Basics of Scheduling - Exercises

1.1 At a family-house construction a group of workers is performing the tasks below – seven days a week:

Task	Duration [days]		W o	r k d a	a y s	
Erecting the masonry wall	3					
Lifting and spacing slab elements	1					
Formworking the ringbeam	1					
Reinforcing and concreting the ringbeam	2					

1.2 At a construction site two groups of workers are performing the tasks below. One of the groups is performing earthmork and concreting, while the other is doing the carpentry works – five days a week.

The concrete of foundation should be at least a day (twenty-four hours) old before placing any formwork on it.

Task	Duration						С	a l e	n d a	a r					
	[days]	Μ	Т	W	Th	F	Sa	Su	Μ	Т	W	Th	F	Sa	Su
Excavating the foundation	3														
Formworking foundation	3														
Concreting the foundation	3														
Formworking the walls	3														
Concreting the walls	3														

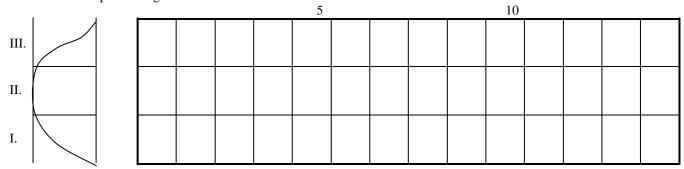
1.3 A sewer-line is being constructed in a synchronized-belt performance system (progression of tasks are even and alike). Succeeding jobs are launched a day after the preceeding ones had started (minimum succession time is a day).

Task	D								V	V o	r k	i n g	g d	a y	S							
	[days]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Excavation	15																					
Timbering	15																					
Pipe-laying	15																					
Timb. removal	15																					
Trench refilling	15																					

1.4 A sewer-line similar to the preceeding one above is being constructed. Timber works are performed by the only group of carpenters. Minimum succession time is two days. Which days could the carpenters have days-off having no job at the site.

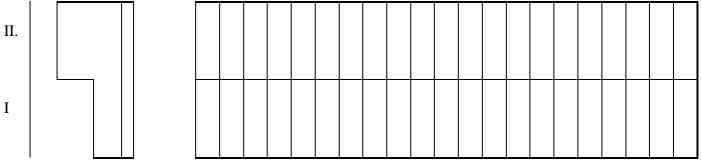
Task	D										,	W	o r	k i	n	g	d a	y s	5									
	[days]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Excavation	18																											
Timbering	12																											
Pipe-laying	18																											
Timb. removal	6																											
Trench refilling	18																											

1.5 At an access-road construction a 300 m-s long hollow (cut-through) excavation is to be performed. Due to the varying depth the site engineer estimated the likely duration of processes for three sections (I, II, III) within it, separately. Durations of mass excavation performed by heavy equipments are estimated to be 2, 6 and 1 days – respectively. Duration of refinery excavation (progression of which is less effected by the depth and is to be performed by live labour) is estimated as 9 days for the total of 300 m-s. When should the refinery excavation be started for to provide at least a day succession time after the mass excavation and the labourers performing it with no break.



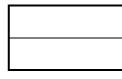
1.6 A retaining wall is to be constructed. According to the varying height the site engineer divided the overall length of it into two sections (I, II). Foundation is not changing along the wall. Minimum succession time should be at least one day. There are specialized groups (workers and/or equipments) assigned to the tasks to be performed, listed below, one for each. Do prepare a schedule of performances in form of a Gantt-Chart and of a two-dimensional time-route chart ("Cyclogram") too.

Task	Dura	tions								V	V o	r k	i n g	g d	l a y	' S							
	I.	ΙΙ	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Excavation	1	2																					
Foundation	1	2																					
Formwork	4	8																					
Concreting	3	6																					
Formw. removal	2	4																					
			-							1					1	1					1		Г

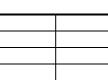


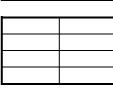
- 1.7 For to perform a complex job (,,technology" or ,,structural" process) different kinds of sub-ordinate processes necessiating special resources for each (a, b, c, ...) are to be done in the same time, simultaneously (,,synchronized resources"). Knowing the quantities, and the available capacities (time standards or performances) do determine the likely duration of the job.
- 1.8 At an embankment construction it is necessary to build a sheetwall barrier. To keep up with the deadline it is necessary to apply two sets of equipments (two pile-driver machines and their staffs). Do develope as many variants in starting location and in progress direction for the two machines working simultaneously as you can.

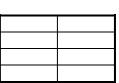












2.1 How many steelfitters would you command to perform the reinforcement works in the cases below? (10 hours are a shift)

Tealr												W	0 /	r k	ir	ı g	d	a y	' S											
Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Formwork																														
Reinforcement																														
Betonozás													_																	

a/ Quantity of reinforcement is 25 ton, the time-standard of a steelfitter is 40 hour/ton;

b/ Budgeted cost of the reinforcement is 24000 € and standard daily performance of a steelfitter is 200 €

2.2 At a sewer system construction a trench of 6000 m^3 is to be excavated. Due to crossing existing public services at most 90 % of the work can be performed by the excavator (which has the experienced hourly output of 135 m^3) while the rest must be performed by live labour (time standard of which is 1.2 hour/m³ per worker). The workers and the machine should work together (simultaneously, on a safe distance from each other). How many workers would you assign to the job?

2.3 Do develope a time schedule and associating resource usage charts for constructing a flat foundation including 80 pieces of monolithic foundation blocks.

Quantities per block: excavation: 25 m³, formwork: 12 m², concreting: 9 m³, refill: 16 m³.

Time standards of works: formworking: 0.2 hour/m², removing formwork (striking): 0.1 hour/m², concreting: 2.5 hour/m³, ditch refilling (+compacting): 1.0 hour/m³;

Experienced hourly output of the backhoe excavator: 25 m³.

Avoiding exposure of sensitive conditions are of high preference. 10 hours are a shift.

Task	р	С							,	W	o r	k i	n g	g d	la	y s	(9	s h	i f	ts))						
Iusk	D	v	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Excavation																											
Formwork																											
Concreting																											
Formw. removal																											
Refill																											

2.6 At a construction site the main tasks are organized into four succeeding processes (A, B, C, D). Assigned resources and estimated durations of each are listed below:

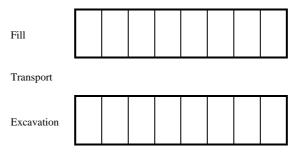
process A	5 workers	14 days,
process B	10 workers	24 days,
process C	8 workers	12 days,
process D	6 workers	24 days.

Minimum succession time is a day. Do plot a schedule for the performances.

Prepare a proposal for shortening the overall execution time keeping in mind that neither more working hours (shifts) in a day nor more workers for any of the processes are available? (Minimum capacity to be assigned to any process is 2 workers.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

3.1 In case of building a retaining wall the refill behind is to be performed in four layers. The soil for fill is excavated at a near-by pit, and transported by trucks to the foot of the wall. There the dumped soil is manipulated by a loader-excavator and is poured behind the wall, where rollers are used for compacting. Do plot the progression curves (cyclograms) of excavation and of fill.



- 3.2 At a public supply-line construction the refill of the trench of 1000 m-s is to be scheduled. Do plot the progression curves (cyclograms) of the performances in cases below. (In both cases the overall execution time should be 8 days.)
 - a; The trench is refilled in four layers, one layer along the total length at a time.
 - b; The trench is refilled in four layers, in four equal sections, one layer along a section at a time.

1	2	3	4	5	6	7	8

1	2	3	4	5	6	7	8

Do plot cyclograms for the cases above, but with two groups (of workers and/or machines) working simultaneously. The overall execution time should be 8 days in these cases too.

1	2	3	4	5	6	7	8

1	2	3	4	5	6	7	8

1	2	3	4	5	6	7	8

1	2	3	4	5	6	7	8