Exercises on project estimation

Situation

- We aim at estimating the resources needed for developing the following project
- S = 60,000 NCSS (medium size)
- Some requirements are rigid
- The software can be developed in any programming language
- A similar (but not the same) project has been developed
- The software will be exploited by Web interface
- The software needs a small but reliable database

Exercise 1

- Estimate the needed effort by applying the basic and the intermediate CoCoMo models
  - Cost in person-months
  - Delivery time
  - Cost in Euros

Exercise 1 – basic model

- We consider it a semi-detached project
- Cost in person-months:
- $K_m=(3.0\times S_k)^{1.12}$
- $K_m=(3.0\times 60)^{1.12}$ = 335 person-months
- Delivery time:
- $t_d=(2.5\times K_m)^{0.35}$
- $t_d=(2.5\times 335)^{0.35}$ = 10.55 months
- Cost in Euros = person-months x month-cost = 335 x 5000 = 1675 k€

Exercise 1 – intermediate model

- We consider it a semi-detached project
- Nominal cost in person-months
- $K_n = (3.0 \times S_k)^{1.12} = 335$ person-months
- Cost drivers
  - LEXP = 0.95
    - The software can be developed in **any** programming language, so the developers can choose the most known
  - AEXP = 0.91
    - A **similar** (but not the same) project has been developed
  - TIME = 1
    - It is a Web application, there are no specific runtime performance requirements
  - RELY = 1.15
    - The software needs a small but **reliable** database
  - DATA = 0.94
    - The software needs a **small** but reliable database
- Product of the cost drivers = 0.93

Exercise 1 – intermediate model (2)

- Cost in person-months:
- $K_m = K_n \times 0.93 = 312$ person-months

- Delivery time:
- $t_d=(2.5\times K_m)^{0.35}$
- $t_d=(2.5\times 312)^{0.35} = 10.28$ months

- Cost in Euros = person-months x month-cost = 312 x 5000 = 1560 k€

Exercise 2

- Starting from the previous results of needed person-months, apply the Putnam model to estimate the delivery time given an E factor of 15000
- How does the K varies if we schedule a delivery time of 0.5, 1, and 1.5 years?
- Note: Putnam model considers person-years

Exercise 2 – delivery time

- Time to delivery: $t_d = \left(\frac{S}{E\ K^{1/3}}\right)^{\frac{3}{4}}$
- Effort from CoCoMo basic model
  - K = 335 person-months = 28 person-years
  - S = 60000 NCSS
  - E = 15000
  - t_d= 1,239862089 years → 1 year and 3 months
- Effort from CoCoMo intermediate model
  - K = 312 person-months = 26 person-years
  - S = 60000 NCSS
  - E = 15000
  - t_d= 1,262813133 years → 1 year and 3 months

Exercise 2 – Cost on delivery time

- Person years invested: $K = \left(\frac{S}{E\ t_d^{4/3}}\right)^3$
- $K_d = K * 0.39$

t_d	K	K_d
0.5	1024	400
1	64	25
1.5	12	5

Exercise 3

- Given the following scheduling for the project activities in weeks, build the PERT diagram and apply the CPM to:
  - Calculate t_{min} , t_{max} for each node
  - Calculate the project duration
  - Identify the critical activities
  - Calculate the slack of each non critical activity
- What happens if the G activity is delayed of 1 week?

Exercise 3 - scheduling

- Given the following scheduling for the project activities, build the PERT diagram and apply the CPM to calculate the project duration and t_{min} , t_{max} for each node

Activity	Precedence	to	tm	tp
A		2	3	4
B		4	5	12
C	A	2	2	3
D	B,C	3	5	7
E	D	3	3	9
F	E	3	3	3
G	B,C	4	10	10
H	F,G	2	3	4

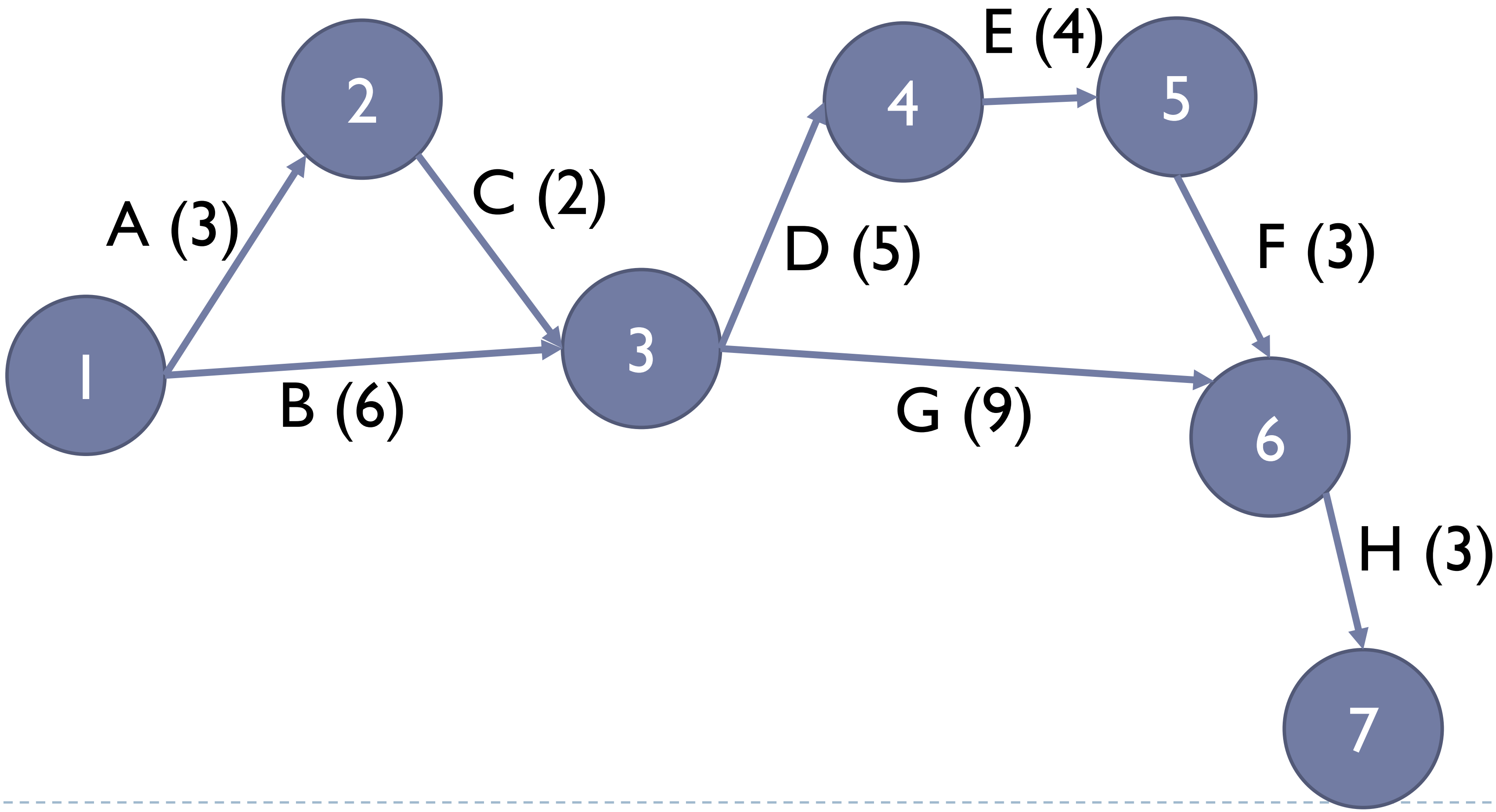
Exercise 3 – expected time

- First, we must calculate the expected times for each activity

Activity	Precedence	to	tm	tp	te
A		2	3	4	**3**
B		4	5	12	**6**
C	A	2	2	3	**2**
D	B,C	3	5	7	**5**
E	D	3	3	9	**4**
F	E	3	3	3	**3**
G	B,C	4	10	10	**9**
H	F,G	2	3	4	**3**

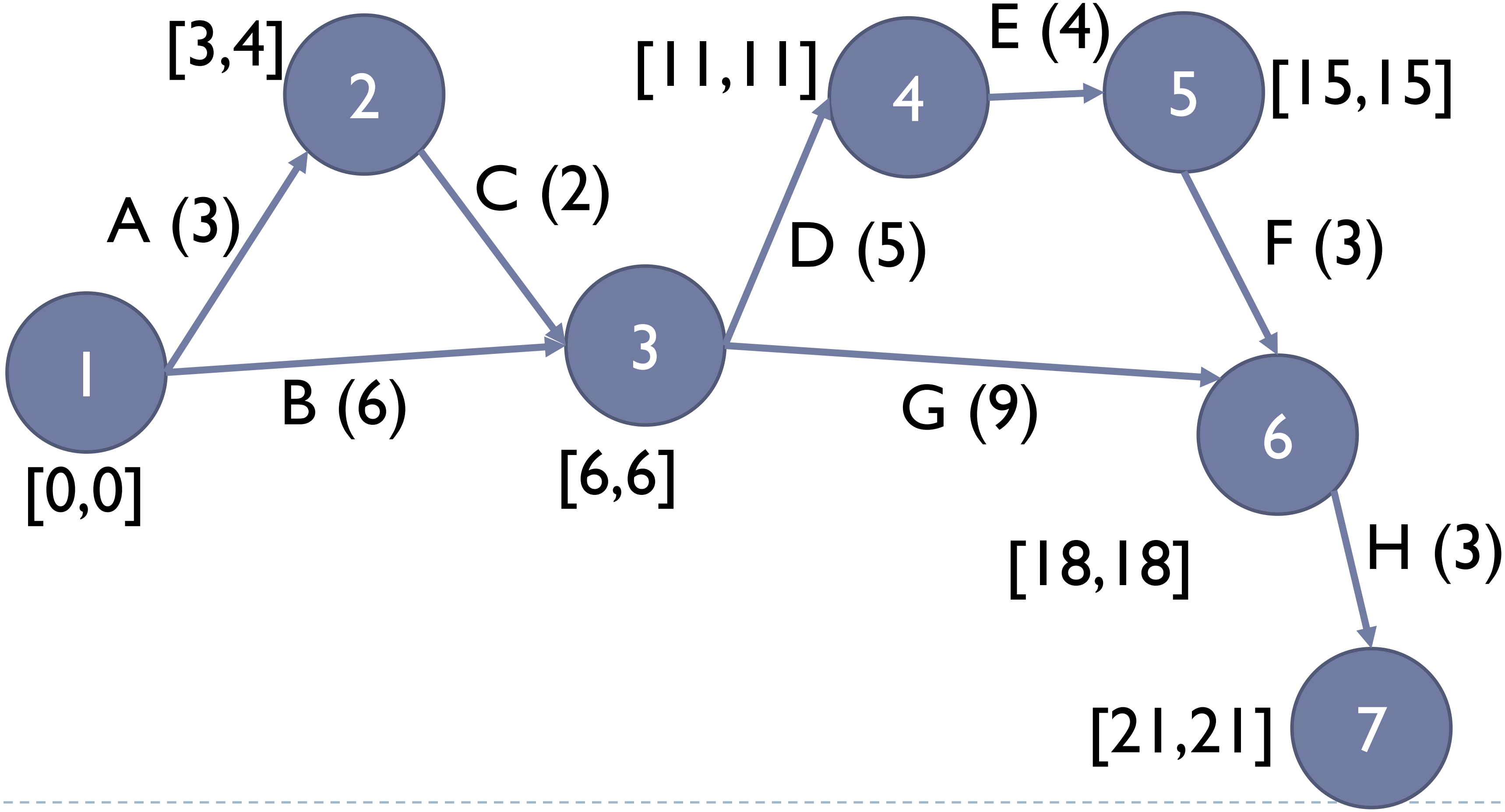
Exercise 3 – PERT diagram

- Then we must build the PERT AOA diagram



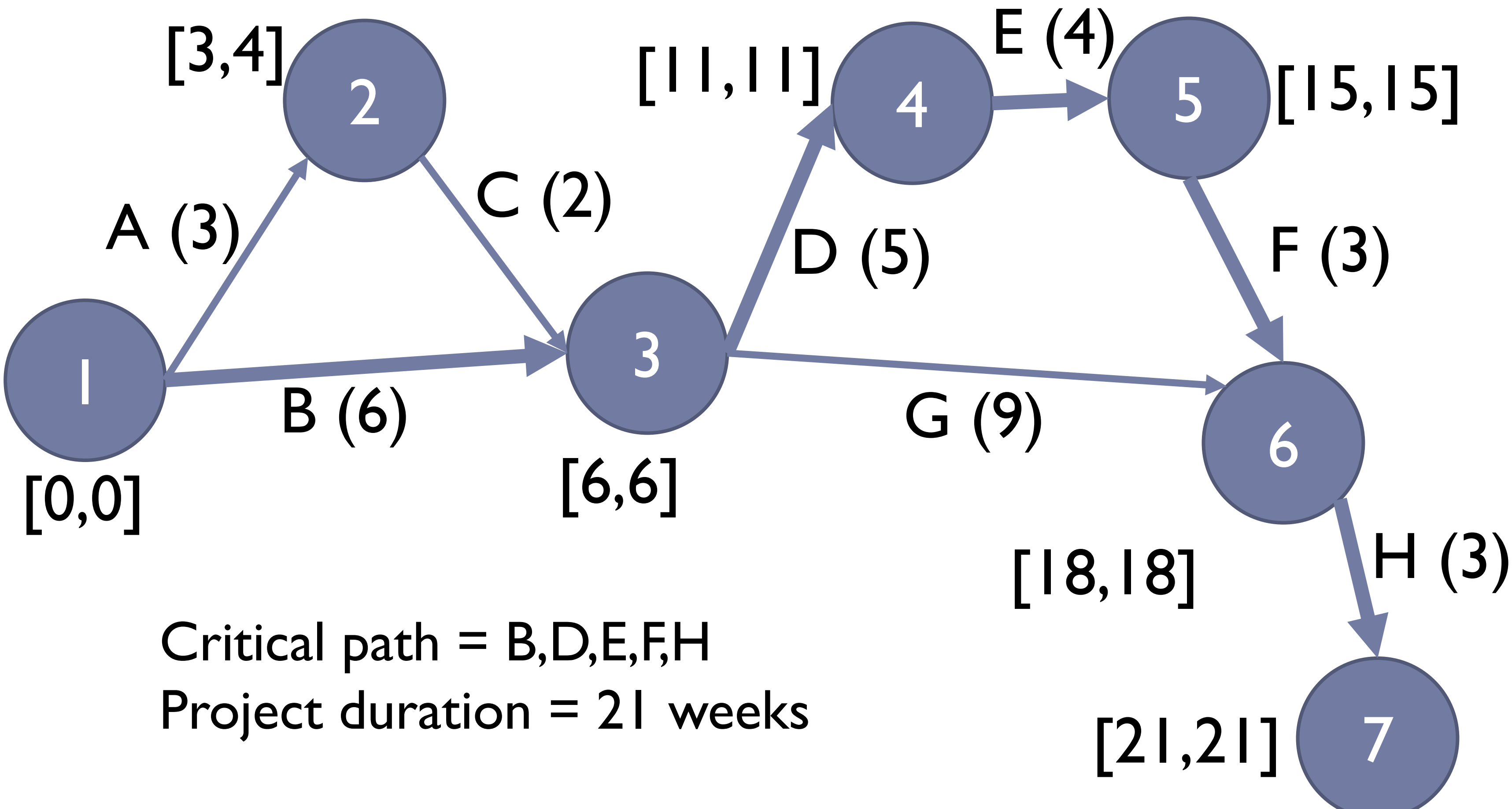
Exercise 3 – t_{min} and t_{max}

- We calculate t_{min} and t_{max} for each node



Exercise 3 – critical path

- We calculate the critical path



Critical path = B,D,E,F,H
Project duration = 21 weeks

Exercise 3 – slacks and summary

- Slacks: $t_{max\text{-}next} - (t_{min\text{-}prev} + t_{activity})$
  - A = 4 – (0 + 3) = 1 week
  - C = 6 – (3 + 2) = 1 week
  - G = 18 – (6 + 9) = 3 weeks
- If the G activity is delayed of 1 week it does not affect the total duration of the project

- Project duration = 21 weeks
- Critical activities = B,D,E,F,H

Exercise 4

- **Given the following activities, define the precedence, estimate the duration for each activity, then build the PERT diagram and apply the CPM to:**
  - Calculate t_{min} , t_{max} for each node
  - Calculate the project duration
  - Identify the critical activities
  - Calculate the slack of each non critical activity

Exercise 4 - activities

- Organize a conference with 4 speakers

A. Decide the content in collaboration with the city administration
B. Define the 4 speakers
C. Decide the date with the speakers
D. Reserve the room
E. Print the flyers
F. Order the desk and the chairs for the room
G. Distribute the flyers
H. Print the posters for the room
I. Arrange the room with desk, chairs, posters