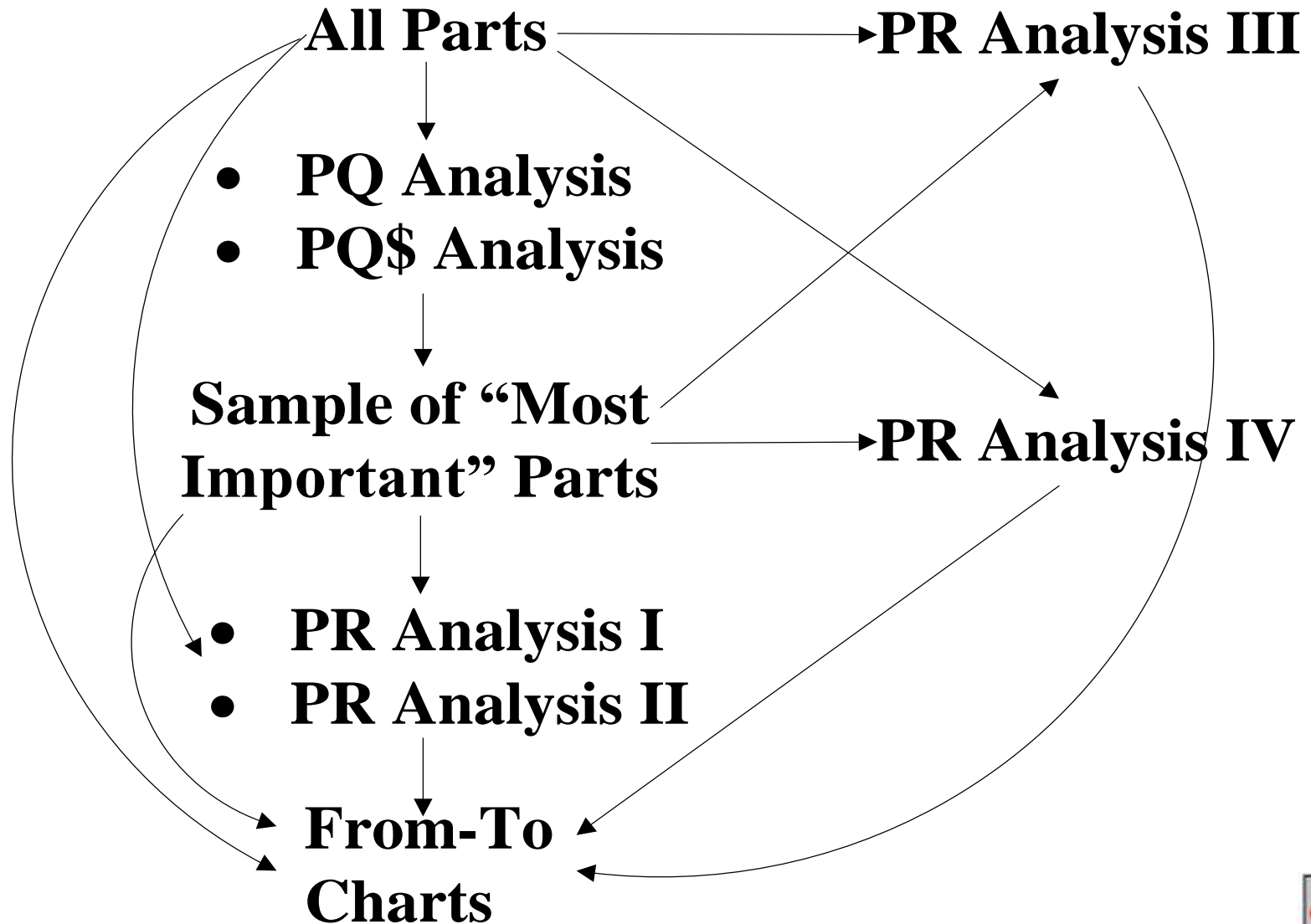
Select the sample of products to use for layout design:

- Routing
- Production Volume (Annual)
- Sales or Profits (Annual)
- Total Labor Hours (or Average Flow Time)

for each product



Typical Usage of PFAST Algorithms

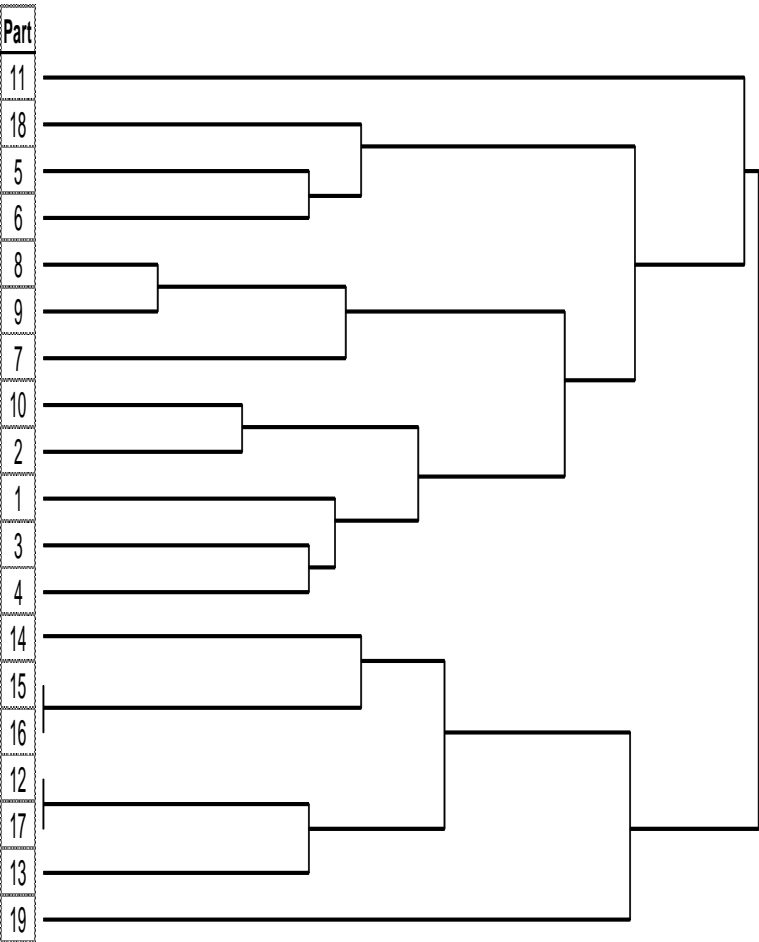


Essential Data for PFAST Analysis

Part Number	Sequence of Machines	Total Batch Machining Time	Batch Size
1	1==>4==>8==>9	96-36-36-72	2
2	1==>4==>7==>4==>8==>7	36-120-20-120-24-20	3
3	1==>2==>4==>7==>8==>9	96-48-36-120-36-72	1
4	1==>4==>7==>9	96-36-120-72	3
5	1==>6==>10==>7==>9	96-72-200-120-72	2
6	6==>10==>7==>8==>9	36-120-60-24-36	1
7	6==>4==>8==>9	72-36-48-48	2
8	3==>5==>2==>6==>4==>8==>9	144-120-48-72-36-48-48	1
9	3==>5==>6==>4==>8==>9	144-120-72-36-48-48	1
10	4==>7==>4==>8	120-20-120-24	2
11	6	72	3
12	11==>7==>12	192-150-80	1
13	11==>12	192-60	1
14	11==>7==>10	288-180-360	3
15	1==>7==>11==>10==>11==>12	15-70-54-45-54-30	1
16	1==>7==>11==>10==>11==>12	15-70-54-45-54-30	2
17	11==>7==>12	192-150-80	1
18	6==>7==>10	108-180-360	3
19	12	60	2

Product-Routing Analysis by PFAST

PR-II Analysis



PR-I Analysis

	2	3	5	6	9	8	4	1	7	10	11	12
11				1								
18				1					1	1		
5				1	1			1	1	1		
6				1	1	1			1	1		
8	1	1	1	1	1	1	1					
9		1	1	1	1	1	1					
7				1	1	1	1					
10						1	1		1			
2						1	1	1	1			
1					1	1	1	1				
3	1				1	1	1	1	1			
4					1		1	1	1			
14									1	1	1	
15								1	1	1	1	1
16								1	1	1	1	1
12									1		1	1
17									1		1	1
13											1	1
19												1

PR-IV Analysis

Part	1	2	3	4	5	6	7	8	9	10	
19										12	
13			11							12	
17			11			7				12	
12			11			7				12	
14			11			7		10			
15			1			7	11	10	11	12	
16			1			7	11	10	11	12	
18			6			7		10			
10						4	7	4	8		
2			1			4	7	4	8	7	
1			1			4			8	9	
3			1			2	4	7		8	9
4			1			4	7			9	
5			1	6	10	7				9	
6				6	10	7			8	9	
7				6		4			8	9	
8	3	5	2	6		4			8	9	
9	3	5		6		4			8	9	
11				6							

PR-IV Analysis

Machine duplicated across both part families and within routings too==> but number available is 4

Parts in Cell 1

Parts in Cell 2

Part	1	2	3	4	5	6	7	8	9	10
19										
13										12
17			11			7				
12										
14						7		10		
15			1				11	10	11	12
16										
18				6		7		10		
10							7			
2							7	4	8	7
1						4				
3			1		2		7			
4										
5										
6					10	7				9
7										
8	3	5	2	6		4			8	
9										
11										

Machine duplicated across both part families and within routings too==> but number available is 3

From/To Charts for Parts in Cell 1

PR-IV Analysis for Part Family1

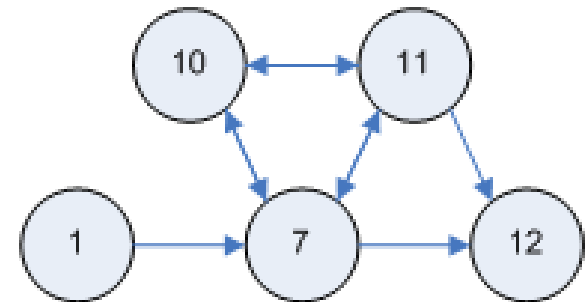
Part	1	2	3	4	5	6	7	8	9	10
19										
13										
17										
12										
14										
15										
16										

PR-IV Analysis for Part Family1: A grid showing parts 1 through 16 on the y-axis and stations 1 through 10 on the x-axis. Shaded cells indicate the presence of parts at specific stations: Part 11 at station 3, Part 7 at station 6, Part 10 at station 8, Part 12 at station 10, and Part 1 at station 3. Red arrows show the flow: 11 → 7 → 10 → 11 → 12; 7 → 10 → 11 → 12; 10 → 11 → 12; 11 → 12; 1 → 7 → 10 → 11 → 12.

From-To Chart for Cell #1

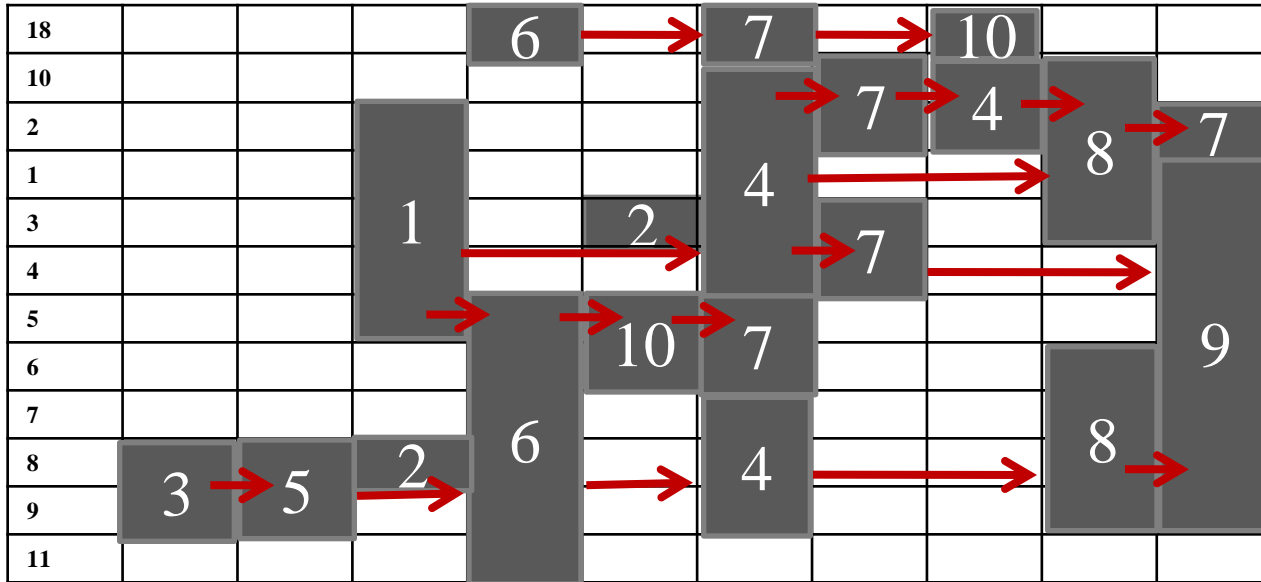
	1	7	10	11	12
1		3			
7			3	3	2
10				3	
11		5			4
12					

From-To Chart for Cell #1: A matrix showing the flow of parts between stations 1, 7, 10, 11, and 12. The values represent the number of parts moving from the row station to the column station.



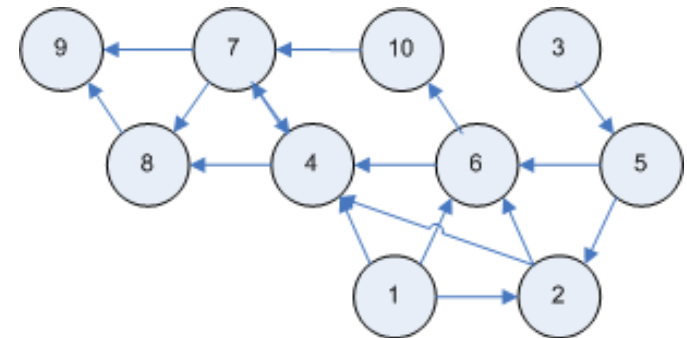
From/To Charts for Parts in Cell 2

PR-IV Analysis for Part Family 2



From-To Chart for Cell #2

	1	2	3	4	5	6	7	8	9	10
1		1		8		2				
2				1		1				
3					2					
4							9	9		
5		1				1				
6				4			3			2
7				5				1	2	3
8							3		8	
9										
10							3			



Workload Analysis for Equipment Requirements Planning

Part/Machine	1	2	3	4	5	6	7	8	9	10	11	12	Total
19												60	60
11						72							72
7				36		72		48	48				204
1	96			36				36	72				240
13											192	60	252
15	15						70			45	108	30	268
16	15						70			45	108	30	268
6						36	60	24	36	120			276
10				240			20	24					284
4	96			36			120		72				324
2	36			240			40	24					340
3	96	48		36			120	36	72				408
12							150				192	80	422
17							150				192	80	422
9			144	36	120	72		48	48				468
8		48	144	36	120	72		48	48				516
5	96					72	120		72	200			560
18						108	180			360			648
14							180			360	288		828
Total	450	96	288	696	240	504	1280	288	468	1130	1080	340	

Total Work Content for Part 14

Total Work Load for Machine 7

Machine Reqmts. vs. Duplication

Part	1	2	3	4	5	6	7	8	9	10	
19											
13				→							12
17			11	→				→		280/384 =0.73	
12			864/384 =2.25			7					
14						620/384 =1.6	→				
15			1				11	10	11	12	
16			30/384=0.08	→			99/384=0.28	450/384=1.17	108/384=0.28	90/384=0.23	
18				6	→		7	10			
10							7	4			
2							40/384=0.10	240/384=0.63	8	7	
1							348/384=0.91	→		144/384=0.38	
3		1		2							
4		420/384=1.09					7				
5											
6						10	7			9	
7						320/384=0.84	180/384=0.43			478/384=1.22	
8											
9											
11											
		3	5	2		6	4		8		
		288/384=0.8	240/384=0.6			396/384=1.03	108/384=0.28		144/384=0.38		

$108/384=0.28$

$360/384=0.94$

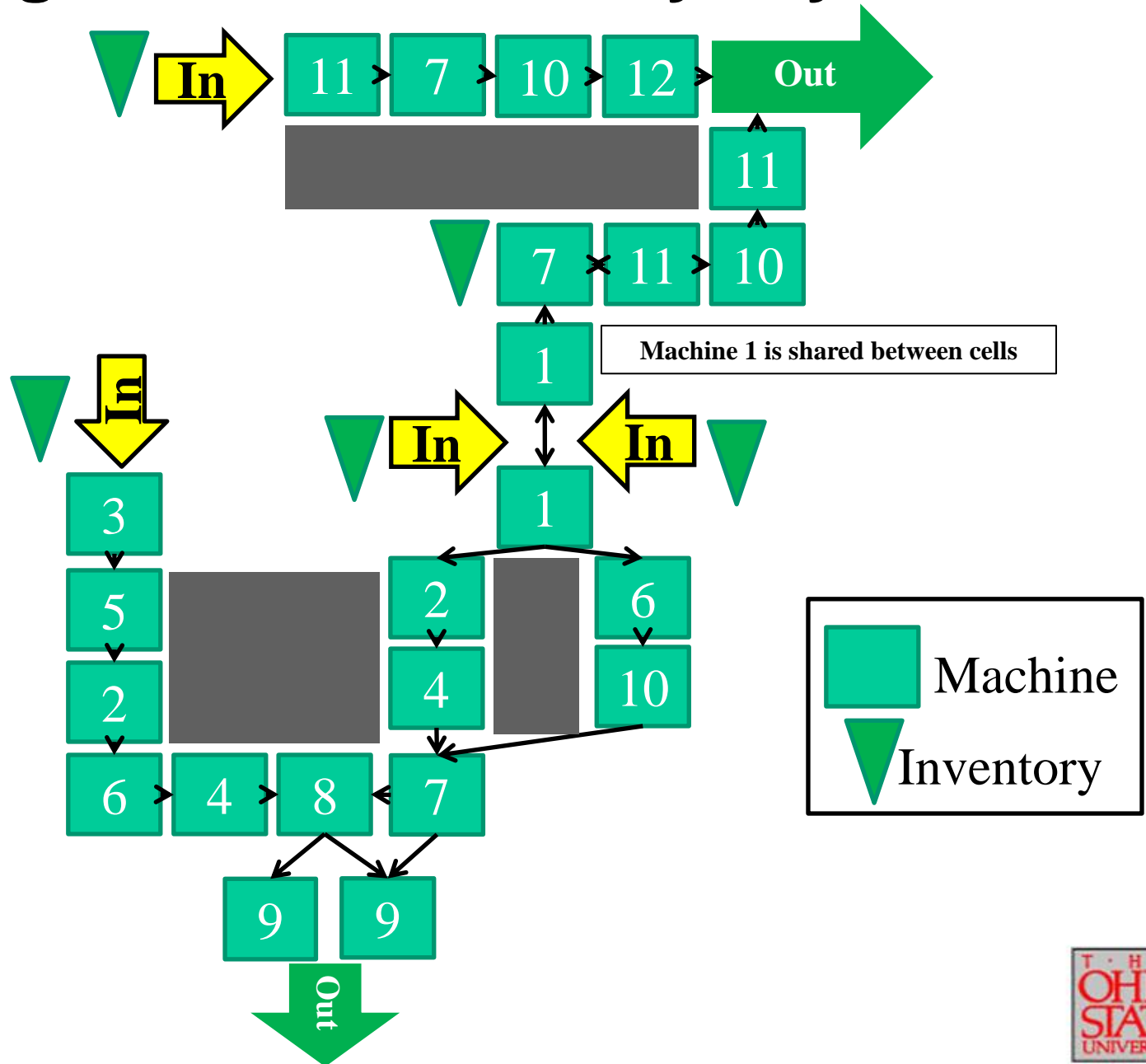
$48/384=0.13$

$180/384=0.47$

$20/384=0.05$

$48/384=0.13$

Design of Overall Facility Layout



Further Reading

Irani=> S. A. (1999). **Classroom Tutorial on the Design of a Cellular Manufacturing System.** (Chapter 7 in *Handbook of Cellular Manufacturing Systems*=> John Wiley & Sons=> ISBN 0-471-12139-8).