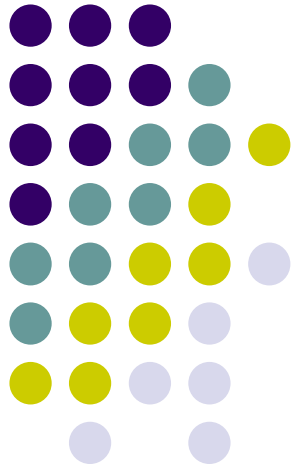
# Management of ICT Projects

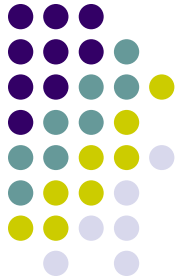
Project Crashing & Cost Management



# Time compression of a project Project Crashing

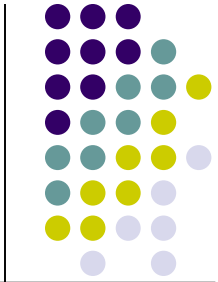
- The project manager often faces the obligation to reduce the planned completion time of a project in order to meet a deadline.
- In other words, the manager must complete the project earlier than the CMP/PERT technique has proven.
- The duration of the project can often be reduced by assigning more work to the activities of the project. For example working overtime or allocating more resources and material equipment.
- However, the allocation of additional work and resources increases the cost of the project!
  - Trade off between cost and duration

# Time compression of a project Project Crashing



- Project Crashing is a method to reduce the duration of the project by reducing the time of one (or more) critical activity of the project to less than its normal time.
- This reduction of the normal activity time is referred *crashing.*
- This is achieved by devoting more recourses to the *crashed activities*.
- How can we find the best solution (strike a balance)?

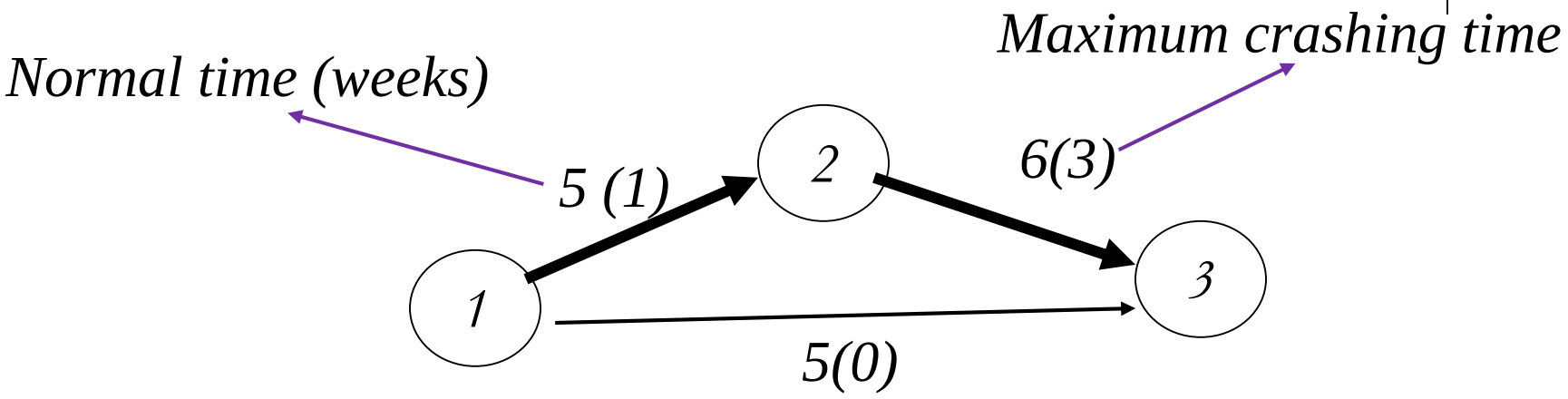
# The concept of optimal solution
## Trade-off concept



- We are trying to “crash" some "critical" activities by allocating more resources to them. So that the time of one or more vital activities is decreased and finally the time will become less than the normal time of the activity.

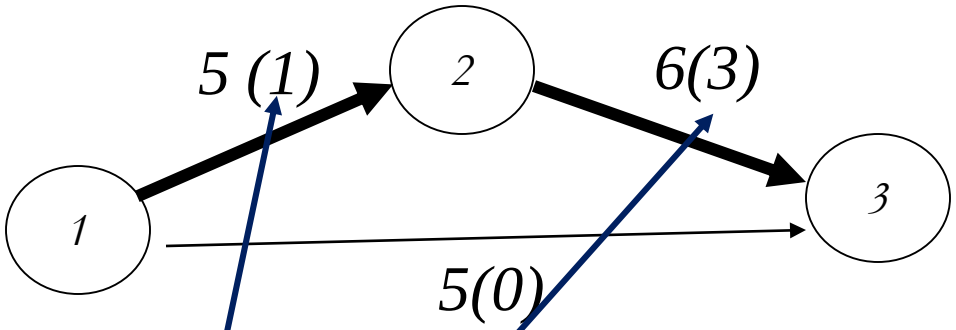
- How to do this?
- On what criteria should our decision be based on when we crash critical activities?

# Example – crashing (1)




- The critical path is 1-2-3 and the completion time is 11
- Why?
  - The path: 1-2-3 = 5+6 = 11 weeks.
  - The path: 1-3 = 5 weeks.
- How many days can we reduce (crash) the completion time of the project?

# Example – crashing (1)



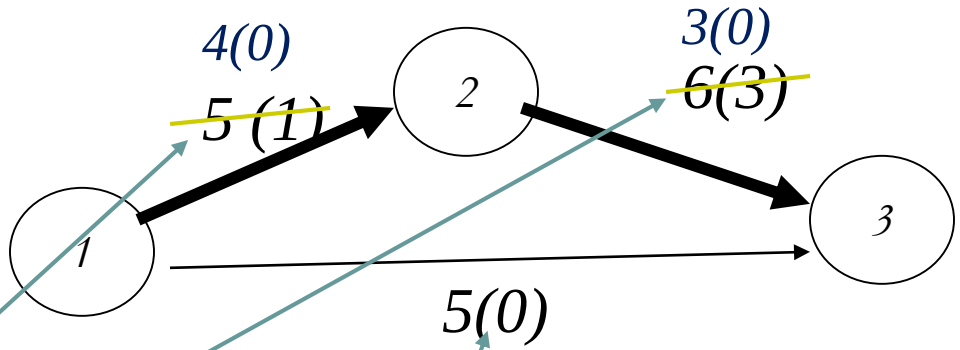

*The maximum time that it can be reduced :*

*path 1-2-3 = 1 + 3 = 4*

*path 1-3 = 0*

***Should we use these 4 weeks?***

# Example – crashing (1)




*If we use 4 weeks reduction then, the path 1-2-3 has:*

*(5-1) + (6-3) = 7 weeks completion time*

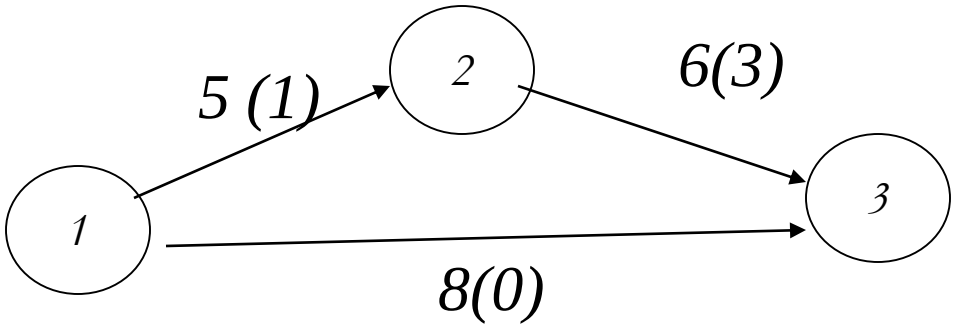
*Now, we need to calculate if the completion time for path 1-3 requires less than 7 weeks to be completed (why?)*

*Now, path 1-3 has (5-0) = 5 weeks.*

*As path 1-3 will still take less than 7 weeks to be completed, we can use all four weeks. (Crashed time)*

***Question: What would it happen if 1-3 requires 8 weeks completion time?***

# Example – crashing (1)

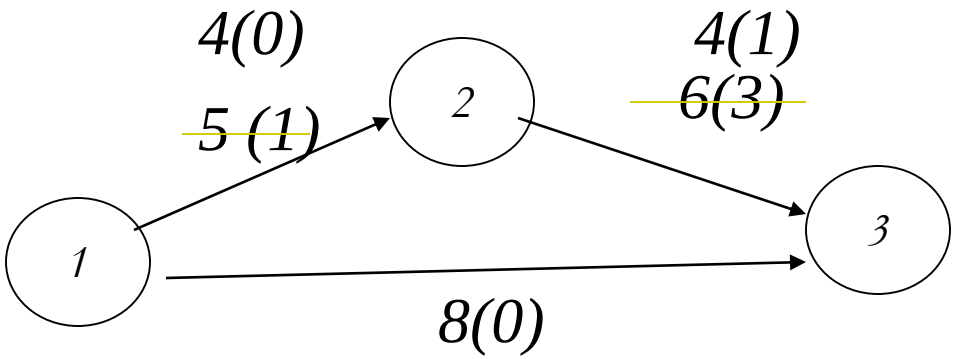



We can not use all the time of the 4 weeks as the path 1-2-3 will not be the critical path any longer since path 1-3 will be longer

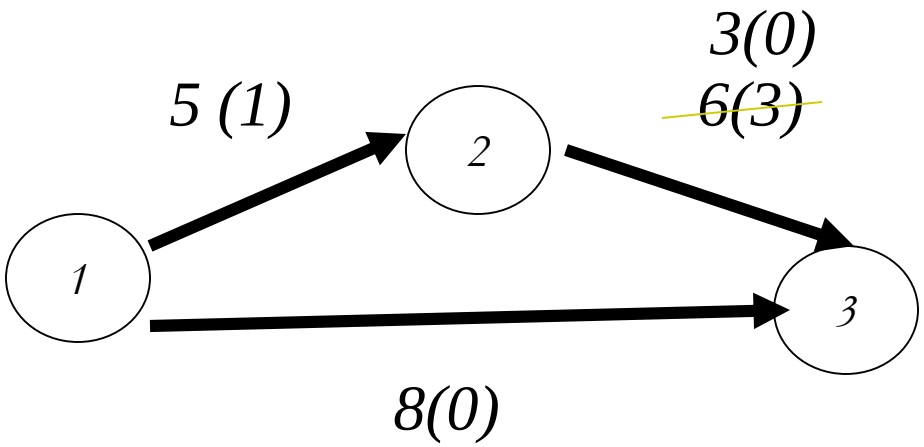
***So we can reduce the completion time of the path 1-2-3 so that this time is equal to the completion time of path 1-3.***

# Example – crashing (1)

*Solution:*

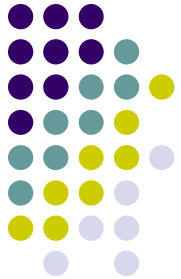



*or*




***Now, the 1-2-3 and 1-3 paths are both critical paths***

# Time/Duration Management

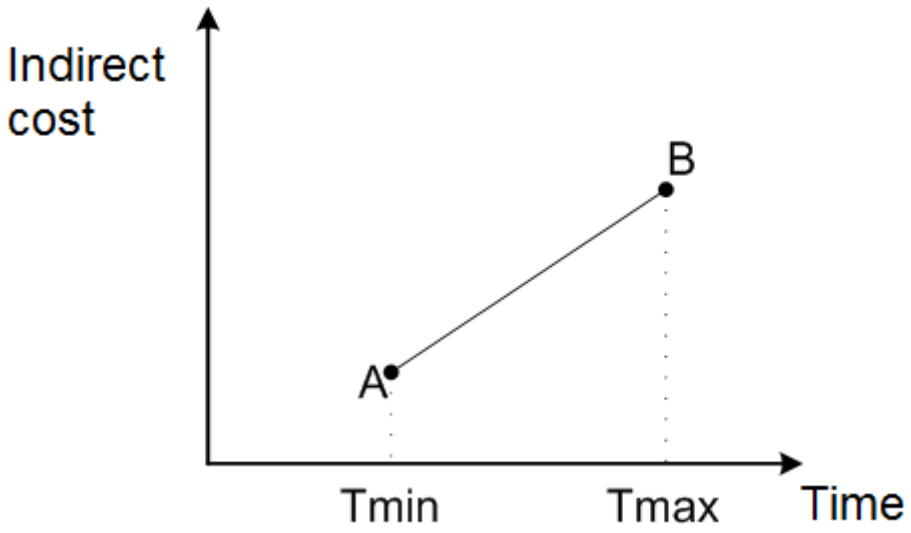


- Project cost estimation
  - Direct costs: e.g. salaries, machine costs, raw material costs etc.
  - Indirect costs: e.g. general operating expenses for project management, insurance premiums, guarantees, taxes, interest on loans, etc.

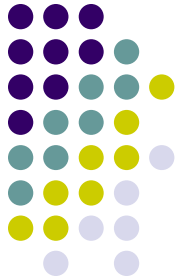
# Time-Indirect cost relation

The indirect cost has a linear relation with time and increases with the duration of the project.

*In order to calculate the indirect cost for each activity of the project, we firstly calculate the Total Indirect Cost of the project and we allocate it to every activity.*

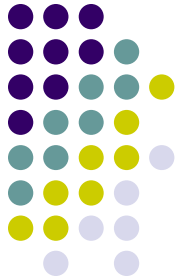


# Direct cost



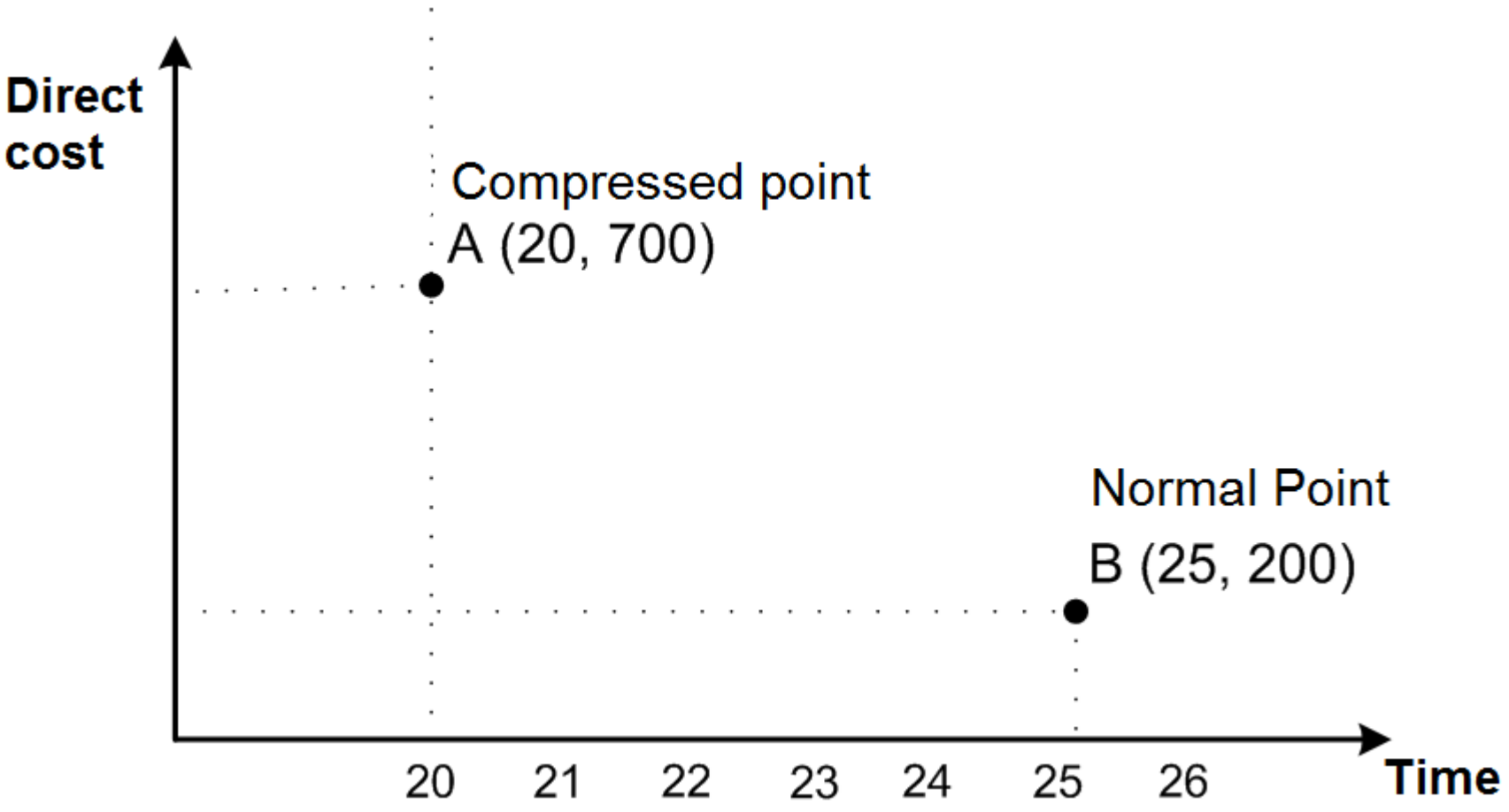
- Calculate the direct cost for each activity.
- The Total Direct Cost is the sum of the direct costs of all activities.

# Time-Direct cost relation

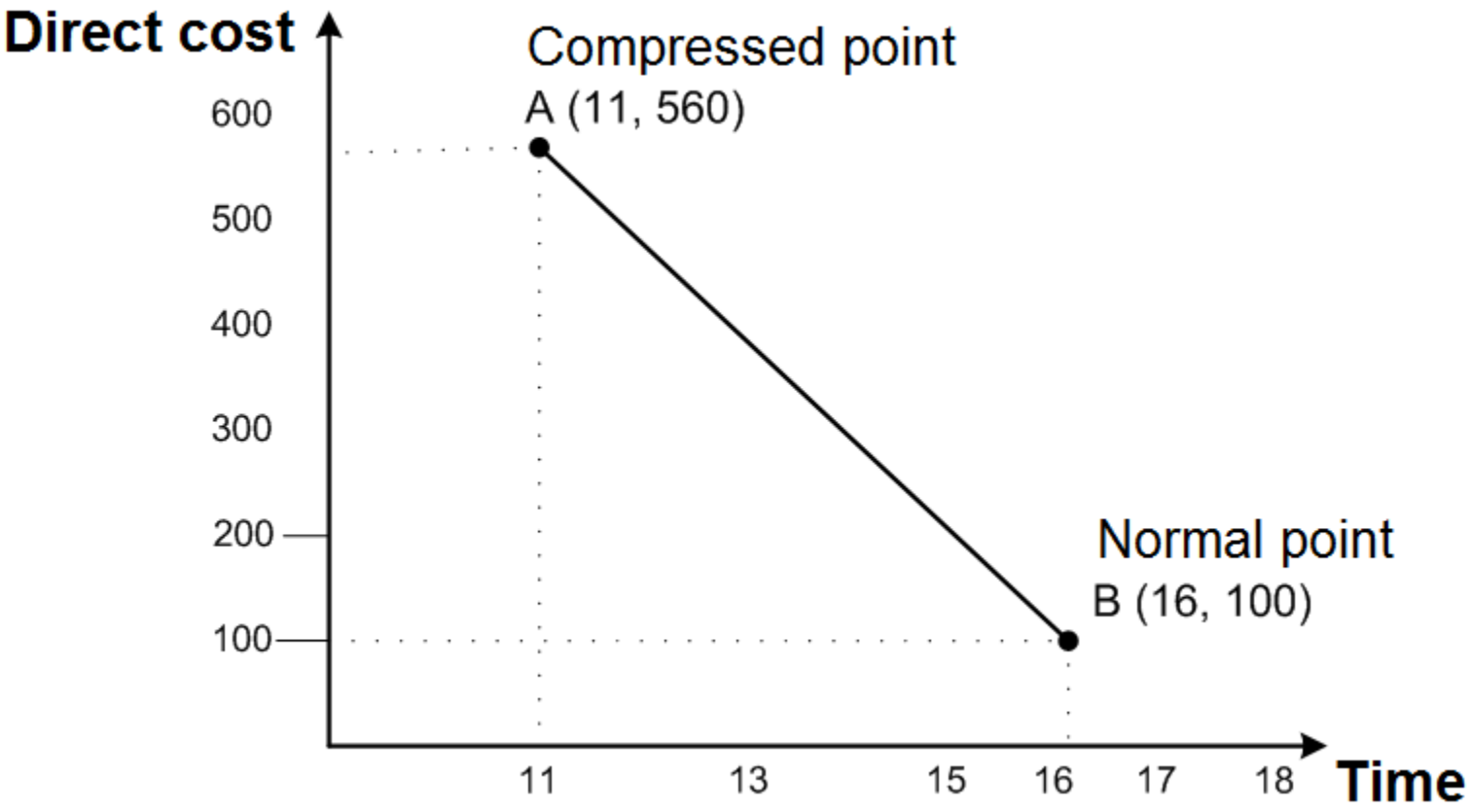


- Critical relation in order to decide the optimum completion time of the project, aiming to minimize the required cost.
- For the ICT Projects the direct cost of an activity is a decreasing function of time as in order to decrease the duration of an activity additional resources are required e.g. overtime, personnel recruitment etc.

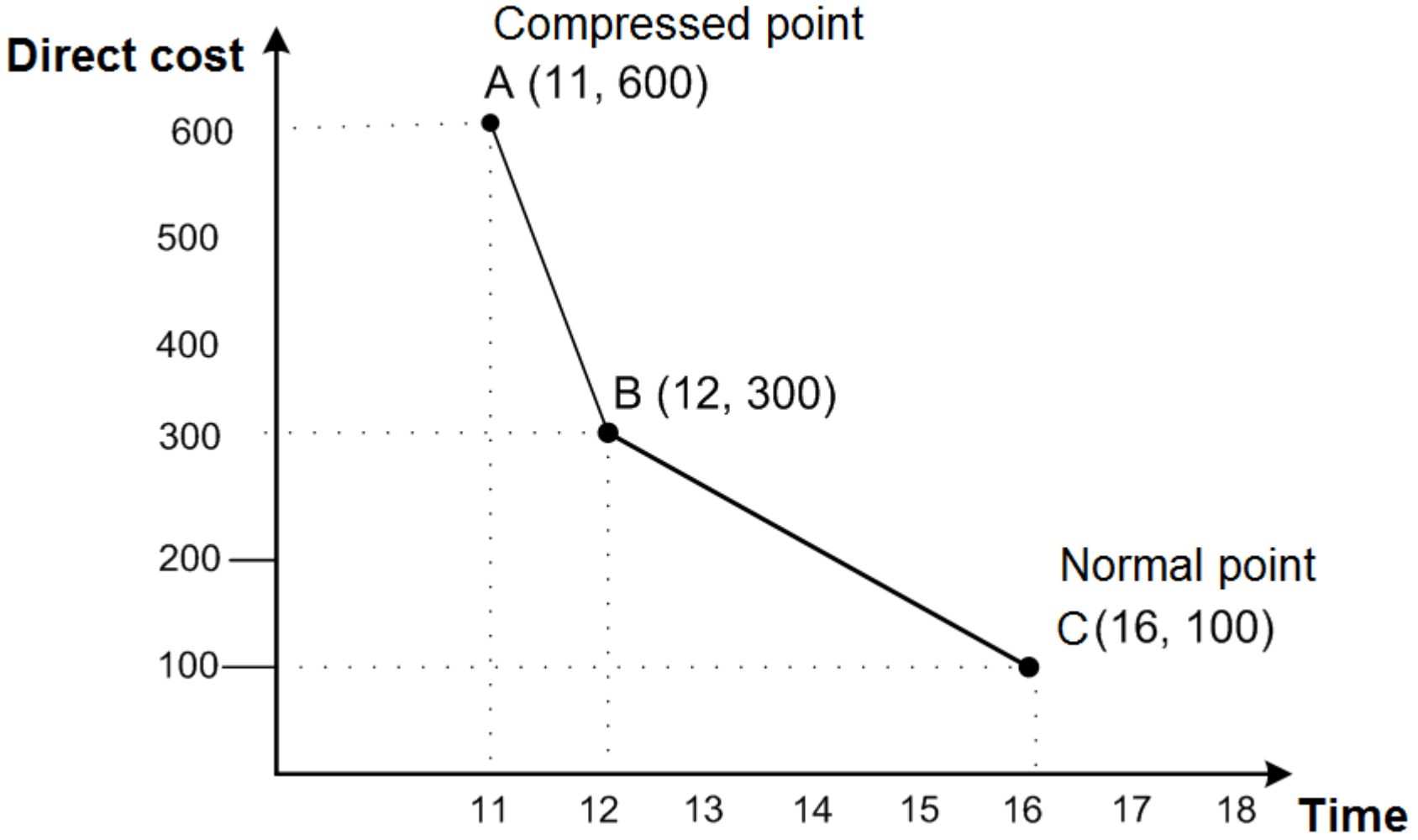
# Discrete relation between time – direct cost



# Linear relation between time – direct cost



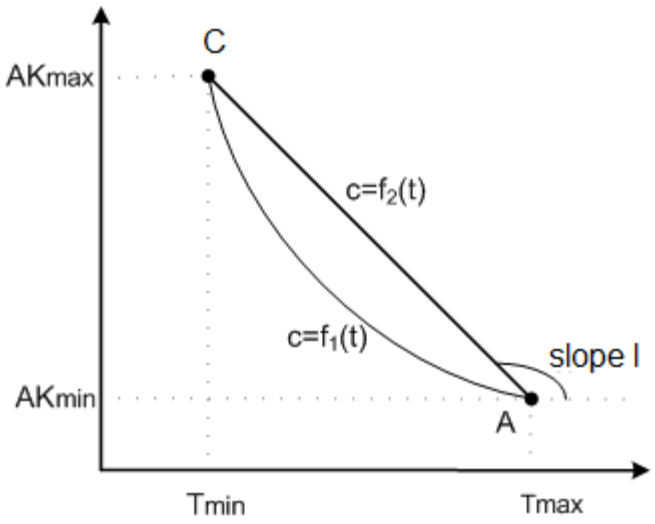
# Multi-linear relation between time – direct cost in different time frames



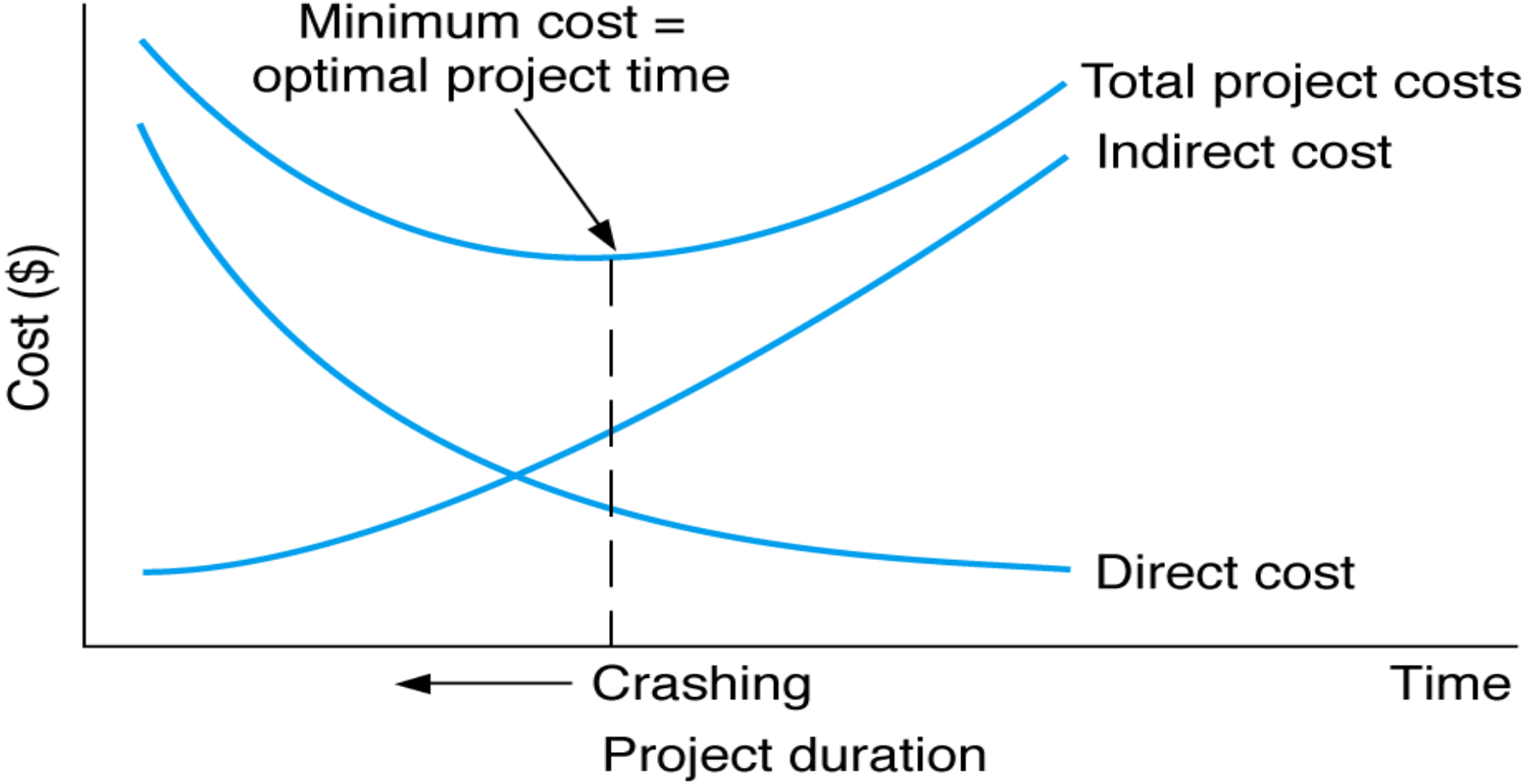
# Time-direct cost relation

- The exact form of the function **c=f(t)** is hard to determine.
  - Practically we regard the relation between time-direct cost as linear (AC segment).
  - The slope l of the AC segment gives the additional direct cost for the activity per time unit.

$$\text{slope} = \frac{AK_{max} - AK_{min}}{T_{max} - T_{min}}$$



# Optimizing the time-cost function

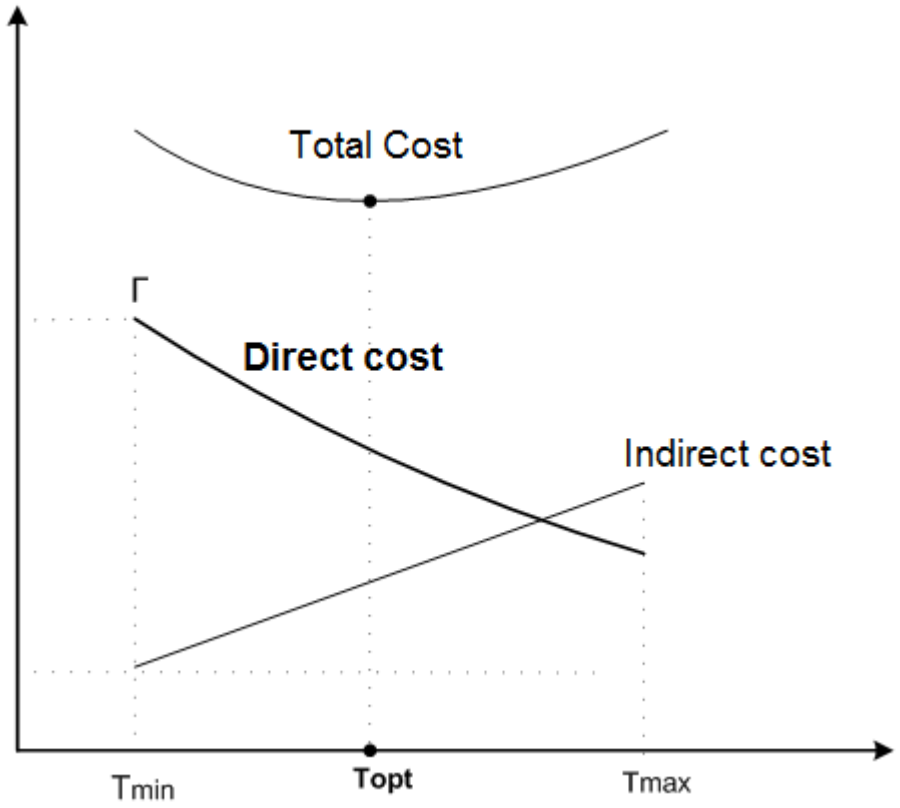



*Time-cost function (Trade-Off )*

# Determining the optimal project duration

*Which is the optimal duration of the project that corresponds to the minimum total cost?*

1. Construct the direct cost diagram and the corresponding indirect cost diagram.
2. The optimal duration is the lower point at the total cost diagram.



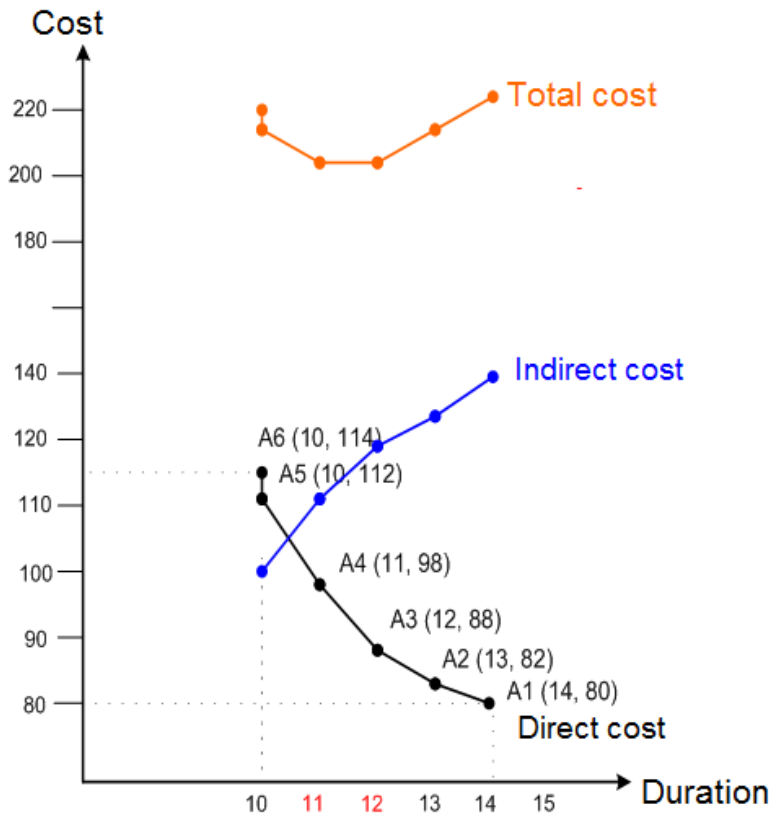
# Exercise

- The development of an app requires 5 activities that have normal and compressed durations and costs. The implementation of the project is delayed. The Project Manager defined the following possible compressions scenarios (in each scenario one or more activities are compressed). The indirect cost is 10.000 € per day.
- Q1: Draw the direct, indirect and total cost diagram for the project.
- Q2: Which is the optimal duration of the project?

| Compression scenario | Duration (in days) | Direct cost (in thous.) |
|---|---|---|
| $A_1$ | 14 | 80 |
| $A_2$ | 13 | 82 |
| $A_3$ | 12 | 88 |
| $A_4$ | **11** | 98 |
| $A_5$ | 10 | 112 |
| $A_6$ | 10 | 114 |

# Solution

| Point | Duration (in days) | Direct cost (in thous.) | Indirect cost (in thous.) | Total cost(in thous.) |
|---|---|---|---|---|
| $A_1$ | 14 | 80 | 140 | 220 |
| $A_2$ | 13 | 82 | 130 | 212 |
| $A_3$ | 12 | 88 | 120 | 208 |
| $A_4$ | **11** | 98 | 110 | 208 |
| $A_5$ | 10 | 112 | 100 | 212 |
| $A_6$ | 10 | 114 | 100 | 214 |




*Optimal Project Duration: 11 days*

# Q & A