Software Project Management
(A.Y. 2018/2019)
Mock Exam Paper – 2h

January 30^{th}, 2019

Preamble

The Silly Software Company (SSC) has been asked to develop a complex software system. You, as an employee of the company, have been appointed as 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 that the **week** gross salary of the emplyees is as following specified:

- *Senior developer:/Analysts* 2000€
- *Junior developer:* 1200€

Moreover historical data show that the company generally experiments a 60% overhead

Exercise 1.

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

Activity (Precedents)	Activity Duration (weeks)				
	Optimistic (a)	Most likely (m)	Pessimistic (b)	Expected te	Standard deviation (s)
T1.1	9	9	15	10	1
T1.2	6	7	14	8	1,33
T1.3 (T1.2,T2.1)	14	16	18	16	0,66
T2.1 (T3.1,T1.2)	7	8	9	8	0,33
T2.2 (T1.1, T1.2)	5	13	15	12	1,66
T2.3 (T3.1)	8	15	16	14	1,33
T3.1	9	9	15	10	1
T3.2 (T2.1,T2.3)	8	9	16	10	1,33
T3.3 (T2.2,T3.1)	7	8	9	8	0,33
T4.1 (T3.2,T3.3)	7	7	13	8	1
T4.2 (T3.1,T3.3)	3	6	9	6	1
T4.3 (T4.1,T4.2)	9	10	11	10	0,33

Table 1: Activities time estimates (in weeks)

TO derive a first estimation you should now apply the PERT approach to:

- Compute the duration of the project
- Compute the probability of successfully terminating task T4.2 within 36 weeks
- Compute the deadline by which the probability of having finished task T4.2 is 95%
- Immagine to have just observed that tasks T1.1 and T1.2 just ended at week 11 and task T2.2 can now start. Which is now the probability to have it done by week 22?

12 points

Solution:

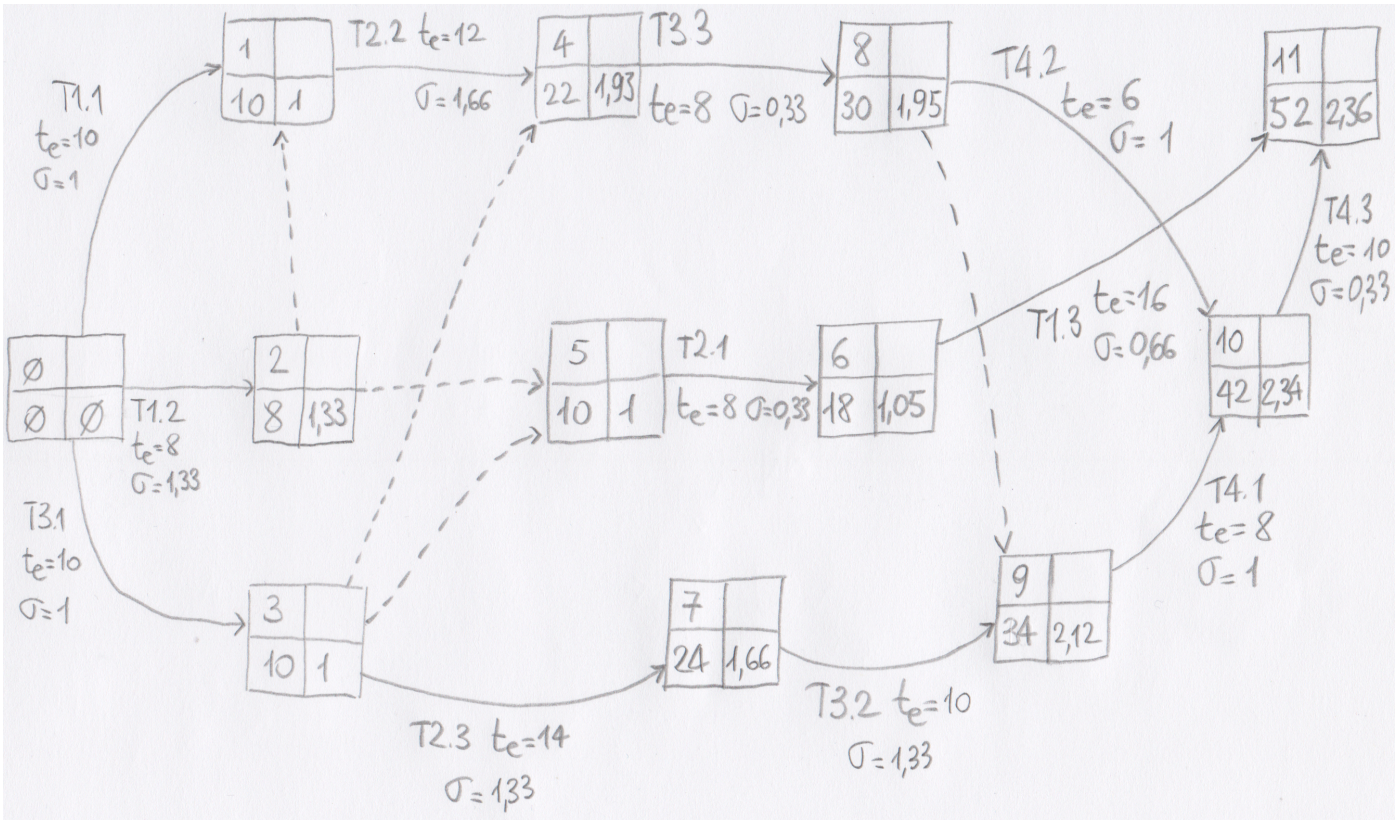

Figure 1: PERT network

- As represented in Figure 1 the expected duration of the project is 52 weeks
- Accordng to the network Task 4.2 is expected to end at weeks 36 so the probability is 0,5
- In the network the nodes 10 reports data related to the incoming path ending with T4.1 so it is necessary to recompute the data for T4.2. Applying the well know formula we get $t_e = 36$ and $\sigma = \sqrt{1,95^2 + 1^2} = 2,19$. As a result using the formula $T = Z * \sigma + t_e$ using $Z = 1,75$ we obtain the value of 40 weeks for T.
- Knowing that the task is going to start at week 11, and being the duration of the task equal to 12, to answer to the reuest we need to compute the probability of closing the task in 11 weeks. So using the usual formula to compute Z we obtain the value $-0,6$ which gives us a probability of finishing within week 22 of $\approx 0,25$

Exercise 2.

In order to derive the plan you now consider the critical chain method. For deriving the plan you consider the numbers reported in Table 2 and you consider as duration the one expressed by t_e, and the corresponding comfort zone is the one derived considering a probability of 95% with an approximation derived using ceiling to the whole week. In deriving the plan you should use the value $0,5$ to define the project buffer and $0,25$ for the feeding buffers (approximate using ceiling to the whole week).

Once you have defined the plan according to the critical chain method you now derive the expected costs on the base of the effort needed by each task in relation to Senior Developers (SD) and Junior Developers (JD) respectively (the effort should be uniformly distributed over the weeks for the whole duration of the corresponding task):

Task	**Effort**
T1.1	10 SD/10 JD
T1.2	16 SD/16 JD
T1.3	16 SD/0 JD
T2.1	0 SD/8 JD
T2.2	12 SD/6 JD
T2.3	14 SD/14 JD
T3.1	10 SD/0 JD
T3.2	0 SD/10 JD
T3.3	16 SD/8 JD
T4.1	0 SD/8 JD
T4.2	6 SD/12 JD
T4.3	40 SD/30 JD

Table 2: Activities, effort and dependencies

1. Provide the resource allocation and compute the total cost.
2. Compute the total cost, possibly suggesting modification to the plan, to respect the following constraints (if possible) (Tables **??** and **??** are provided for your convenience):
   - activities cannot be split in subactivities
   - the company does not have more than 4 Senior Developers and 3 Junior Developers, and recruitment activities should be avoided, if possible (otherwise the cost is 10000€ for each resource to be recrutied)
   - in order to simplify management activities, resources are charged to the project budget for a minimum of 3 weeks (i.e. in case a resource is assigned to a project for less then three weeks in any case the budget to be considered is the one corresponding to three weeks).

12 points

Solution:

Table 3 for each task reports the duration that results in 0,95 probability of having the task done. The formula as indicated in the previous exercise is $T = Z * \sigma + t_e$ using $Z = 1,75$. Figures 2 reports the CPM and the computed values for the project buffer and the feeding buffers. Such values are used to derive a first plan according to the critical chain method. The plan is reported in Figure 3 where the blue-shaded areas represent the feeding buffers.

1. The total cost, in case there are no additional constraint results from the total effort. In such a case it is enough to multiply the number of weeks effort for their cost and according to the two different categories. The considering that the total effort is 140 for SD and 130 for JD the total cost is:

$$(140 \times 2000€ + 130 \times 1200€) \times 1,6 = 697.600€$$

2. The contraints introduced can be solved without any increase in the cost of the project. As represented in Figure 3 the initially proposed solution includes three different violation to the constraints. In particular

   (1) – the allocation of JD for the weeks 10 and 11 exceeds the number of available JD

   (2) – the allocation of SD for the weeks 42–51 exceeds the number of available SD

   (3) – in the weeks 10 and 11 there is a peak in the allocation of JD that last less than three weeks. In such a case the cost should be increased by the amount causing the peak. In such a case 1 JD week should be added to the total cost.

Activity (Precedents)	Activity Duration (weeks)						
	Optimistic (a)	Most likely (m)	Pessimistic (b)	Expected te	Standard deviation (s)	End 95%	Comfort zones
T1.1	9	9	15	10	1	12	2
T1.2	6	7	14	8	1,33	11	3
T1.3 (T1.2,T2.1)	14	16	18	16	0,66	18	2
T2.1 (T3.1,T1.2)	7	8	9	8	0,33	9	1
T2.2 (T1.1, T1.2)	5	13	15	12	1,66	15	3
T2.3 (T3.1)	8	15	16	14	1,33	17	3
T3.1	9	9	15	10	1	12	2
T3.2 (T2.1,T2.3)	8	9	16	10	1,33	13	3
T3.3 (T2.2,T3.1)	7	8	9	8	0,33	9	1
T4.1 (T3.2,T3.3)	7	7	13	8	1	10	2
T4.2 (T3.1,T3.3)	3	6	9	6	1	8	2
T4.3 (T4.1,T4.2)	9	10	11	10	0,33	11	1

Table 3: Activities time estimates (in weeks)

In order to not incur in additional costs it is possible to anticipate of 2 weeks Task T1.2 (this will solve issues (1) and (3)), and to anticipate of 9 weeks task T1.3 (so to solve issue (2)).

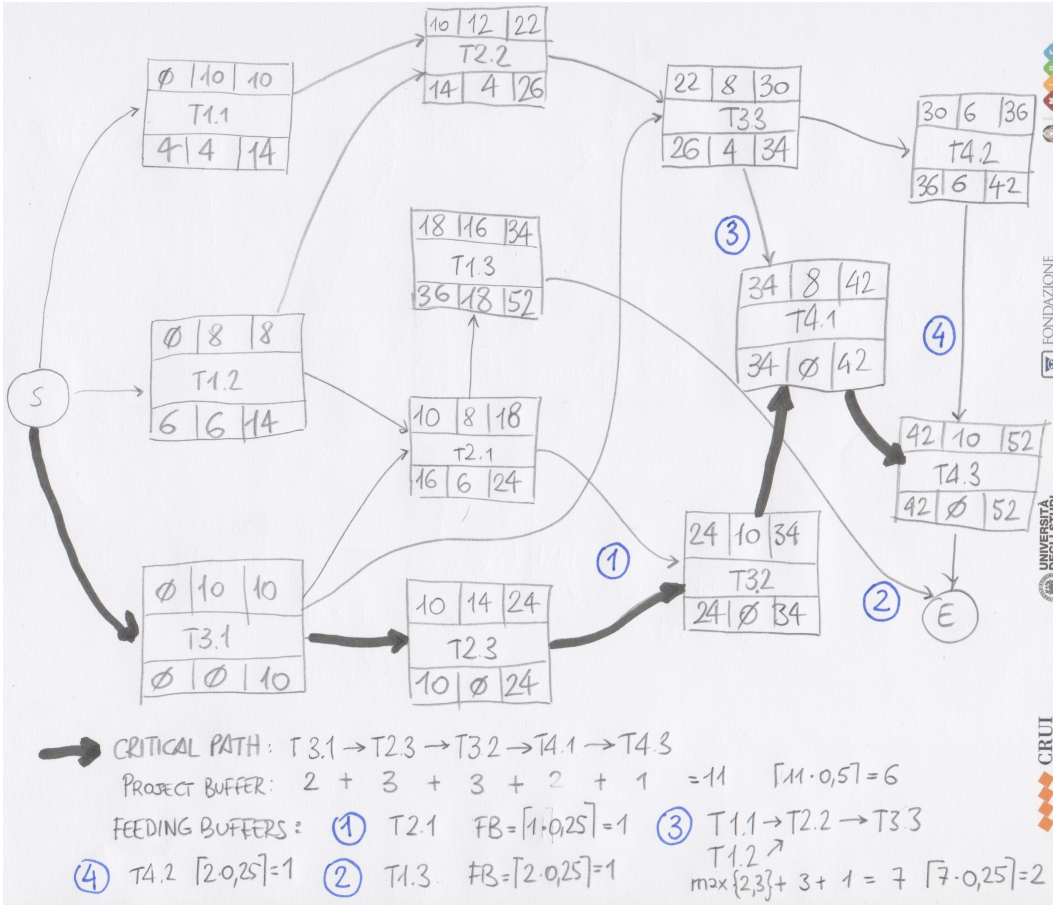

Figure 2: Task network and buffers

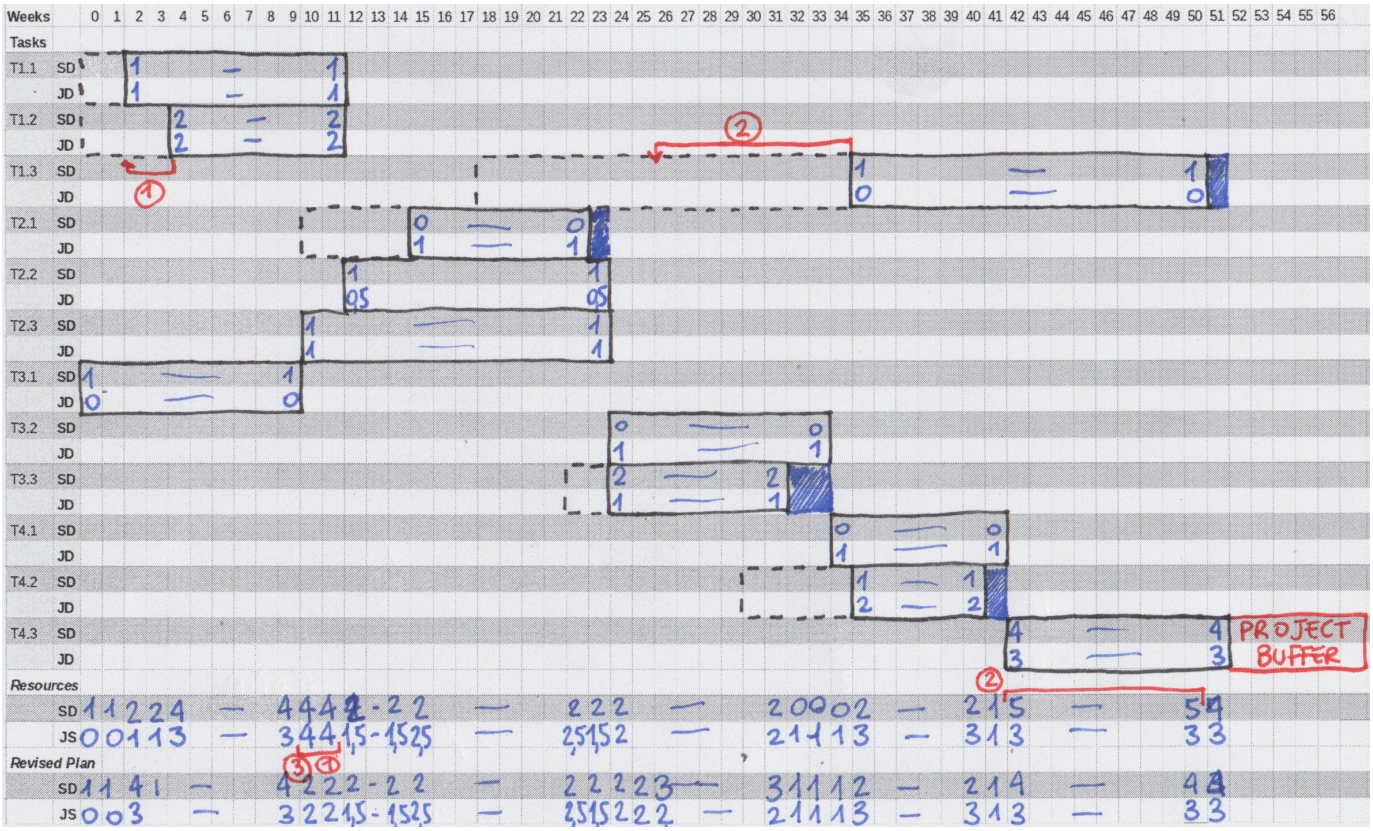

Figure 3: Task network and buffers

Question 1.

Describe the strategy based on the "probability impact matrix" in order to identify the most relevant risks worthy to be considered during risk planning activities.

Solution:

See PM textbook pages 170 and following.

Question 2.

Give a description for values, principles and practices in the context of agile methodologies. Explain then the meaning of the sentence "Better-then-not-doing-it" in relation to the adoption of agile practices. **3 points**

Solution:

See "Agile" textbook pages 26 and following.

Question 3.

Explain what the "last responsible moment" is and how it relates to planning in agile methodologies and in particular in SCRUM. **3 points**

Solution:

See "Agile" textbook pages 247 and following.

Question 4.

Describe the characteristics of COCOMOII and its underlying hypothesis **3 points**

Solution:

See PM textbook pages 120 and following.

Final note:

During the written exam you can use books, notes, and a simple calculator. It will not be possible to use electronic devices. The idea is that it is not important to memorize everything like a calculator, instead the exam aims at assessing your understanding of the topic. Consider that you will not have much time to consult notes and books. Indeed they can be useful to refine and better shape the answers, but experience tells me that if you did not study you will not be able to formulate reasonable answers and in any case you will loose too much time. In summary if you didn't study carefully, it is highly likely that you will not be able to go through the exam.