Managing and Tracking the Software Project

- Not every group is a team, and not every team is effective. Glenn Parker
- If you want to be incrementally better: Be competitive. If you want to be exponentially better: Be cooperative

Questions from a Customer

- Do you understand my problem and needs?
- Can you design a system to solve my problems or satisfy my needs?
- How long will it take to develop the system?
- How much will it cost to develop the system?

Project Planning Principles

- Understand the scope of the project
- Involve the customer in the planning activity
- Recognize that planning is iterative
- Estimate based on what you know
- Consider risk as you define the plan
- Be realistic
- Adjust granularity
- Define how you intend to ensure quality

Project Planning

- Before starting
  - Establish system's scope and objectives
  - Consider alternative solutions
  - Identify technical and management constraints
- As a Project Manager
  - Decompose the product function (FD)
  - Select an appropriate process model
  - Select the task set for the project
  - Decompose the tasks into smaller work items (WBS)
  - Estimate effort for each task/work item
  - Estimate completion time of the project (Task/Activity Network)

Word Processing Product

Consider a project that will build a new word-processing product:

- Among the unique features of the product are:
  - continuous voice as well as keyboard input
  - extremely sophisticated “automatic copy edit” features
  - page layout capability
  - automatic indexing and table of contents, and others.
- The project manager must first:
  - establish a statement of scope that bounds these features (as well as other more mundane functions such as editing, file management, document production, and the like).
  - For example, will continuous voice input require that the product be “trained” by the user? Specifically, what capabilities will the copy edit feature provide? Just how sophisticated will the page layout capability be? etc.

Task set example

- Communications tasks
  - Develop list of clarification issues
  - Meet with customer to address clarification issues
  - Jointly develop a statement of scope
  - Review the statement of scope with all concerned
  - Modify the statement of scope as required
- Planning/Construction
  - Understand the required technology
  - Learn the new domain/language
- Modeling
  - Develop the architecture of the system under development

Factors Affecting Choice of Task Set

- Size of project
- Number of potential users
- Mission criticality
- Application longevity
- Stability of requirements
- Ease of communication (customer/developer)
- Maturity of applicable technology
- Performance constraints
- Embedded/Non Embedded characteristics of project
- Staff…

Project Schedule

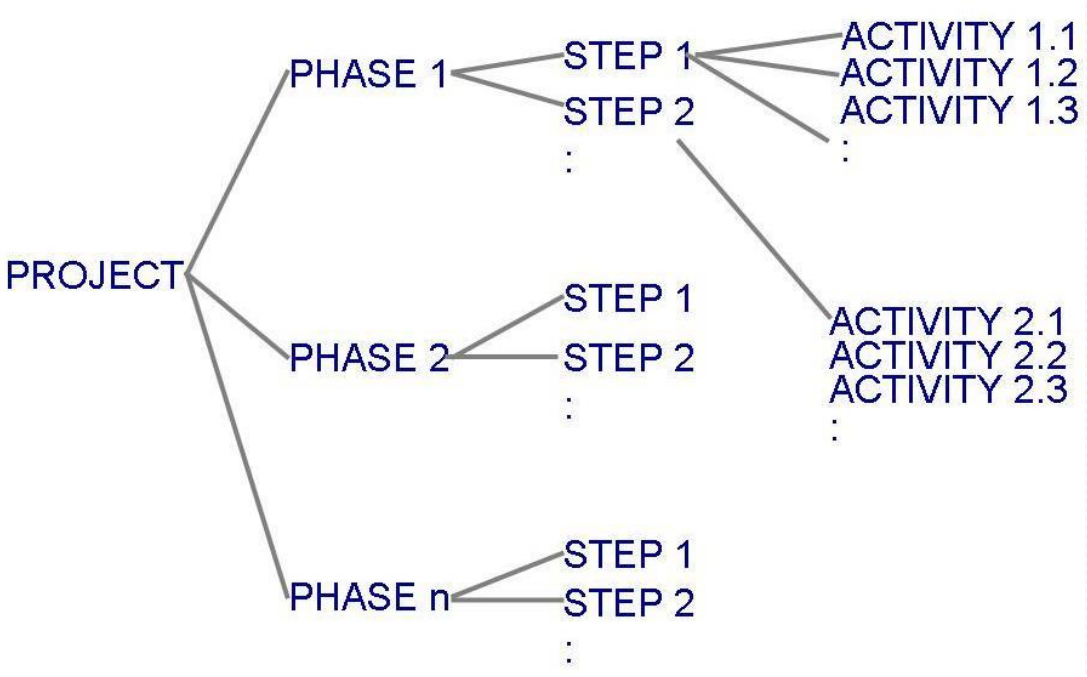
- Describes the software-development cycle for a particular project by
  - enumerating the phases or stages of the project
  - breaking each phase into discrete tasks or activities to be completed
- Portrays the interactions among the activities and estimates the times that each task or activity will take

Project Schedule (Contd.)

- **Activity**: takes place over a period of time
  - Predecessor activity
- **Milestone**: completion of an activity or a set of activities -- a particular point in time
- **Precursor**: event or set of events that must occur in order for an activity to start
- **Duration**: length of time needed to complete an activity
- **Due date**: date by which an activity must be completed

Project Schedule (Contd.)

- Project development can be separated into a succession of phases which are composed of steps, which are composed of activities (Work Breakdown Structure)



WBS Example

Phase 1: Landscaping the lot	Phase 2: Building the house
Step 1.1: Clearing and grubbing	*Step 2.1: Prepare the site*
Activity 1.1.1: Remove trees	Activity 2.1.1: Survey the land
Activity 1.1.2: Remove stumps	Activity 2.1.2: Request permits
Step 1.2: Seeding the turf	Activity 2.1.3: Excavate for the foundation
Activity 1.2.1: Aerate the soil	Activity 2.1.4: Buy materials
Activity 1.2.2: Disperse the seeds	*Step 2.2: Building the exterior*
Activity 1.2.3: Water and weed	Activity 2.2.1: Lay the foundation
Step 1.3: Planting shrubs and trees	Activity 2.2.2: Build the outside walls
Activity 1.3.1: Obtain shrubs and trees	Activity 2.2.3: Install exterior plumbing
Activity 1.3.2: Dig holes	Activity 2.2.4: Exterior electrical work
Activity 1.3.3: Plant shrubs and trees	Activity 2.2.5: Exterior siding
Activity 1.3.4: Anchor the trees and mulch around them	Activity 2.2.6: Paint the exterior
	Activity 2.2.7: Install doors and fixtures
	Activity 2.2.8: Install roof
	Step 2.3: Finishing the interior
	Activity 2.3.1: Install the interior plumbing
	Activity 2.3.2: Install interior electrical work
	Activity 2.3.3: Install wallboard
	Activity 2.3.4: Paint the interior
	Activity 2.3.5: Install floor covering
	Activity 2.3.6: Install doors and fixtures

WBS and Activity Networks

- Work breakdown structure depicts the project as a set of discrete pieces of work
- Activity networks (task network, PERT charts) depict the dependencies among activities

Activity networks can be of two types

AoA: Activity on Arc
AoN: Activity on Node

Project Types

- Concept Development
  - To explore new business concept
- New Application Development
  - As a consequence of specific customer request
- Application Enhancement
  - Modifications to existing functions, performance, interfaces of software; observable by the end user
- Application Maintenance
  - Correct, adapt, extend existing software; not immediately obvious to end user
- Reengineering Projects
  - Redevelop an existing system

Concept Development Projects

- Usually initiated to explore some new business concept or application of some new technology
- Task set might be like:
  - Scope the concept
  - Develop preliminary plan of the concept: develop the ability to undertake the work
  - Assess the technology risk
  - Develop proof of concept
  - Implement the concept
  - Get customer feedback

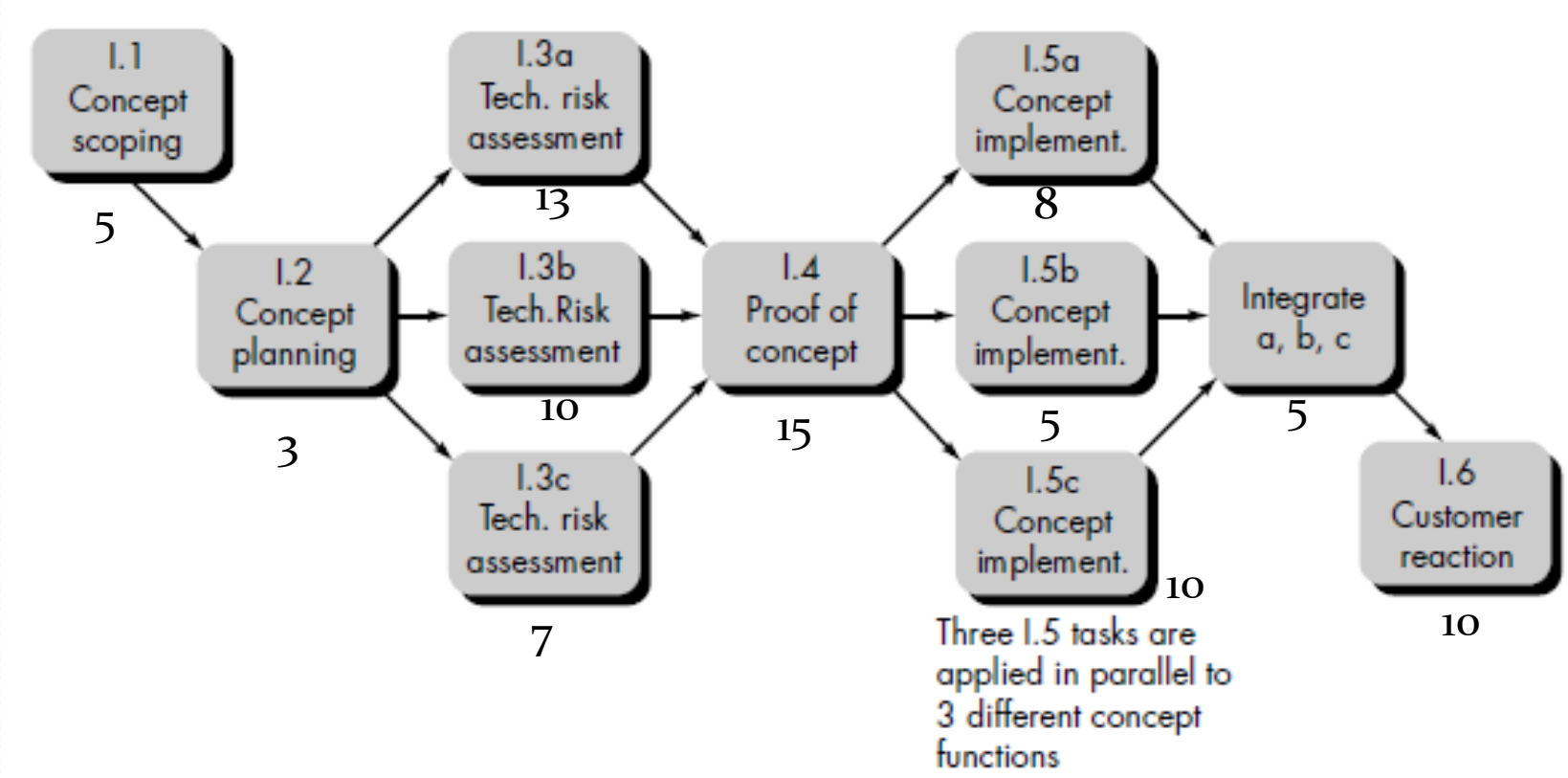
WBS for CDP

```
Task definition:  Task I.1  Concept Scoping

I.1.1        Identify need, benefits and potential customers;
I.1.2        Define desired output/control and input events that drive the application;
   Begin Task I.1.2
      I.1.2.1    FTR:  Review written description of need[9]
      I.1.2.2    Derive a list of customer visible outputs/inputs
                 case of:  mechanics
                 mechanics = quality function deployment
                          meet with customer to isolate major concept requirements;
                          interview end-users;
                          observe current approach to problem, current process;
                          review past requests and complaints;
                 mechanics = structured analysis
                          make list of major data objects;
                          define relationships between objects;
                          define object attributes;
                 mechanics = object view
                          make list of problem classes;
                          develop class hierarchy and class connections;
                          define attributes for classes;
                 endcase
      I.1.2.3    FTR:  Review outputs/inputs with customer and revise as required;
   endtask Task I.1.2

I.1.3        Define the functionality/behavior for each major function;
   Begin Task I.1.3
```

WBS for CDP (Contd.)

```
I.1.3.1   FTR: Review output and input data objects derived in task I.1.2;
I.1.3.2   Derive a model of functions/behaviors;
          case of: mechanics
          mechanics = quality function deployment
                meet with customer to review major concept requirements;
                interview end-users;
                observe current approach to problem, current process;
                develop a hierarchical outline of functions/behaviors;
          mechanics = structured analysis
                derive a context level data flow diagram;
                refine the data flow diagram to provide more detail;
                write processing narratives for functions at lowest level of refinement;
          mechanics = object view
                define operations/methods that are relevant for each class;
          endcase
I.1.3.3   FTR: Review functions/behaviors with customer and revise as required;
endtask Task I.1.3
I.1.4     Isolate those elements of the technology to be implemented in software;
I.1.5     Research availability of existing software;
I.1.6     Define technical feasibility;
I.1.7     Make quick estimate of size;
I.1.8     Create a Scope Definition;
endTask definition:  Task I.1
```

Activity Network for CDP



Activity on Node (AoN) Graph

Estimating Completion

Critical Path Method

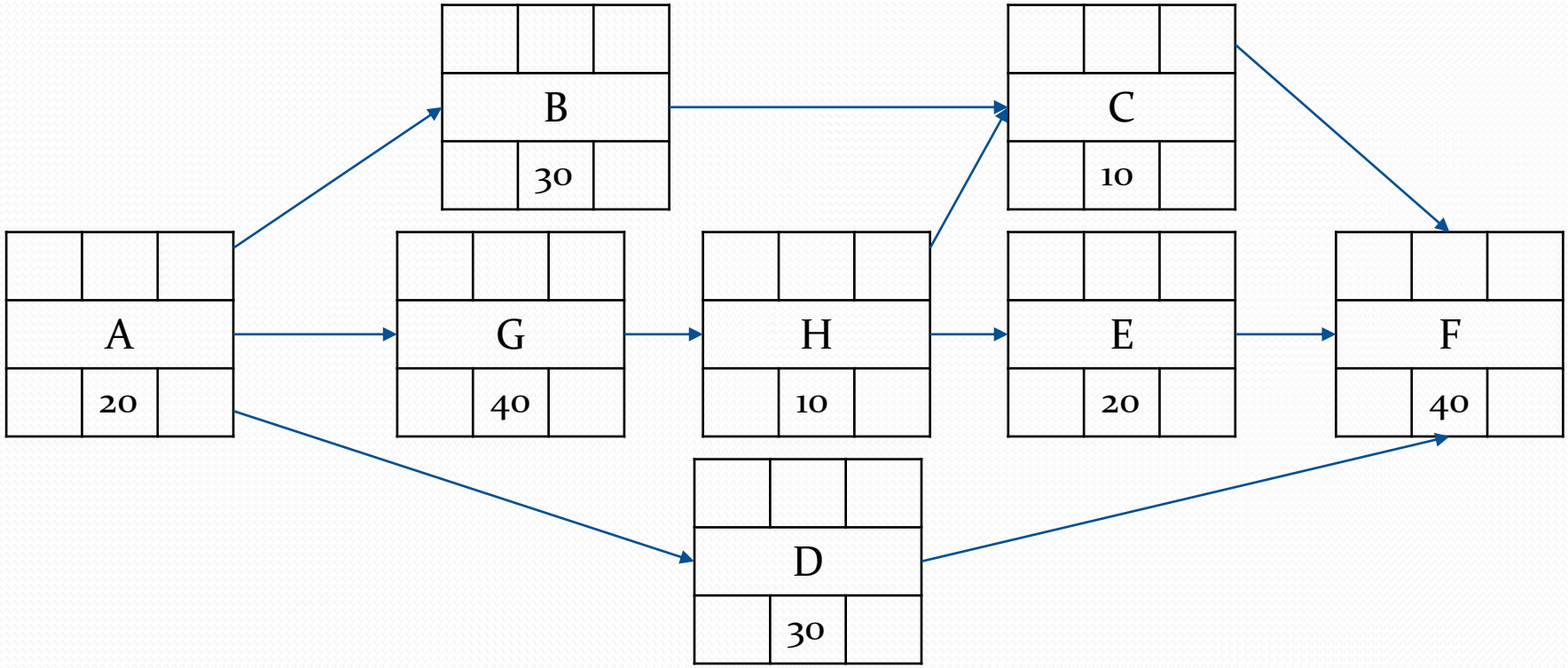
- Minimum amount of time required to complete a project
  - Reveals those activities that are most critical to completing the project on time
- **Real time (actual time):** estimated amount of time required for the activity to be completed
- **Available time:** amount of time available in the schedule for the activity's completion
- **Slack time:** the difference between the available time and the real time for that activity

Estimating Completion

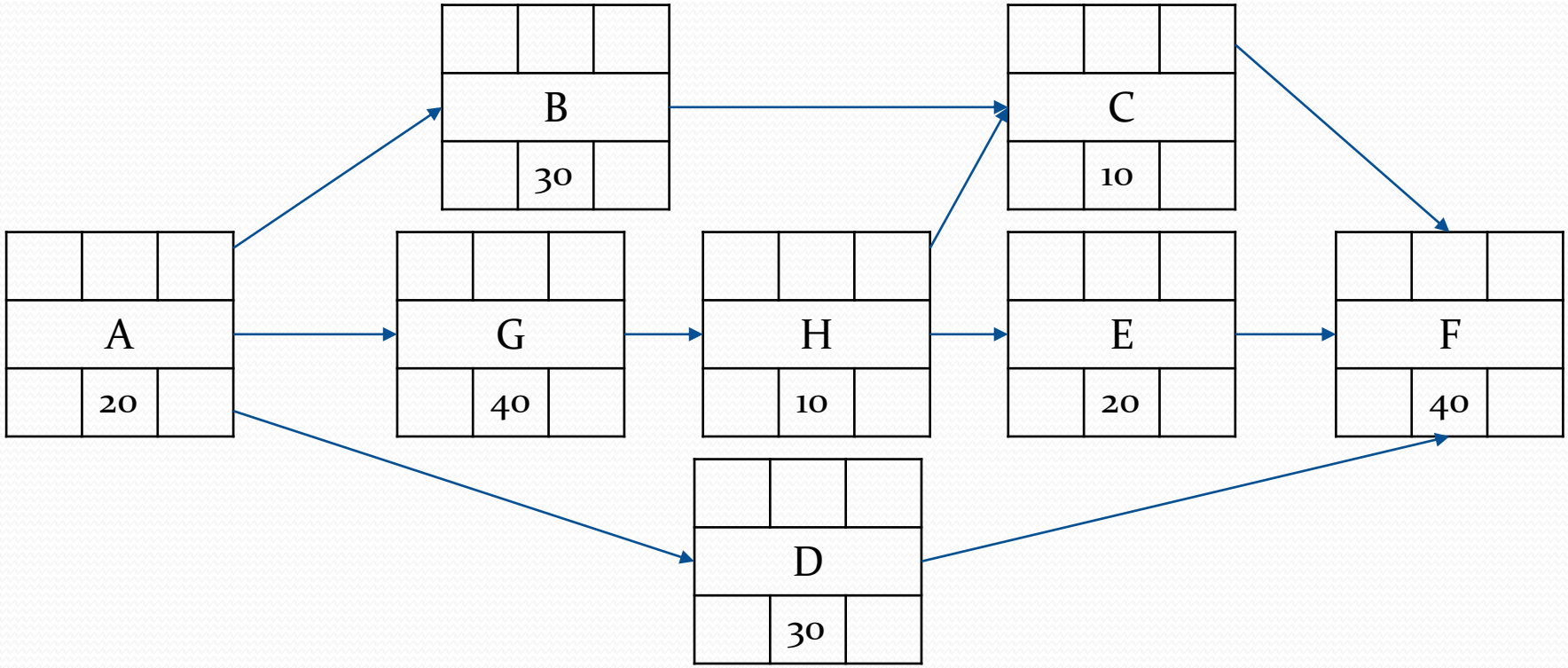
Critical Path Method

- **Critical path**: the slack at every activity is zero
  - can be more than one in a project schedule
- **Slack time** =
  - available time – real time
  - latest start time – earliest start time
- Paths????
- Longest Path???

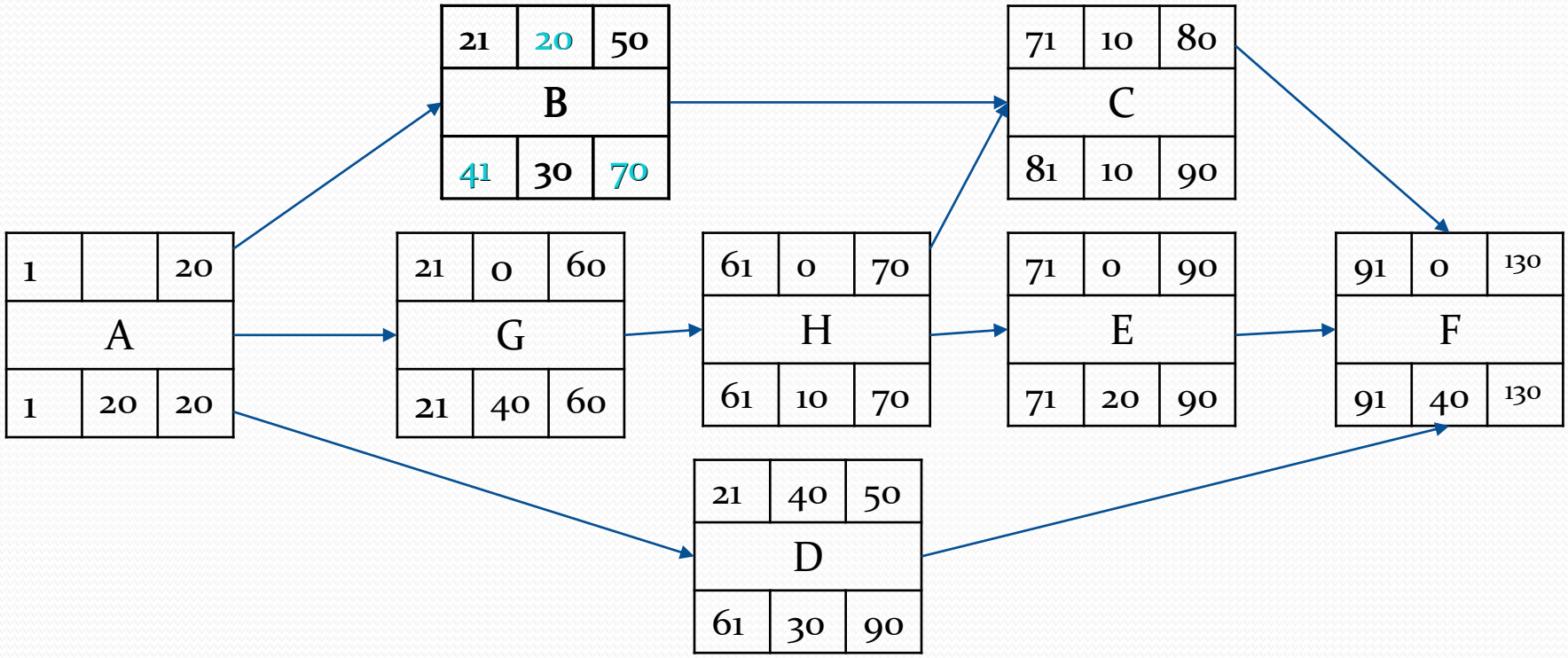
Exercise



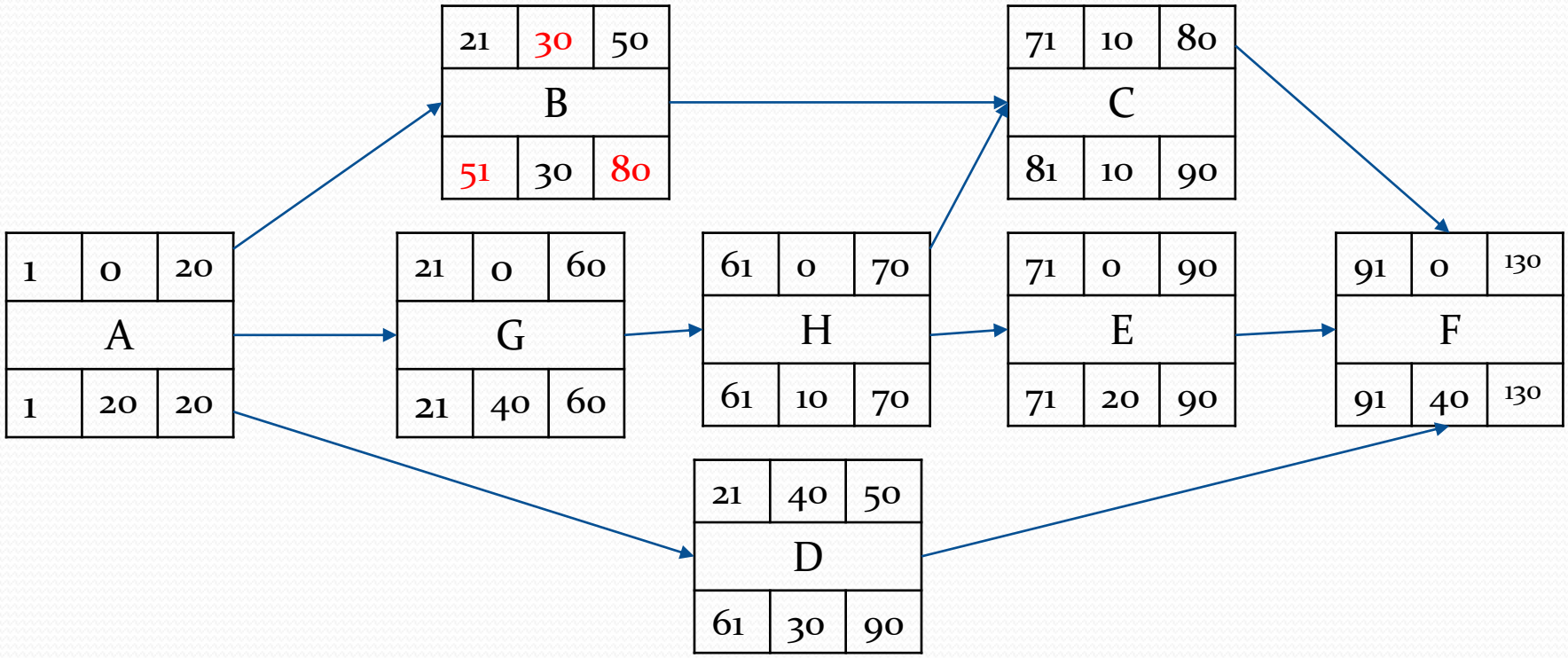
Exercise



Exercise (Contd.)



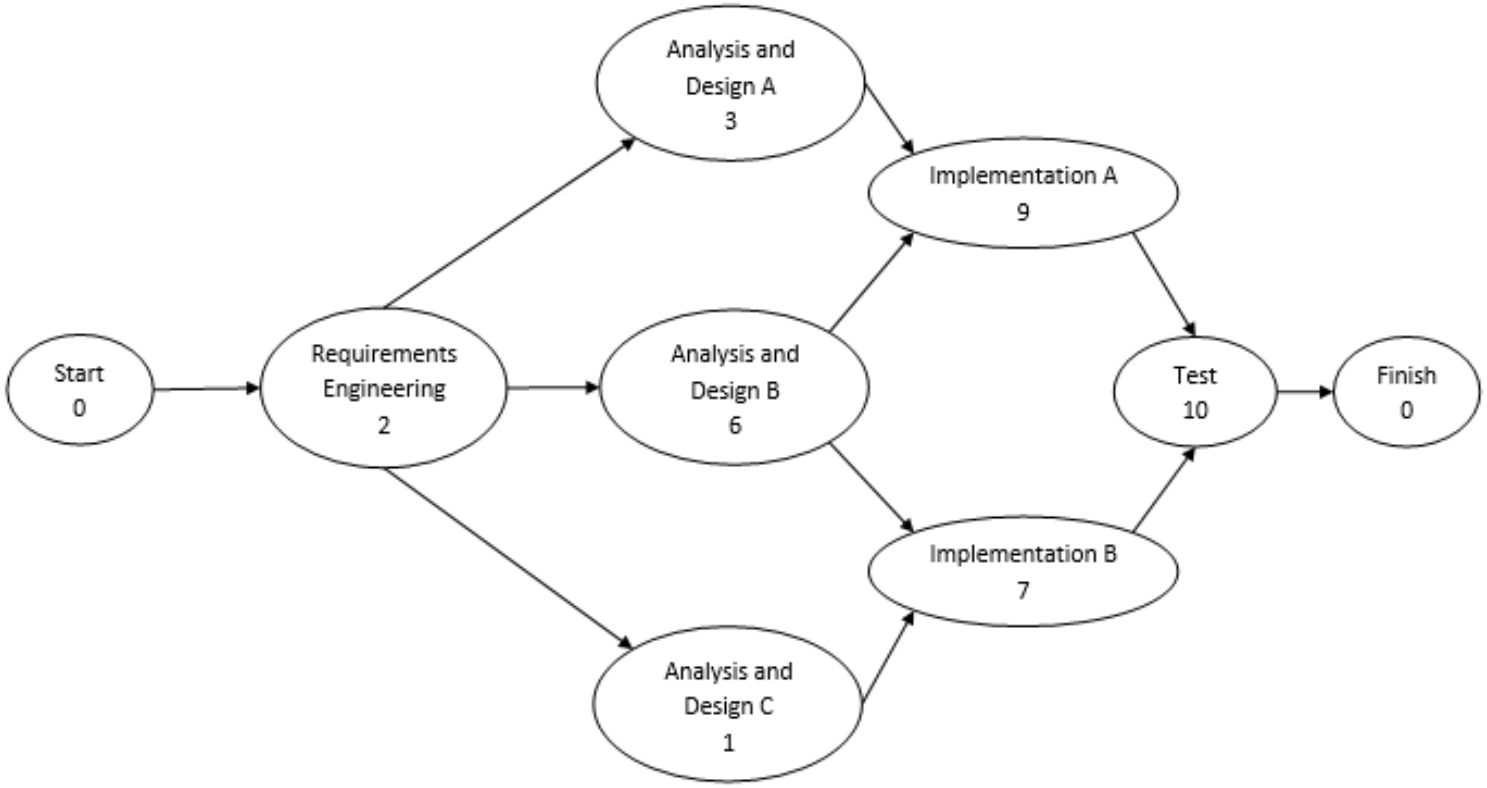
Exercise (Contd.)

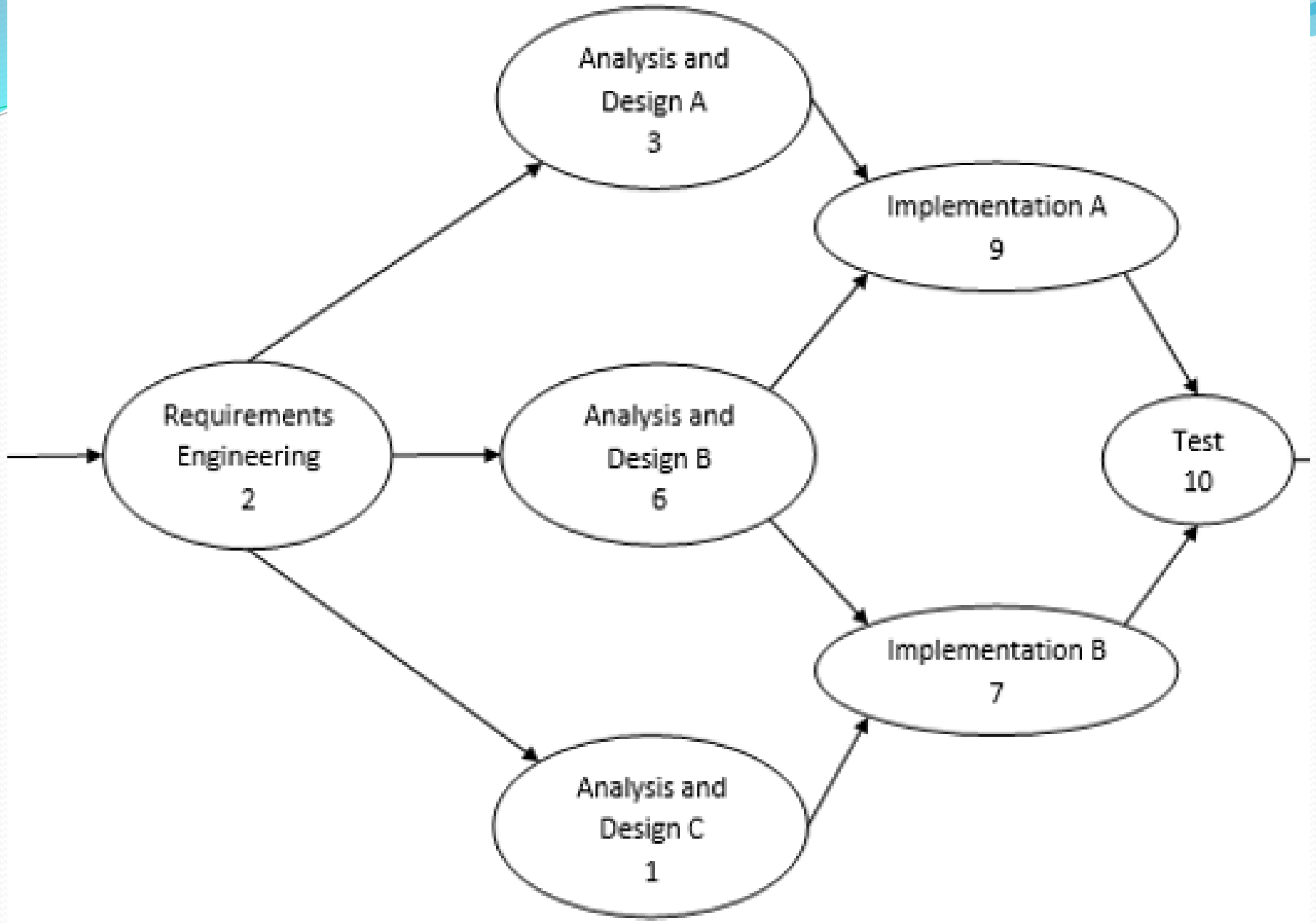


Exercise

Q. The diagram below shows the PERT chart for a software project. Each task is represented by an oval. Numbers inside ovals represent task durations in weeks. Arrows indicate task dependencies.

Identify the tasks on the critical path. Show your working clearly e.g. indicate start and end times of each task.

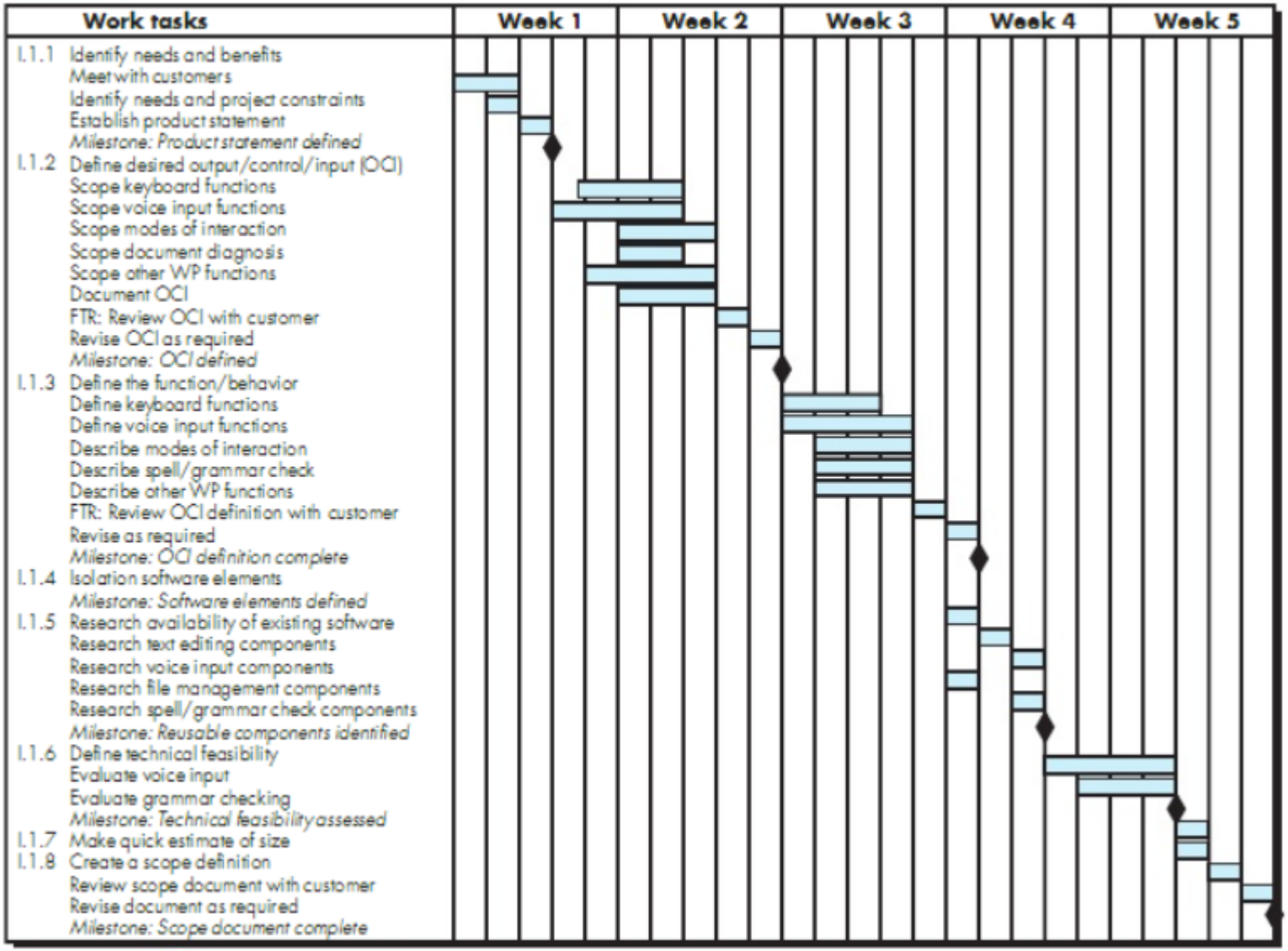



Analysis and
Design A
3
Implementation A
9
Requirements
Engineering
2
Analysis and
Design B
6
Test
10
Implementation B
7
Analysis and
Design C
1

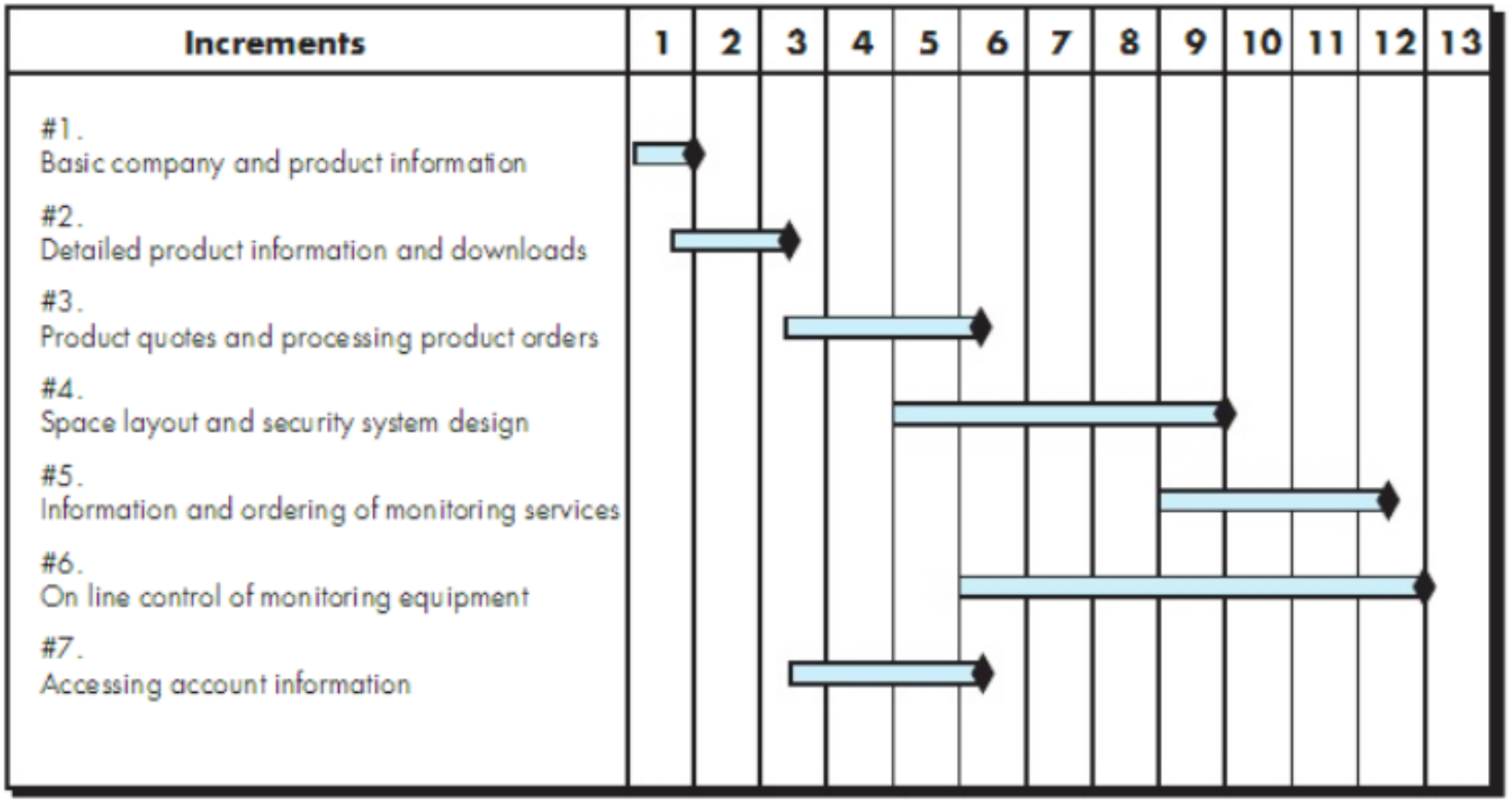
Project Table

Work tasks	Planned start	Actual start	Planned complete	Actual complete	Assigned person	Effort allocated	Notes
I.1.1 Identify needs and benefits							Scoping will require more effort/time
Meet with customers	wk1, d1	wk1, d1	wk1, d2	wk1, d2	BLS	2 p-d	
Identify needs and project constraints	wk1, d2	wk1, d2	wk1, d2	wk1, d2	JPP	1 p-d	
Establish product statement	wk1, d3	wk1, d3	wk1, d3	wk1, d3	BLS/JPP	1 p-d	
Milestone: Product statement defined	wk1, d3	wk1, d3	wk1, d3	wk1, d3			
I.1.2 Define desired output/control/input (OCI)							
Scope keyboard functions	wk1, d4	wk1, d4	wk2, d2		BLS	1.5 p-d	
Scope voice input functions	wk1, d3	wk1, d3	wk2, d2		JPP	2 p-d	
Scope modes of interaction	wk2, d1		wk2, d3		MLL	1 p-d	
Scope document diagnostics	wk2, d1		wk2, d2		BLS	1.5 p-d	
Scope other WP functions	wk1, d4	wk1, d4	wk2, d3		JPP	2 p-d	
Document OCI	wk2, d1		wk2, d3		MLL	3 p-d	
FTR: Review OCI with customer	wk2, d3		wk2, d3		all	3 p-d	
Revise OCI as required	wk2, d4		wk2, d4		all	3 p-d	
Milestone: OCI defined	wk2, d5		wk2, d5				
I.1.3 Define the function/behavior							

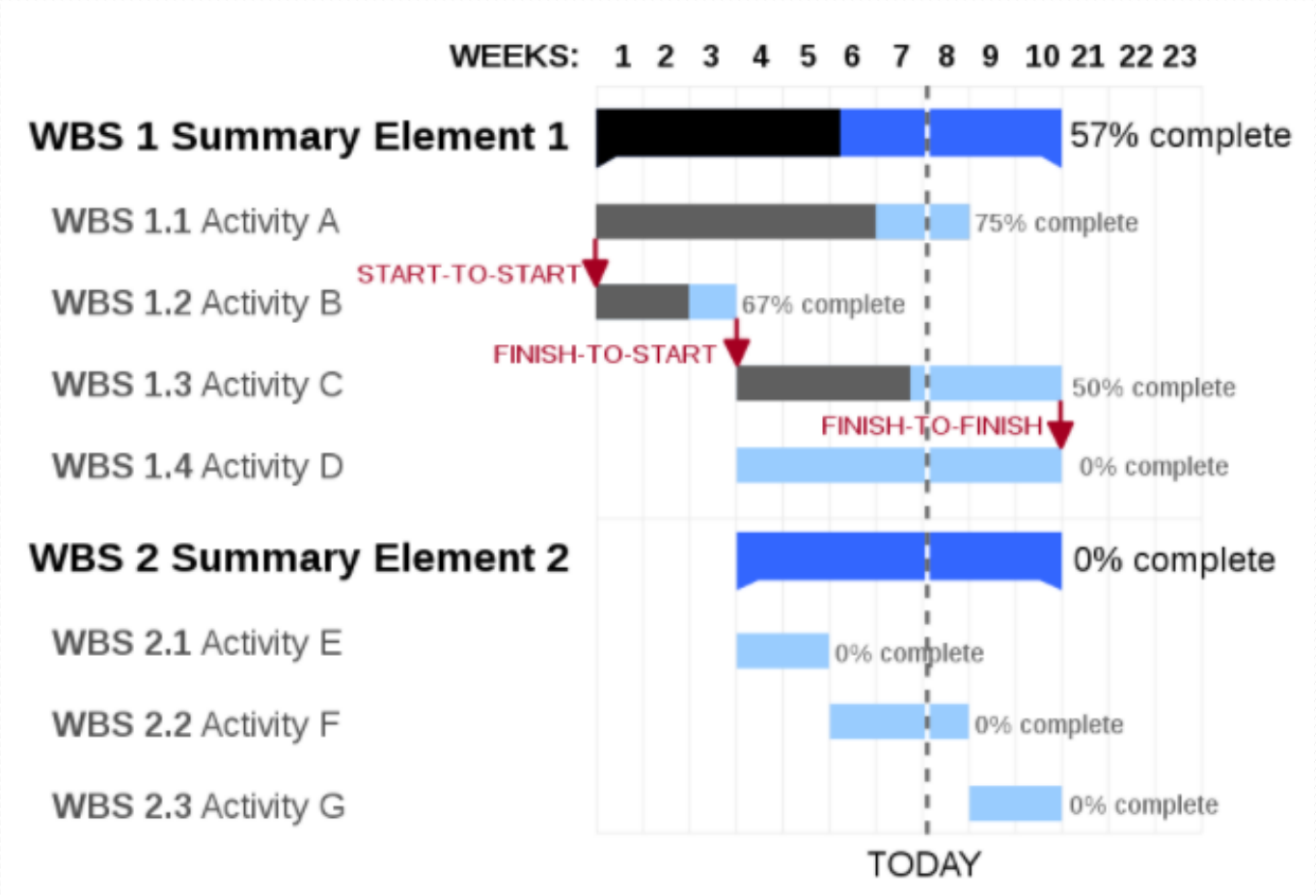
Gan


Work tasks
Week 1
Week 2
Week 3
Week 4
Week 5
I.1.1 Identify needs and benefits
Meet with customers
Identify needs and project constraints
Establish product statement
Milestone: Product statement defined
I.1.2 Define desired output/control/input (OCI)
Scope keyboard functions
Scope voice input functions
Scope modes of interaction
Scope document diagnosis
Scope other WP functions
Document OCI
FTR: Review OCI with customer
Revise OCI as required
Milestone: OCI defined
I.1.3 Define the function/behavior
Define keyboard functions
Define voice input functions
Describe modes of interaction
Describe spell/grammar check
Describe other WP functions
FTR: Review OCI definition with customer
Revise as required
Milestone: OCI definition complete
I.1.4 Isolation software elements
Milestone: Software elements defined
I.1.5 Research availability of existing software
Research text editing components
Research voice input components
Research file management components
Research spell/grammar check components
Milestone: Reusable components identified
I.1.6 Define technical feasibility
Evaluate voice input
Evaluate grammar checking
Milestone: Technical feasibility assessed
I.1.7 Make quick estimate of size
I.1.8 Create a scope definition
Review scope document with customer
Revise document as required
Milestone: Scope document complete

Macroscopic Project Schedule

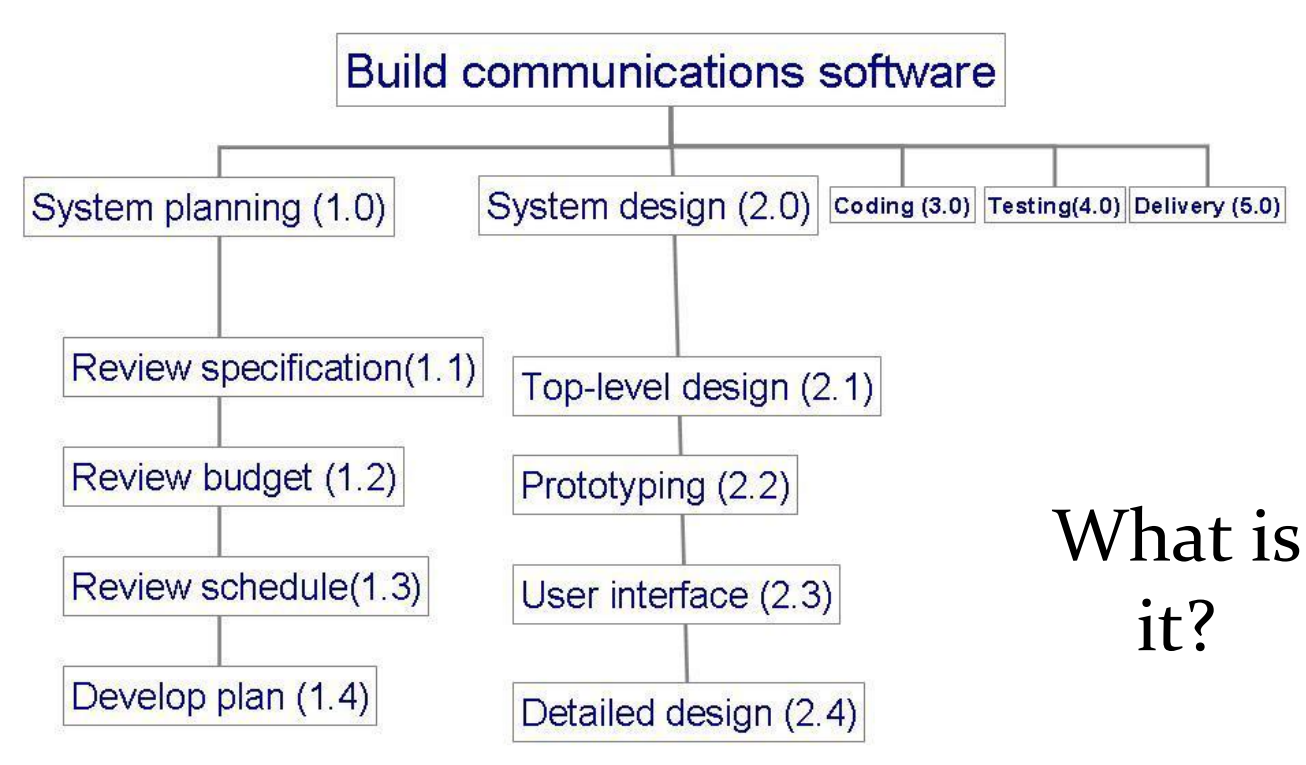


Gantt Chart (Contd.)



Source: https://www.workamajig.com/blog/gantt-charts-project-management

- Example: to track progress of building a communication software



What is it?

References

- Pfleeger SE Book
- Pressman SE Book

Acknowledgement

- A few slides have been reused from UCF slides for the SE course