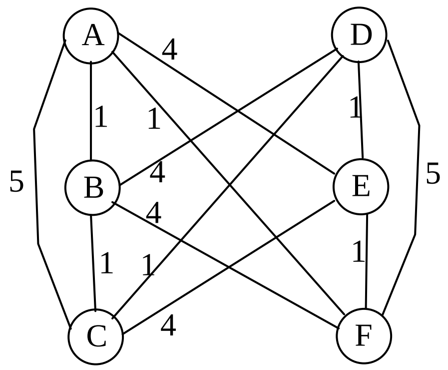
Exercise 8

Parts 1 to 12 have to be produced on 6 machines A; B, C, D, E, and F.

	1	2	3	4	5	6	7	8	9	10	11	12
A	1	1	1	1	1							1
B	1						1	1	1	1		
C	1	1	1	1	1						1	
D						1	1	1	1	1	1	
E		1	1	1	1	1						
F						1	1	1	1	1		1

a) Show that this yields the following graph of common parts:



b) Assume that the graph of common parts is as given above. Let the initial clustering of machines in 2 groups be {A, B, C} and {D, E, F}. Using the Kerninghan-Lin algorithm find an improved clustering of the 6 machines in 2 groups.

Excercise 9

Fort he final assembly of a product 10 jobs need to be done (A, B, ..., J). The following table contains the processing times (in minutes) and precedence conditions for all jobs.

Job	Precedessor	Proc.time
A	-	7
B	-	8
C	-	7
D	A, B	6
E	C, D	12
F	D	8
G	E	10
H	E	12
I	F, H	8
J	G, H	9

a) Determine the cyle time if production is done in 2 working shifts, each of them taking 8 hours, and an output quantity of 50 items.

b) Apply the following priority rules for assigning jobs to stations (apply rule 1 first, rule 2 is only to be applied in case of equality obtained with rule 1

Rule 1: Choose jobs according to monotonuously increasing upper bound for the number of stations needed for job j and all his precedessors.

$$PV_j := E_j = \left\lceil \left(t_j + \sum_{h \in V_j^m} t_h \right) \Big/ c \right\rceil$$

Rule 2: Decreasing positional weight („Positionswert“)

c) Calculate the system´s efficiency.

Exercise 10

Models A, B and C are to be produced by mixed-model assembly. The following table contains the precedence conditions and processing times for all jobs of all models:

	A		B		C	
Job	Precedessor	t_{jA}	Precedessor	t_{jB}	Precedessor	t_{jC}
a	-	4	-	3	-	1
b	a	7	a	1	-	3
c	a	2	d	2	d	3
d	a	1	-	5	a	2
e	b, d	5	b, c	2	a	1
f	c, e	1	e	4	b, c, e	3

We have to produce 3 units of model A, 1 unit of model B, and 2 units of model C. The planning horizon is 60 time units.

a) Assign jobs to stations by applying the heuristic of Thomopoulos ($\lambda = 0$).
b) Assume λ to be 20. Does the solution found in a) change?

Exercise 11

Models A, B and C are to be produced by mixed-model assembly. The following table contains the precedence conditions and processing times for all jobs of all models:

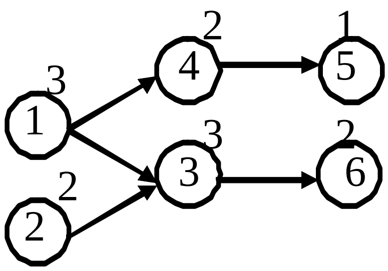
	A		B		C	
Job	Pred.	t_{jA}	Pred.	t_{jB}	Pred.	t_{jC}
a	-	2	-	3	-	2
b	a	3	a	2	a	2
c	-	-	a	2	a	1
d	b	4	a	6	a	1
e	b	6	-	-	b,c	2
f	e,d	2	b,c,d	2	d,e	1

We have to produce 1 unit of model A, 2 units of model B, and 2 units of model C. The planning horizon is 40 time units.

a) Assign jobs to stations by applying the heuristic of Thomopoulos ($\lambda = 0$).
b) What happens if λ is assumed to be 34?

Exercise 12

Consider the following precedence graph for an assembly line. The numbers above the nodes (operations) indicate the durations.



a) What is the minimal possible cycle time, if exactly 2 stations should be built. Explain why!

b) Let the cycle time be c = 5. Find the optimal assembly line balancing using dynamic programming (Jackson).