

## HW2 Solution

1. Question 16, page 253.

	Activity	Duration (weeks)	Earliest		Latest		Slack
			Start	Finish	Start	Finish	
1	Problem Definition	2	0	2	-5	-3	-5
2	System Analysis	5	2	7	-3	2	-5
3	Design Input & Output	3	7	10	6	9	-1
4	Design Database	15	7	22	2	17	-5
5	Develop Input Screens	8	10	18	11	19	1
6	Develop Output Reports	10	10	20	9	19	-1
7	Develop Database	2	22	24	17	19	-5
8	Test System	6	24	30	19	25	-5
9	Implement System	5	30	35	25	30	-5

The latest start and latest finish times are based on a 30 week required completion date.

No, the project cannot be completed in 30 weeks. We see this by the fact that the earliest finish time is greater than 30 weeks or that the minimum slack is negative.

The critical path is 1-2-4-7-8-9.

2. Question 4, page 266.

Earliest expected finish time  $EF = 138$  days.

Required completion (latest finish) time  $LF = 130$  days.

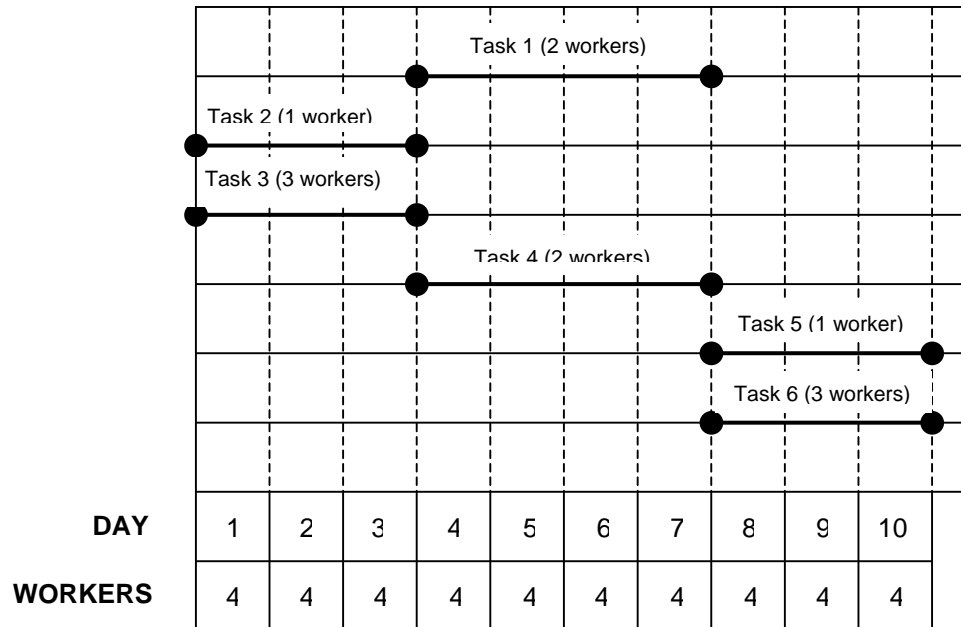
Standard deviation of total distribution of activities on longest path  $\sigma_t = 6$ .

Number of standard deviations between  $LF$  and  $EF$  is  $Z = (LF - EF)/\sigma_t = (130-138)/6 = -1.33$ .

The area under the normal curve represented by  $Z = 1.33$  is 0.40824, as read from Table 10.1. Since  $LF < EF$ , then this value is subtracted from 0.5. Thus, the probability that the project will be completed in 130 days or less is  $0.5 - 0.40824 = 0.09176 = 9.176\%$ .

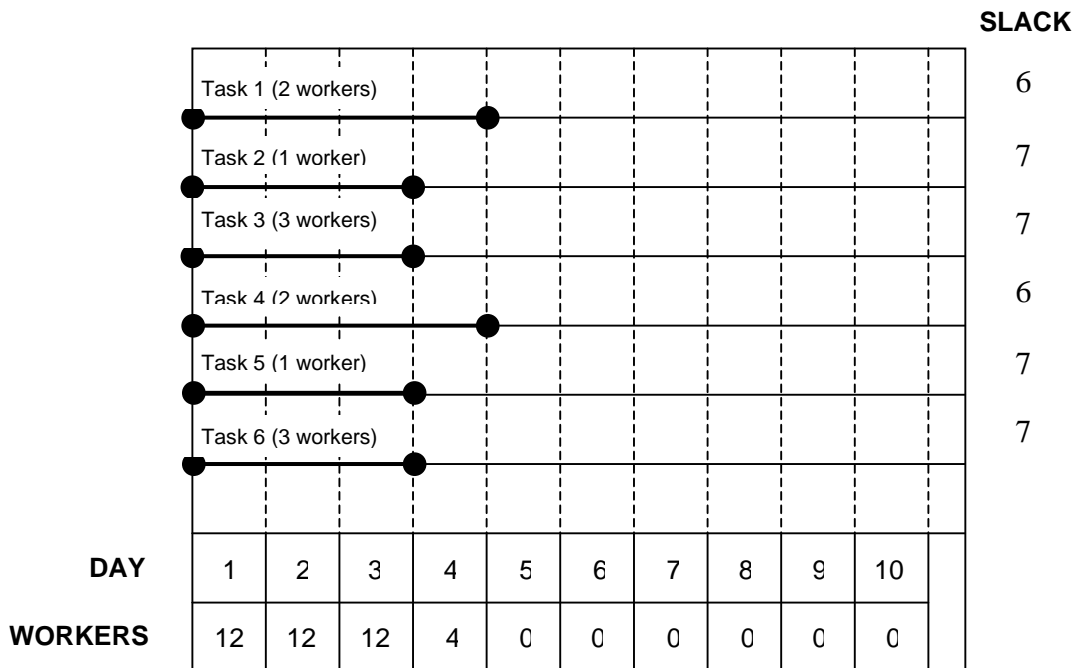
3. Question 11, page 305.

The fewest number of workers needed at any one time without extending the length of the project is 4. We can achieve this using resource leveling by performing tasks 1 and 4 together, and then either task 2 with 3 and task 5 with 6, or task 2 with 6 and task 3 with 5. One possible schedule is shown below.

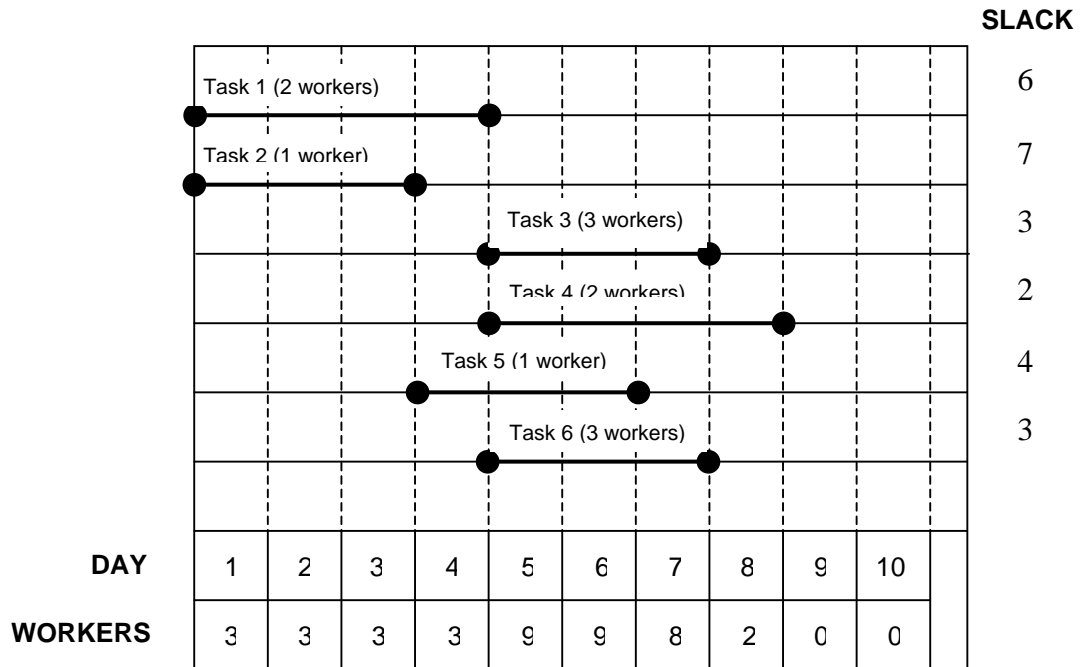


4. Question 12, page 306.

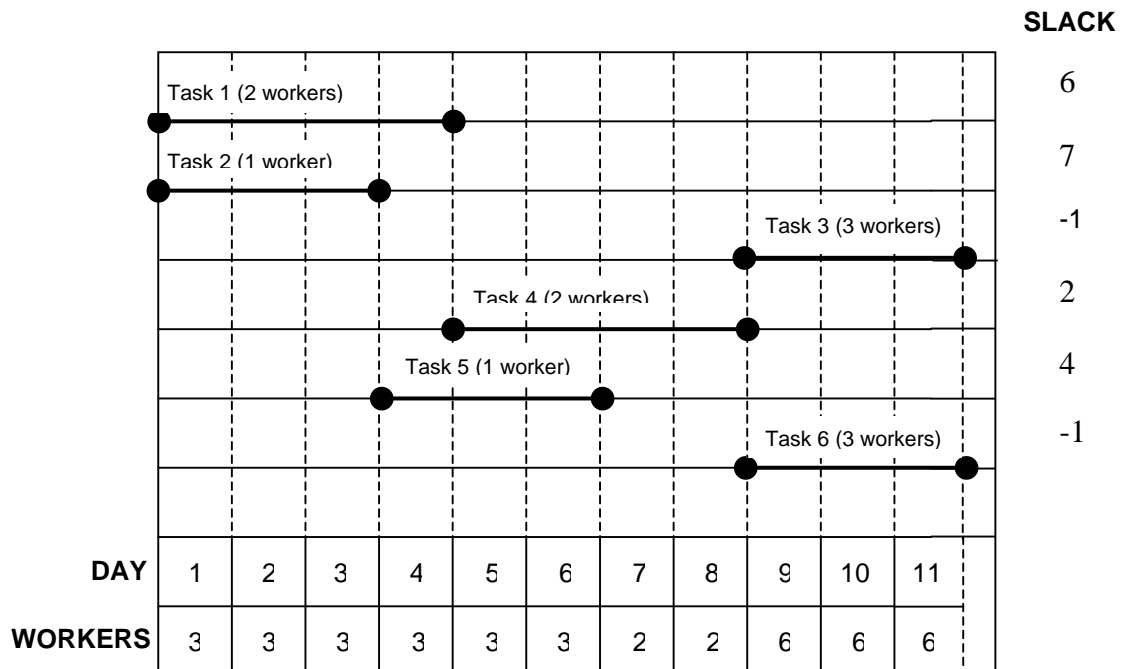
Since the tasks are all independent, we start with all done in parallel.



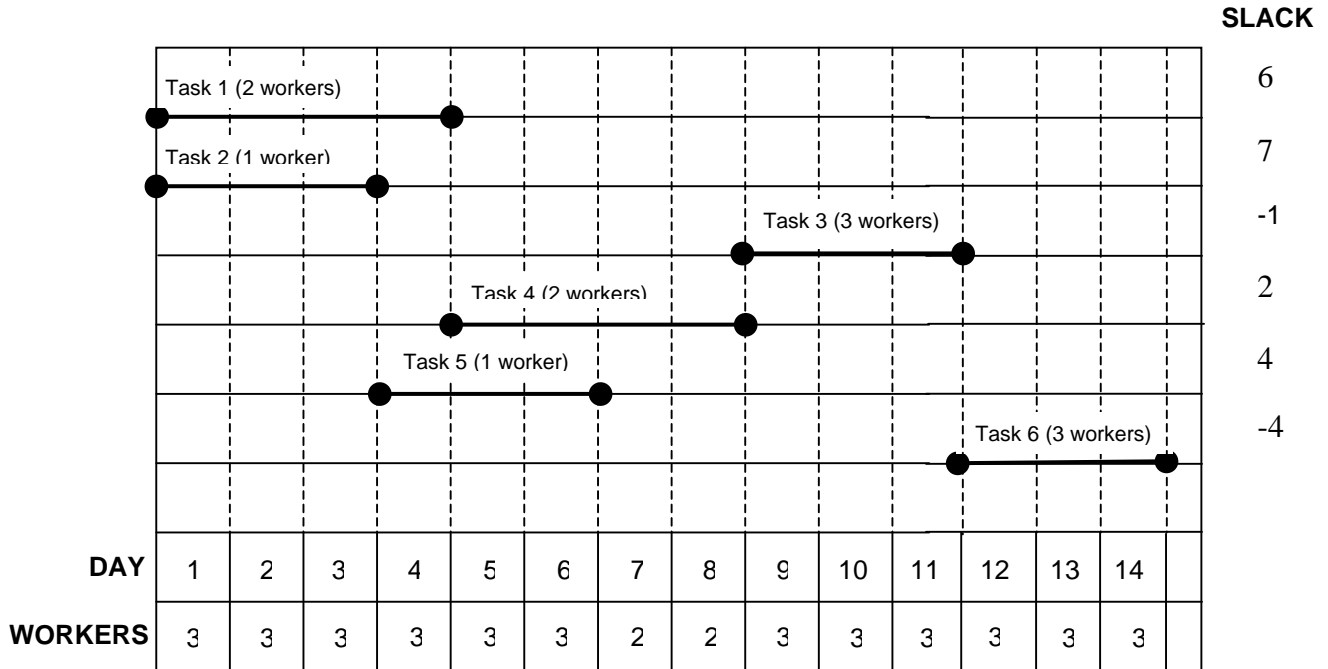
However, with only three workers available at any one time, resource-limited scheduling is necessary. We always choose the task with the least slack to schedule next, which indicates task 1 or 4. I'll choose task 1. Task 1 only requires two workers, so we can also schedule task 2 or 5 in parallel with 1 (both have the same slack of 7). I'll choose task 2, yielding the following schedule.



Now, task 4 has the smallest slack and will be scheduled next starting at day 5. Task 5 can be left at day 4, because task 4 only requires 2 workers. The resulting schedule follows.



Finally, task 3 and 6 cannot be done in parallel. They both have the same slack and same slack history, so I'll arbitrarily choose task 3 to schedule at day 9, and task 6 will start on day 12. The final schedule follows.



The new completion time of the project is 14 days.

5. The MSProject file (HW2.mpp) for the solution is available on the course web page.
  - a. After entering the salaries, the cost of the project is \$47,600.
  - b. If Jim assumes Steve's task, the cost increases to \$50,800, and the duration increases from 59 to 62 days. If Jeff assumes Steve's task, the cost remains to \$47,600, but the duration again increases from 59 to 62 days.