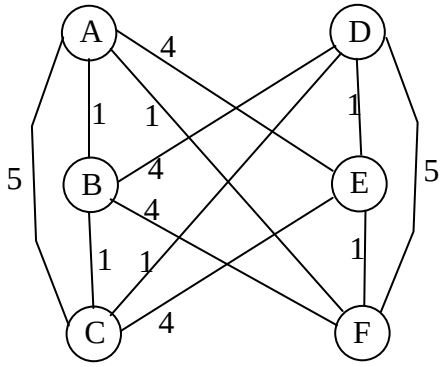
Exercise 8

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

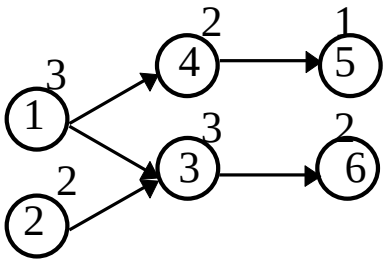
Models A, B and C are to be produced by mixed-model assembly. The following table contains the precedence conditions and processing times for all jobs of all models:

	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.
Assign jobs to stations by applying the heuristic of Thomopoulos ($\lambda = 0$).

Exercise 11

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).