

Software Project Management (A.Y. 2016/2017) Commented Solutions

April 12th, 2017

Preamble

The Dummy Software Company (DSC) has been asked to develop a complex software system and you, as an employee of the company, have been nominated Project Manager. The management is now asking you to provide some forecasting in order to decide on how to proceed with the project.

In deriving your prediction you should consider the following amounts as the gross salary **per week**:

- *Senior developer:/Analysts* 3500\$
- *Junior developer:* 2000\$

Moreover historical data show that the company generally experiments a 57% overhead

Exercise 1.

In order to derive a more reliable estimation you sketch a set of workpackages (WPs) and tasks needed in order to complete the project. WPs and tasks are detailed in Table 1. The table also includes information concerning the dependencies among the tasks.

| Activity (Precedents) | Activity Durations (weeks) | | |
|--------------------------|----------------------------|--------------------|--------------------|
| | Optimistic (a) | Most likely (m) | Pessimistic (b) |
| T1.1 | 1 | 2 | 4 |
| T1.2 | 1 | 2 | 4 |
| T1.3 (T1.1) | 4 | 8 | 13 |
| T1.4 (T1.2,T1.3) | 8 | 12 | 17 |
| T1.5 (T3.3) | 6 | 10 | 12 |
| T2.1 (T1.1,T1.2) | 3 | 4 | 5 |
| T2.2 (T2.1) | 3 | 4 | 4,5 |
| T2.3 (T1.1,T1.2,T2.2) | 2 | 4 | 6 |
| T3.1 (T1.2,T1.3) | 2 | 4 | 7 |
| T3.2 (T3.1) | 7 | 8 | 9 |
| T3.3 (T2.2,T3.2) | 8 | 12 | 13 |
| T3.4 (T1.4,T1.5) | 5 | 7 | 10 |
| T4.1 (T2.3) | 3 | 4 | 5 |
| T4.2 (T1.4,T1.5) | 3 | 4 | 5 |
| T4.3 (T4.1,T4.2) | 6 | 8 | 11 |

Table 1: PERT activities time estimates (in weeks)

Apply the PERT approach to:

- Compute the duration of the project
- Provide the probability of successfully terminating task T3.3 exactly as indicated in the derived PERT network.
- Provide the probability of successfully terminating task T4.1 within 20 weeks, according to the dependencies and the corresponding path ending with activity 4.1
- Provide the probability of finishing the project after one year (i.e. 52 weeks)
- Provide the ordered list of activities belonging to the critical path where the value for the time is the one specified by t_e .

Solution:

- To compute the expected duration of the project we need to build the PERT network as reported in Figure 1. Then from the data reported there we can deduce that the expected duration for the project is 55,8 weeks.
- In this case it is not necessary to do any computation since the probability of successfully terminating a task as indicated in the PERT network is always 0,5
- In this case we need to calculate the formula $z = (T - t_e)/s$ for the path ending with task T4.1. In this case we should not consider the value on node 12 being related to the path ending with task T4.2. So we need to compute the value for t_e and s with respect to that path. Using the usual formula we obtain the following values $t_e = 14,07 + 4 = 18,07$ and $s = \sqrt{0,93^2 + 0,33^2} = 0,98$. Therefore $z = (20 - 18,07)/0,98 = 1,97$. Now using the table for z we obtain that the probability of finishing Task T4.1 project within the 20th week is higher than 0,96.
- In this case we can use the value on node 13 on Figure 1 to compute the value of z . In particular we obtain $z = (52 - 55,8)/2,34 = -1,62$. Using the table for the value of z we can deduce that the probability of finishing the project after one year is around 0,05.
- The critical path is generally computed applying the CPM technique. Nevertheless if the value to use is the one for t_e we can deduce the critical path also from a PERT network given that the number in it follow the same approach used in CPM. In particular in this case we have that there are two critical paths as listed in the following:

1. T1.1 \rightarrow T1.3 \rightarrow T3.1 \rightarrow T3.2 \rightarrow T3.3 \rightarrow T1.5 \rightarrow T4.2 \rightarrow T4.3
2. T1.2 \rightarrow T1.3 \rightarrow T3.1 \rightarrow T3.2 \rightarrow T3.3 \rightarrow T1.5 \rightarrow T4.2 \rightarrow T4.3

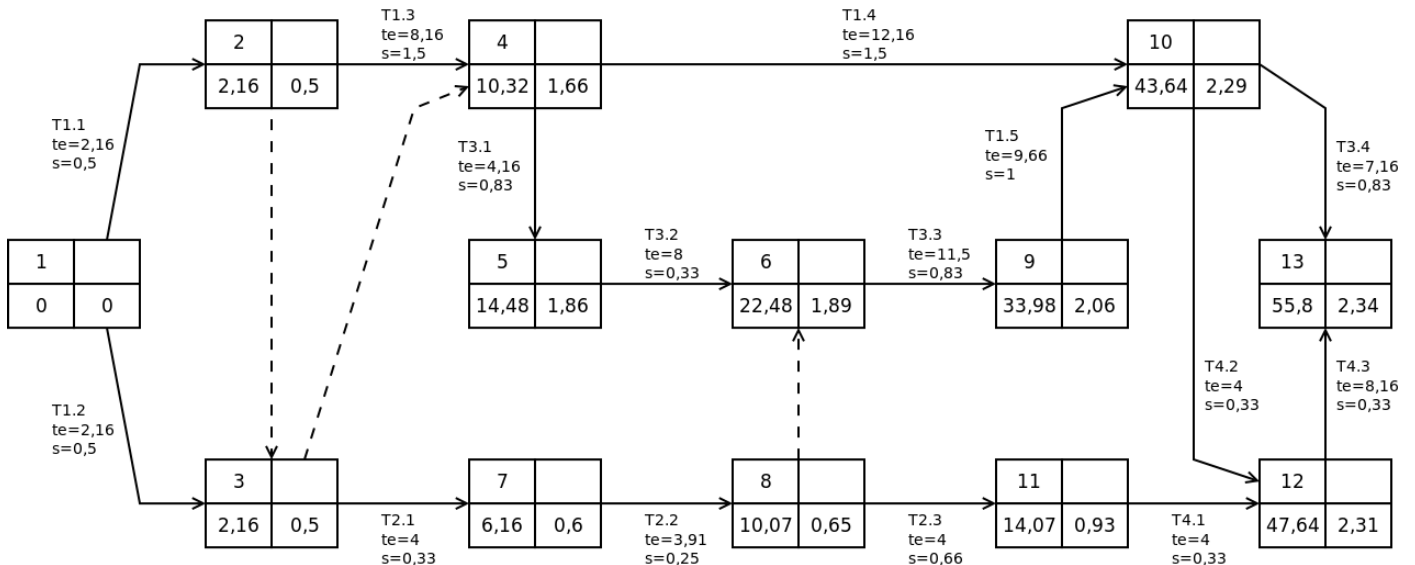


Figure 1: PERT network

Exercise 2.

Consider now a project in which the foreseen activities and dependencies are the ones specified in Table 2, where the duration is expressed in weeks, and the effort is expressed in terms of needed Senior Developers (SD) and Junior Developers (JD) respectively:

- Report the CPM network and derive the total duration of the project, as well as the various floats for each activity
- Compute the total cost for the project
- Provide a possible allocation of resources respecting the following constraints:
 - activities cannot be split in subactivities
 - effort should be uniformly distributed over the weeks for the whole duration of the corresponding activity
 - the company does not have more than 5 Senior Developers and 4 Junior Developers.

8 points

| Task | Duration | Effort | Depends on |
|------|----------|-------------|------------|
| T1.1 | 10 | 20 SD/10 JD | |
| T1.2 | 12 | 24 SD/12 JD | |
| T1.3 | 2 | 2 SD/2 JD | |
| T1.4 | 6 | 6 SD/0 JD | T1.1 |
| T2.1 | 2 | 4 SD/2 JD | |
| T2.2 | 8 | 0 SD/8 JD | T2.1 |
| T2.3 | 6 | 12 SD/6 JD | T1.4, T2.2 |
| T3.1 | 4 | 12 SD/8 JD | T1.2, T1.3 |
| T3.2 | 16 | 0 SD/32 JD | T3.1 |
| T4.1 | 4 | 8 SD/0 JD | T2.3 |
| T4.2 | 6 | 12 SD/6 JD | T3.2 |

Table 2: Activities, effort and dependencies

Solution:

- The CPM network and related information can be easily derived from Figure 2 given the dependencies reported in Table 2.
- Figure 2 reports also the effort needed for each activity and the total effort for SD, and JD. As indicated the total cost of the project is 819540\$.
- In order to respect the constraints listed in the third item of the problem list, it will be necessary to move the tasks within their float. The objective will be to derive a distribution of effort that still respects tasks dependencies and the additional constraints. Figure 3 reports a possible allocation respecting all the listed constraints.

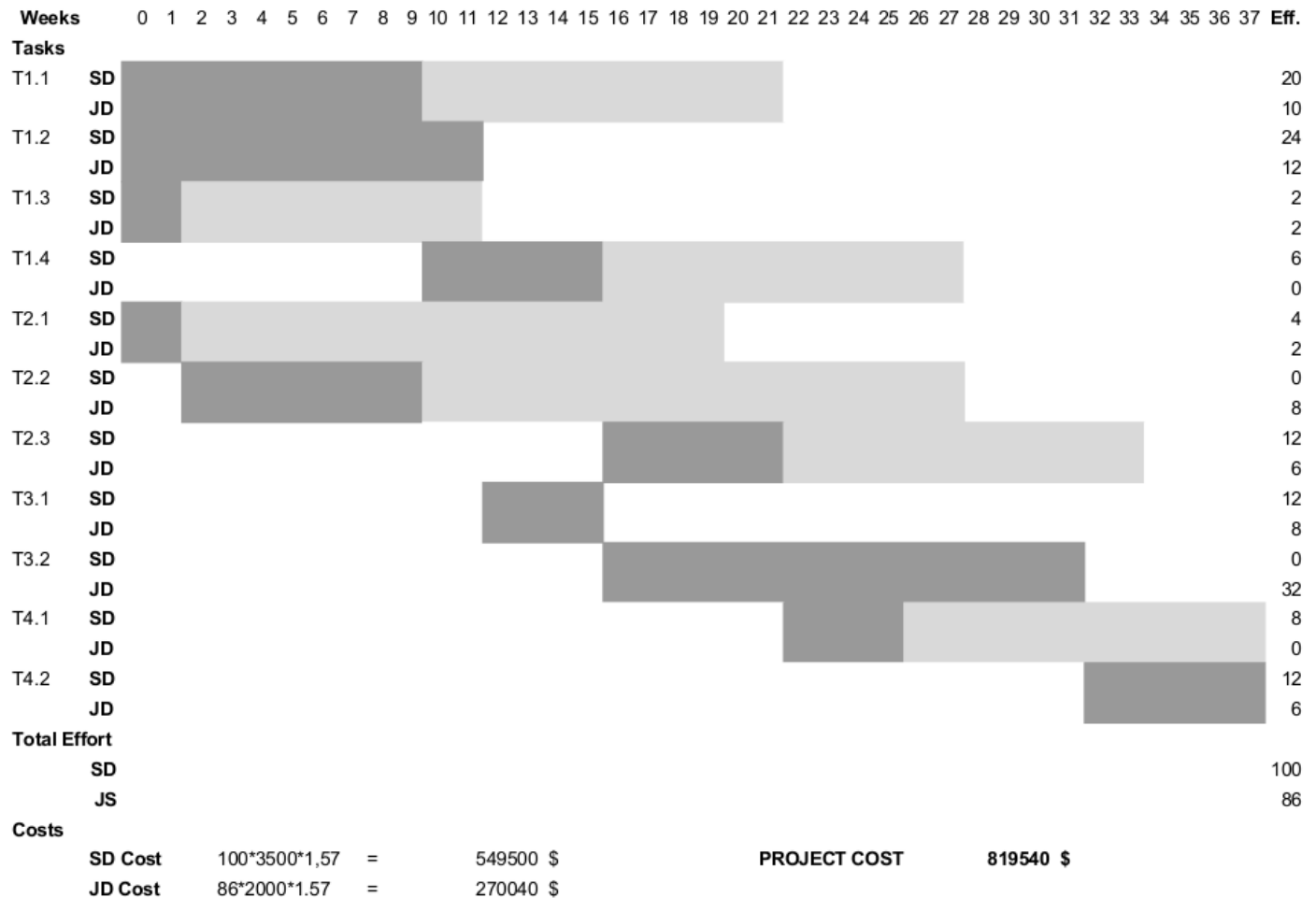


Figure 2: CPM and costs indication

