Topic 7

Managing the Software Process

Part 2 - Cost Estimation and Risk Management

Cost estimation

To estimate how much software-engineering time will be required to do some work.

- Elapsed time
  - The difference in time from the start date to the end date of a task or project.
- Development effort
  - The amount of labour used in person-months or person-days.
  - To convert an estimate of development effort to an amount of money:

    You multiply it by the weighted average cost (burdened cost) of employing a software engineer for a month (or a day).

Cost Estimation

1. Divide and conquer.
2. Include all activities when making estimates.
3. Base your estimates on past experience combined with knowledge of the current project.
4. Be sure to account for differences when extrapolating from other projects.
5. Anticipate the worst case and plan for contingencies.
6. Combine multiple independent estimates.
7. Revise and refine estimates as work progresses

Algorithmic models

Allow you to systematically estimate development effort.

- Based on an estimate of some other factor that you can measure, or that is easier to estimate:
  - The number of use cases/user stories
  - The number of distinct requirements
  - The number of classes in the domain model
  - The number of widgets in the prototype user interface
  - An estimate of the number of lines of code

Algorithmic models

- A typical algorithmic model uses a formula like the following:
  - Constructive Cost Model (COCOMO):

$$E = a + bN^c$$

  - Functions Points:

$$S = W_1F_1 + W_2F_2 + W_3F_3 + \ldots$$

Project Scheduling vs Tracking

- Scheduling
  - the process of deciding:
    - In what sequence a set of activities will be performed.
    - When they should start and be completed.
- Tracking
  - is the process of determining how well you are sticking to the cost estimate and schedule.

Project Management Terminology

- Task/Activity:
  - something we have to do during the project; e.g.
    - Defining user requirements
    - Coding a module
    - Doing system testing

Project Management Terminology

- Duration
  - Each task or activity has a duration
  - Measured in days, weeks, person-days, person-weeks, …
  - Eg. Person-day = number of people * number of days
    - Example: 12 person days for writing all code could mean 1 person 12 days or 4 people 3 days
    - Note: not always true that a task that takes 1 programmer 12 days would take 12 programmers 1 day

Project Management Terminology

- Deliverable
  - some concrete thing which is to be delivered, to the client or internally to the development team; e.g.
    - Specifications reports
    - Executable program
    - Source code

Project Management Terminology

- Dependency
  - For a given task, may be impossible to start it without some other task(s) having been completed
    - Cannot start coding without completing design
    - Cannot start system testing without completing code integration and test plan

Project Management Terminology

- Milestone
  - some achievement which must be made during the project; e.g.
    - Delivering some deliverable
    - Completing some task
  - Note, delivering a deliverable may be a milestone, but not all milestones are associated with deliverables

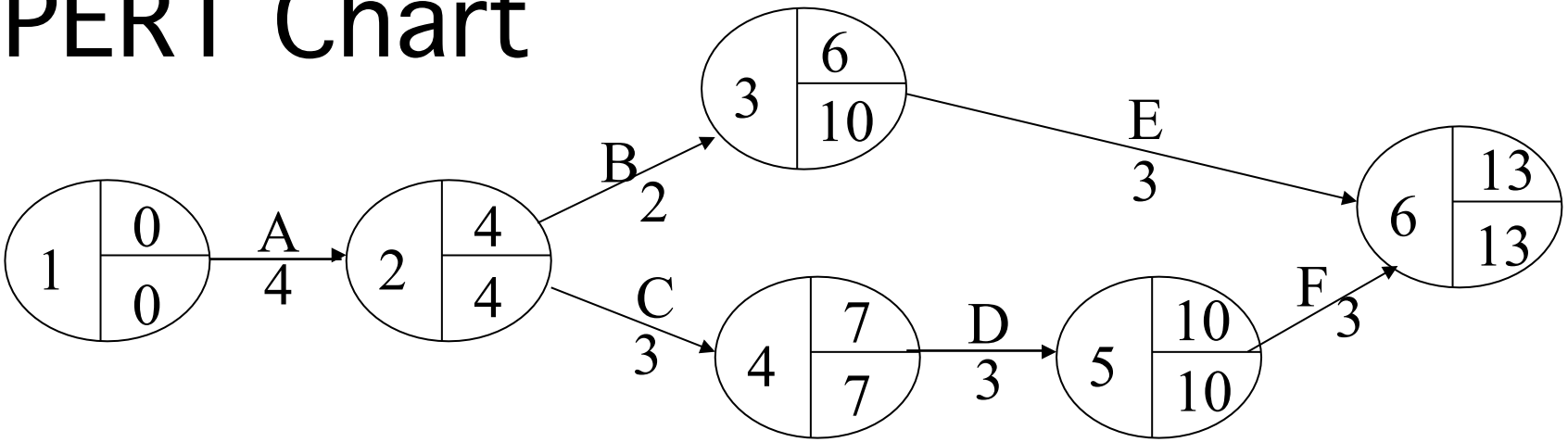
Setting and Making Deadlines

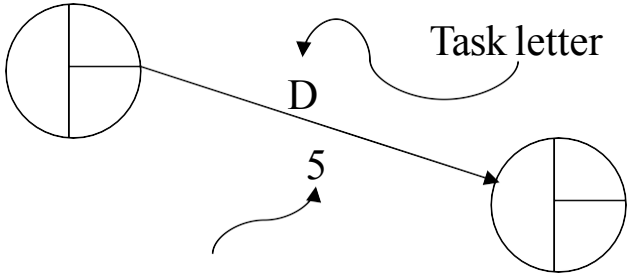
- Deadline
  - time by which milestone has to be met
  - Some deadlines are set by the client
  - Others are set by us on project to make sure project stays on track
- To set a deadline for task T, consider
  - Time to complete the tasks that T depends on
  - Time to complete T itself

Setting and Meeting Deadlines

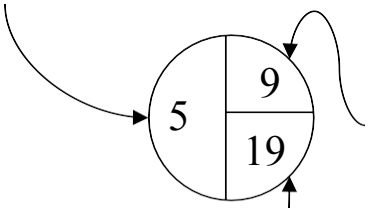
- If we miss a deadline, we say (euphemistically) “the deadline has slipped”
  - This is virtually inevitable

PERT Chart





Event Number:
Sequence number assigned



Earliest Completion Time (ECT):

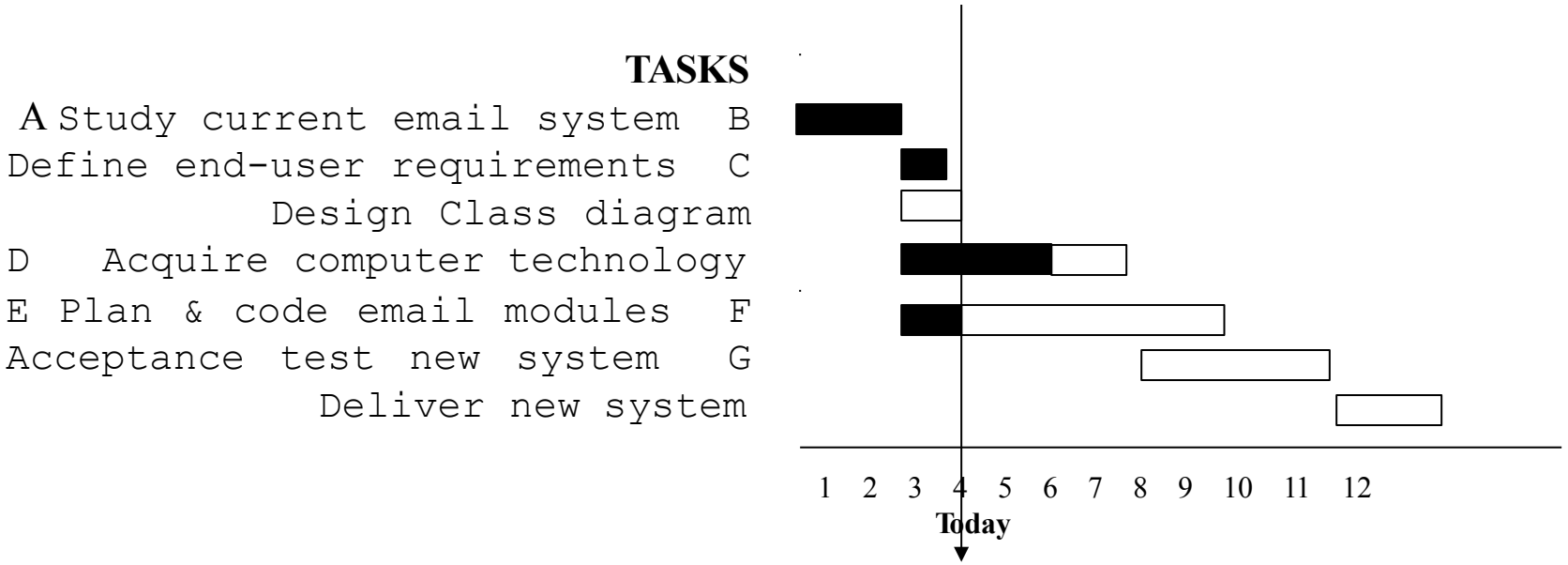
Earliest time this event can be achieved, given durations and dependencies

Latest Completion Time (LCT)

Latest time this event could be safely achieved

**Not tested on Final*

Gantt Chart



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Challenges in Project Management

Accurately estimating costs is a constant challenge

- Follow the cost estimation guidelines.

It is very difficult to measure progress and meet deadlines

- Improve your cost estimation skills so as to account for the kinds of problems that may occur.
- Develop a closer relationship with other members of the team.
- Be realistic in initial requirements gathering, and follow an iterative approach.

Challenges in Project Management

Tracking the project and rescheduling

- Monitor whether past deadlines have slipped
- Monitor whether future deadlines are going to slip
- Allocate or reallocate resources to help make deadlines

Challenges in Project Management

It is difficult to deal with lack of human resources or technology needed to successfully run a project

- When determining the requirements and the project plan, take into consideration the resources available.
- If you cannot find skilled people or suitable technology then you must limit the scope of your project.

Challenges in Project Management

Communicating effectively in a large project is hard

- Learn about communication, both written and oral.
- Learn how to run effective meetings.
- Review what information everybody should have, and make sure they have it.
- Make sure that project information is readily available.
- Use ‘groupware’ and collaborative technologies to help people exchange the information they need to know

Challenges in Project Management

It is hard to obtain agreement and commitment from others

- Learn negotiating and leadership skills.
- Ensure that everybody understands (get buy in):
  - The position of everybody else.
  - The costs and benefits of each alternative.
  - The rationale behind any compromises.
- Ensure that everybody's proposed responsibility is clearly expressed.
- Listen to everybody's opinion, but take assertive action, when needed, to ensure progress occurs.

Risk Management

- Risk
  - a situation involving exposure to danger
  - a risk is a problem that has yet to occur
- Risk Management
  - identify, prioritize and mitigate risks
  - attempt to bound uncertainty
  - not about being negative or worrying

Main reference for this section: Waltzing with Bears, Demarco & Lister

Risk Management Activities

- Risk discovery
  - Both in initial planning and on an ongoing basis
- Exposure analysis
  - probability and potential impact (to value and cost)
- Contingency planning
  - what to do if problem occurs
- Mitigation
  - Steps to take now to make contingency possible/timely
- Ongoing monitoring
  - Are any risks starting to become actual problems

Risk Sources

- Schedule flaws/Under sizing
- Requirements inflation
- Turnover of employees
- Specification Breakdown (cancellation)
- Under performance
- New methodology/platforms
- Special skills shortage
- Resource shortage

Risk Identification

- Brainstorming strategies:
  - What is your worst nightmare for the project?
  - Pretend to use a crystal ball
  - Switch perspectives
  - What are some blame-free disasters?
  - What are some blameworthy disasters?
  - What kinds of partial failures are there?

General Risk Mitigation Strategies

- Iterative delivery
- Start early
- Backup work
- Avoid single points of failure