

AD642 OL

2020 – Fall

Week 5 – Lecture 5

The Art and Science of Project Management

Professor Greiman

Questions or Concerns???

- Ask your Facilitator for Guidance
- Email or schedule a call with your Professor one on one
- Reach out to your Classmates
- Post your Questions on the Discussion Board
- Raise questions during the Live Class
- Send an email to all concerned
- Ironically, some of my most successful students professionally never received an A in the course. Instead, they took the concepts and ideas from the course and applied them to their future endeavors.

Never waste time worrying about something that can be resolved quickly!

Upcoming Due Dates: Mark your Calendar

SEPTEMBER 2020 AD642 A3 Wednesday LfA						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
KEY: IA= Individual Assignment TA=Team Assignment Quizzes in red Discussions in green Lectures in blue	31	1	2 Lecture 1 Disc 0 already open Disc 1 opens	3	4	5 Disc 1 first post in
6	7 Labor Day	8	9 Lecture 2	10	11	12
13	14	15 Disc 1 closes 11:59PM IA1 (Project Example) due	16 Lecture 3 Quiz 1 opens 6AM Disc 2 opens	17 TA1: Scope/Charter in for review	18	19 Disc 2 first post in
20 Quiz 1 closes 11:59PM	21	22	23 Lecture 4	24	25	26
27 TA2: WBS in for review	28	29 Disc 2 closes 11:59PM	30 Lecture 5 Disc 3 opens	1	2	3

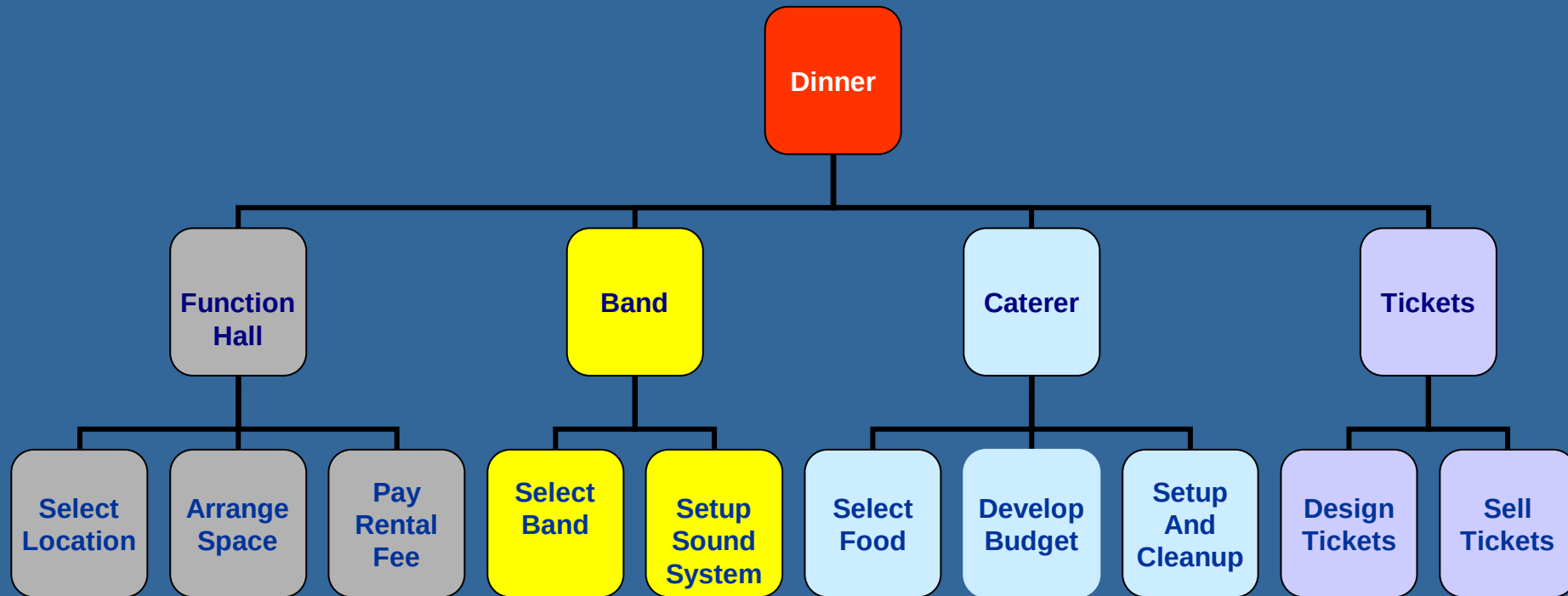
Looking Ahead: October Calendar

OCTOBER 2020 AD642 A3 Wednesday LfA						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
27	28	29	30	1	2	3 Disc 3 first post in
4	5	6	7 Lecture 6 Quiz 2 opens 6AM	8	9	10
11 Quiz 2 closes 11:59PM	12 Columbus Day	13 TA3: Hand - drawn Network Diagram in for review	14 Lecture 7 Quiz 3 opens 6AM Disc 3 closes 11:59PM	15 Disc 4 opens 11:59PM	16	17
18 Quiz 3 closes 11:59PM Disc 4 first post in	19 IA2 (Columbia Gas Case) draft due if you want feedback (optional)	20	21 Lecture 8	22	23	24
25	26	27 TA4: Budget in for review	28 Lecture 9 Disc 4 closes 11:59PM	29	30	31 Halloween

Team Leaders in this Class - A3

- Team 1 - Anna Gabriela Garcia Esquivel
- Team 2 – Xiumen Zhang
- Team 3 – Xueyang Long
- Team 4 – Danlin Wang
- Team 5 – Jiabin Zhao
- Team 6 – Amish Shah Nishil
- Team 7 – Chih Chun Chen
- Team 8 – Jiaming Li

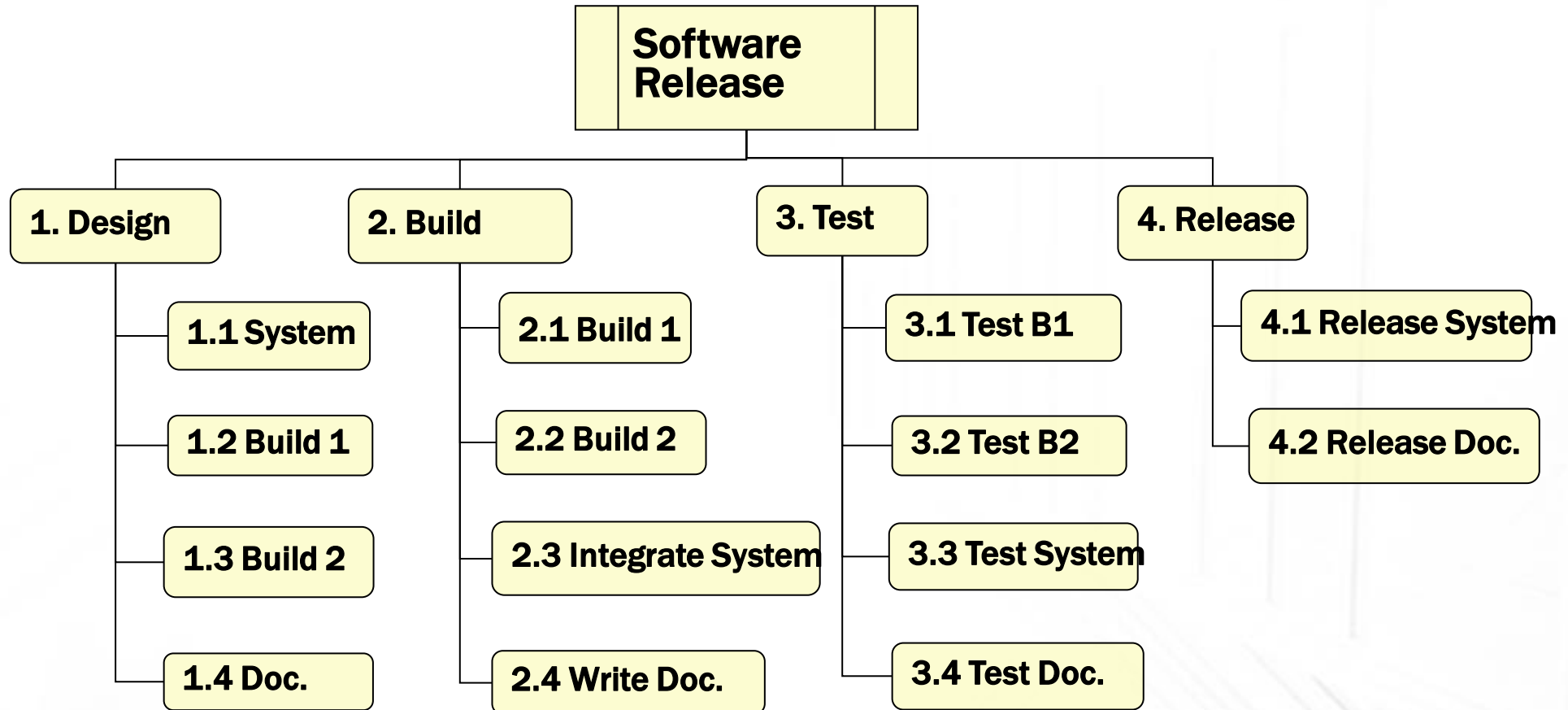
WBS for Charitable Dinner



The WBS

- 1 Kitchen**
 - 1.1 Initial Planning**
 - 1.1.1 Conduct Client Meetings**
 - 1.1.2 Establish Colors & Fixtures**
 - 1.1.3 Measure, Budget, and obtain Approval**
 - 1.1.4 Obtain Permits**
 - 1.2 Hire Contractors**
 - 1.3 Order Everything**
 - 1.4 Delivery of Materials**
 - 1.4.1 Receive Materials**
 - 1.4.2 Inspect and Accept materials**
 - 1.4.3 Carry out Alterations**
 - 1.4.4 Demolition**
 - 1.4.5 Reconstruction**
 - 1.4.5.1 Floor, Doors and Windows**
 - 1.4.5.2 Electrical & Plumbing**
 - 1.4.5.3 Install Cabinets**
 - 1.4.5.4 Install Appliances**
 - 1.5 Client Walk-Through and Approval**

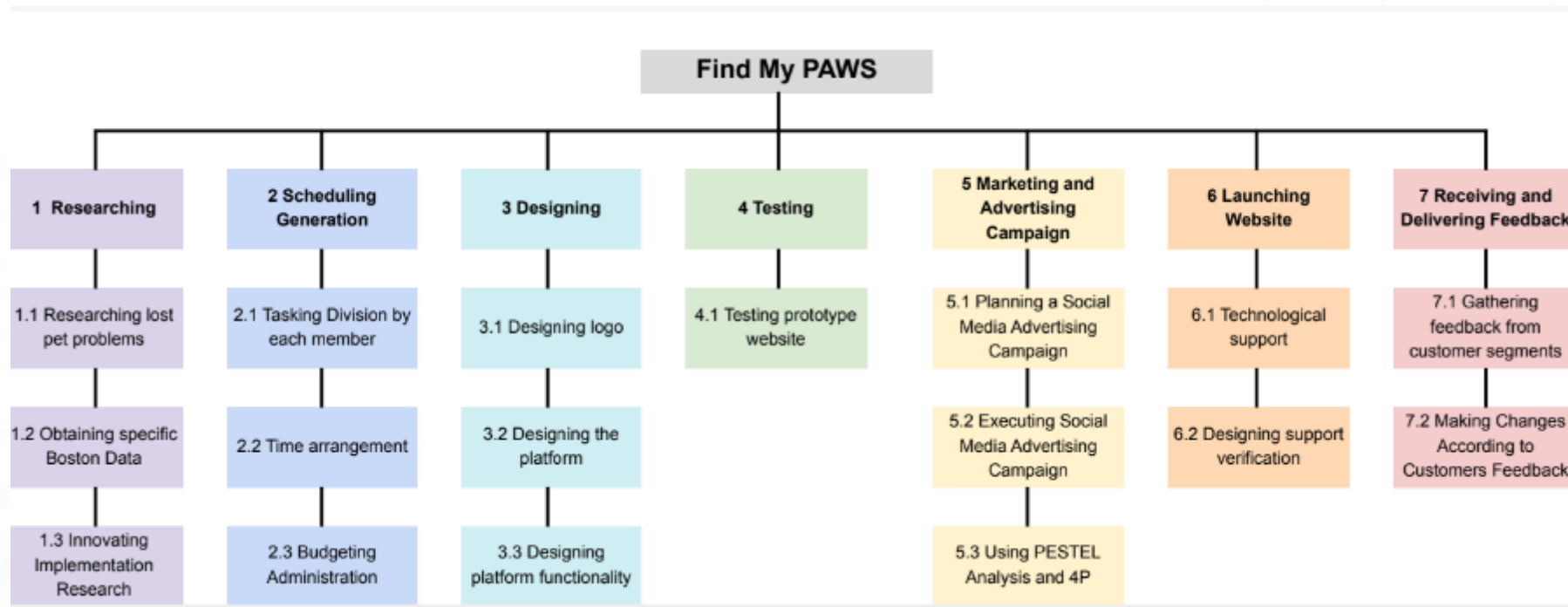
WBS – Process Oriented - Graphical



WBS – Outline or Tabular Format

Software Release	
1.	Software
1.1	Build 1
1.2	Build 2
1.3	Integration
1.4	Testing
1.4.1	Functional
1.4.2	User
2.	Documentation
3.	Training
3.1	User
3.2	Technical Support
3.3	Call Center
4.	Project Management

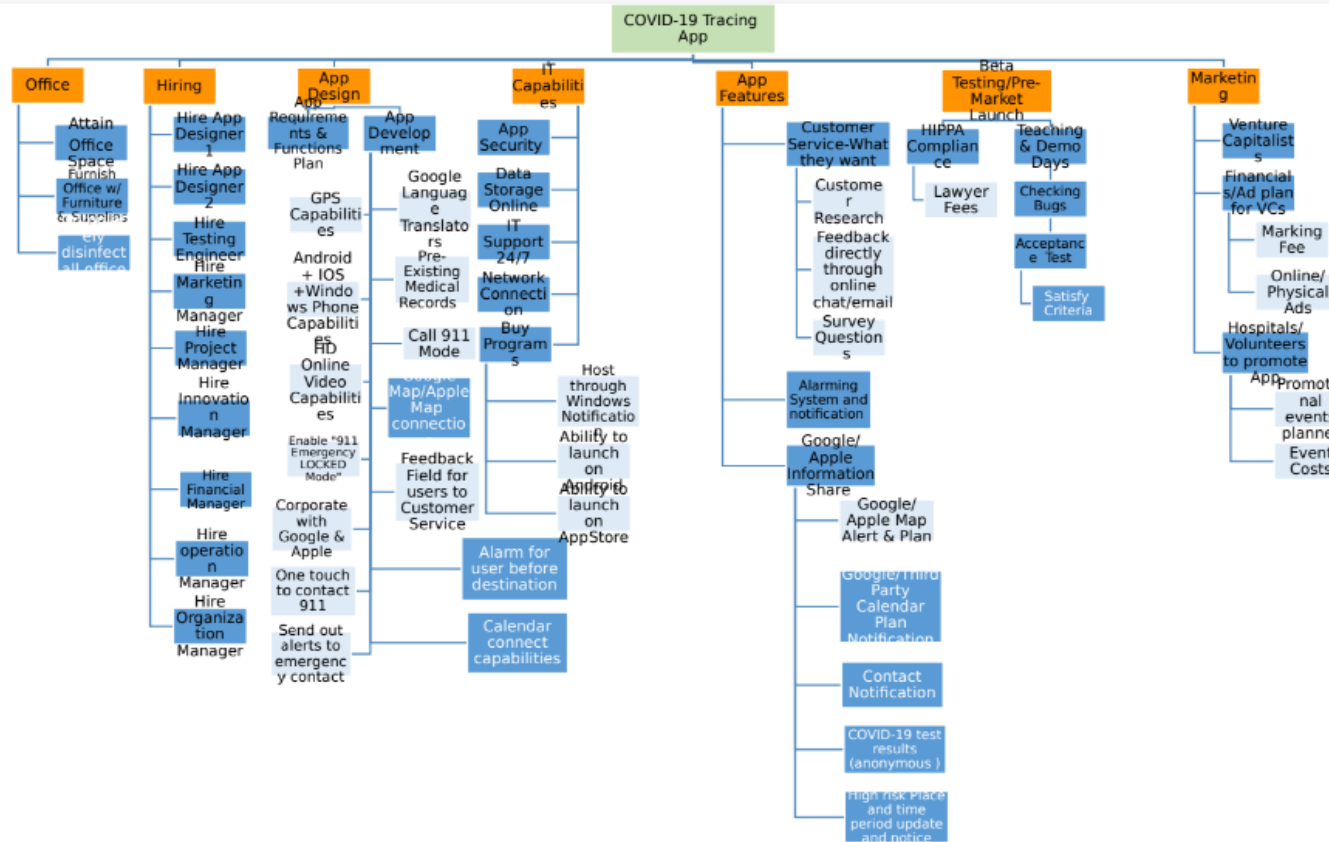
Team 1 – Find My Paws



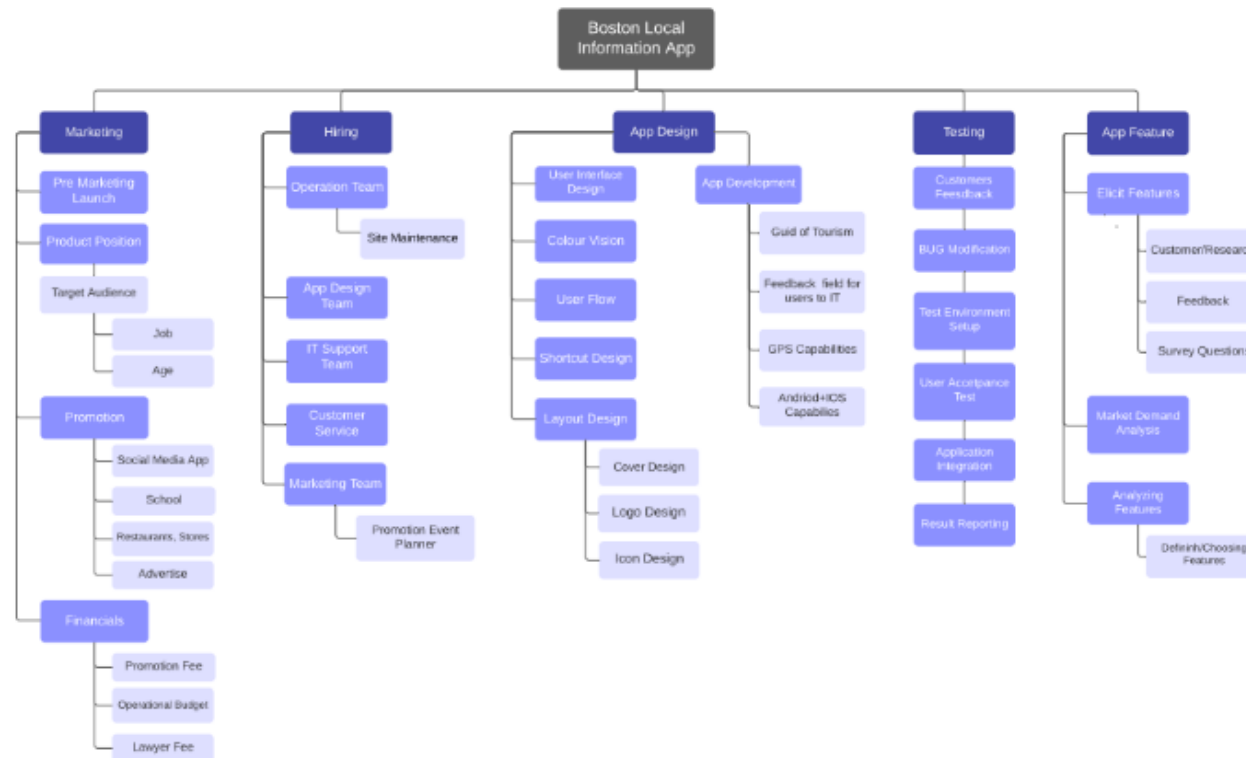
Team 2: Amazon Global Store



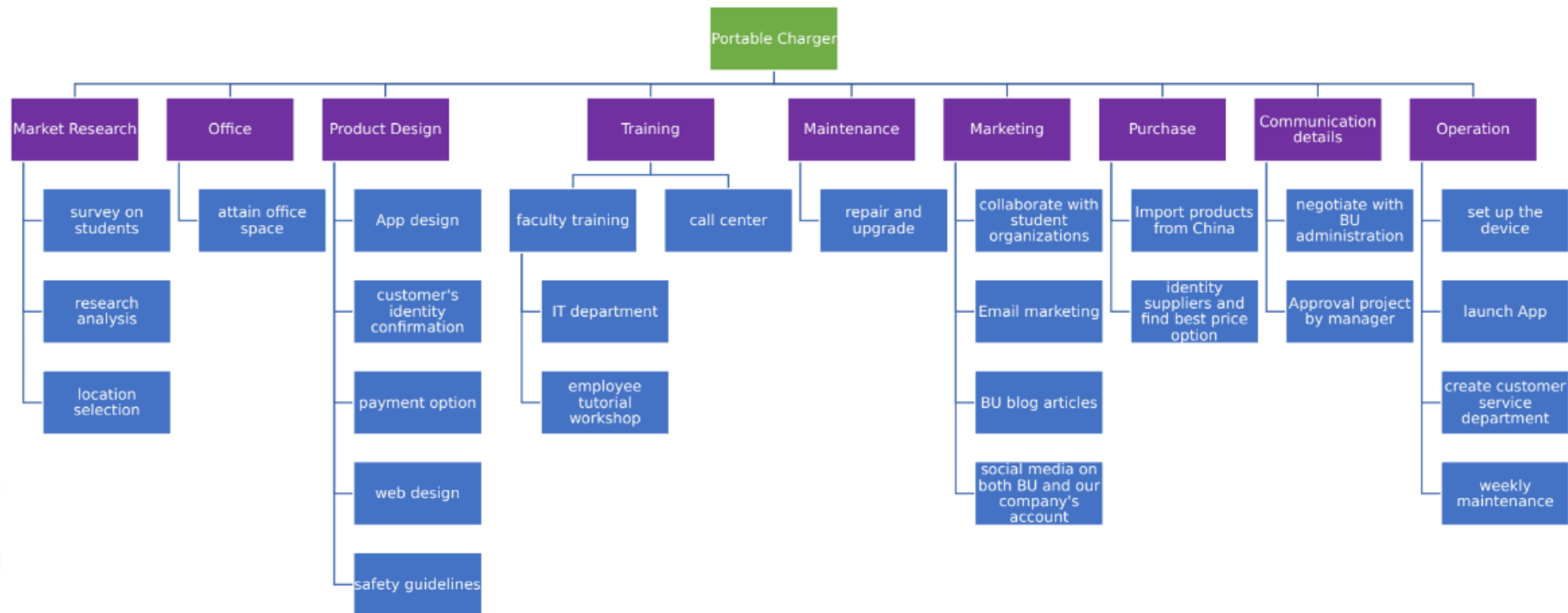
Team 3 – COVID 19 Tracing App



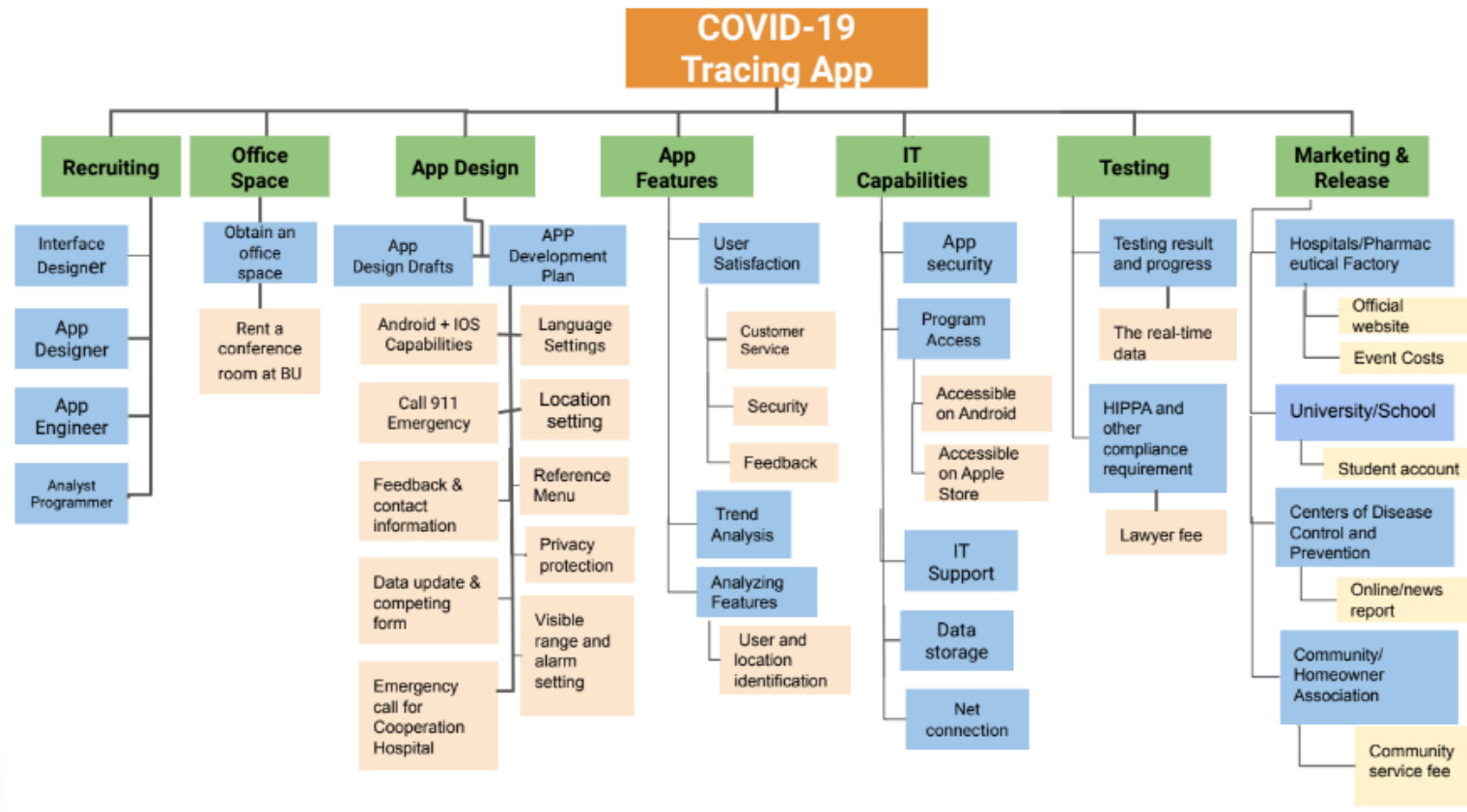
Team 4 – Boston Local Information App



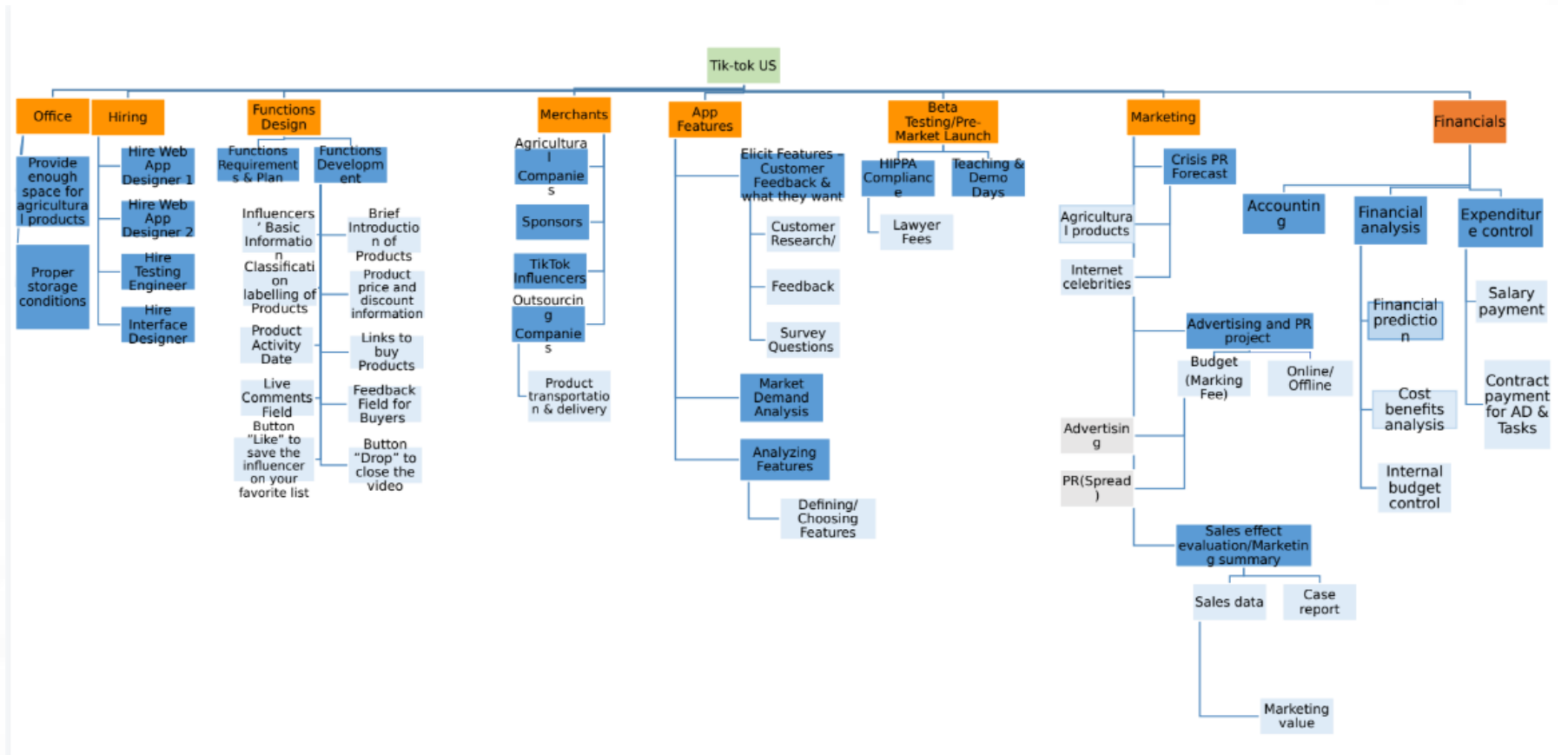
Team 5 – Portable Charger



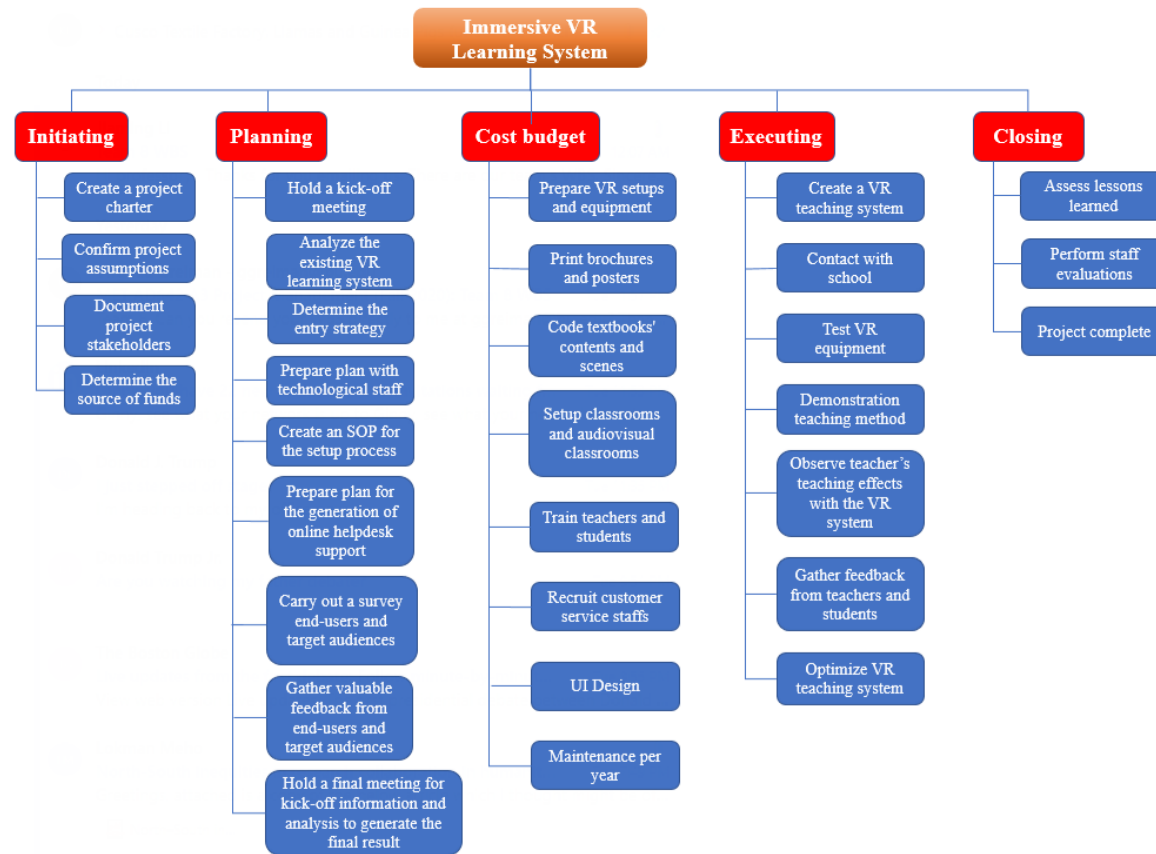
Team 6 – Tracing App



Team 7 – Tik Tok



Team 8 – Immersive VR Learning System



Team 8: Outline

Team8 Immersive VR Learning System WBS

Accessibility Mode

Team Assignment 2 - WBS Immersive VR Learning System

Team 8 members: Jiaming Li, Jiayuan Wu, Hung-An Yang, Hao Xue

1. Initiating

- 1.1 Create a project charter
- 1.2 Confirm project assumptions
- 1.3 Document project stakeholders
- 1.4 Determine the source of funds

2. Planning

- 2.1 Hold a kick-off meeting
- 2.2 Analyze the existing VR learning system
- 2.3 Determine the entry strategy
- 2.4 Prepare plan with technological staff
- 2.5 Create an SOP for the setup process
- 2.6 Prepare plan for the generation of online helpdesk support
- 2.7 Carry out a survey end-users and target audiences
- 2.8 Gather valuable feedback from end-users and target audiences
- 2.9 Hold a final meeting for kick-off information and analysis to generate the final result

3. Cost budget

- 3.1 Prepare VR setups and equipment
- 3.2 Print brochures and posters
- 3.3 Code textbooks' contents and scenes
- 3.4 Setup classrooms and audiovisual classrooms
- 3.5 Train teachers and students
- 3.6 Recruit customer service staffs
- 3.7 UI Design
- 3.8 Maintenance per year

4. Executing

- 4.1 Create a VR teaching system
- 4.2 Contact with school
- 4.3 Test VR equipment
- 4.4 Demonstration teaching method
- 4.5 Observe teacher's teaching effects with the VR system
- 4.6 Gather feedback from teachers and students
- 4.7 Optimize VR teaching system

Sample Scope and Charter

Most Common Omissions

1. References for your article – 3 to 4 articles relevant to your Assignment including at least one scholarly article.

Jones, D. (2018) How to develop a project charter, International Journal of Project Management 3 (2) 456 – 472.

2. Risks and Risk Mitigation

3. Success Factors

A. General Information

Project Title:	Fengtai City Center Green		
Brief Project Description:	Building a multi-functional urban green space in the Fengtai City Center of Beijing involving intentional design elements, created by Diller Scofidio and Renfro, that offer eco-friendly educational, entertainment, and relaxation spaces to residents and tourists.		
Prepared By:	Team 5		
Date:	September 18, 2019	Version:	Version #1

B. Project Objectives:

The Fengtai City Center Green project aims to enhance the existing Fengtai district landscape and, in doing so, improve residential quality of life, as well as, promote an influx of tourism and business by offering unique urban design features. Design elements will include spaces for education, entertainment, and rest areas using sustainable building practices that improve the reputation of Beijing. Additionally, this green space will draw movement to develop the Fengtai district of Beijing into a city of its own.

1. Determine the design features necessary for these objectives and secure architects.
2. Secure funding from commercial, public, and governmental sources.
3. Complete the construction on-time, and within budget.
4. Establish teams of operational, marketing, pr, finance, and development departments.
5. Launch site and provide ongoing support as needed.

C. Assumptions

1. General public interest in and support of this project
2. Availability of funds and non-fluctuating contractual binds of business partnerships
3. Weather permitting construction
4. Governmental approval and support

Lecture 5 Agenda

- Project Networks
- Calculating Earliest Times (Forward Pass)
- Calculating Latest Times (Backward Pass)
- Calculating Slack and Critical Path
- Activities: Define Activities
- Sequence Activities
- Different Kinds of Activity Sequencing Relationships
- Types of Dependencies and their Effect on Activity Sequencing
- Project Network Diagrams
- Critical Path
- Relation to PMBOK® Guide

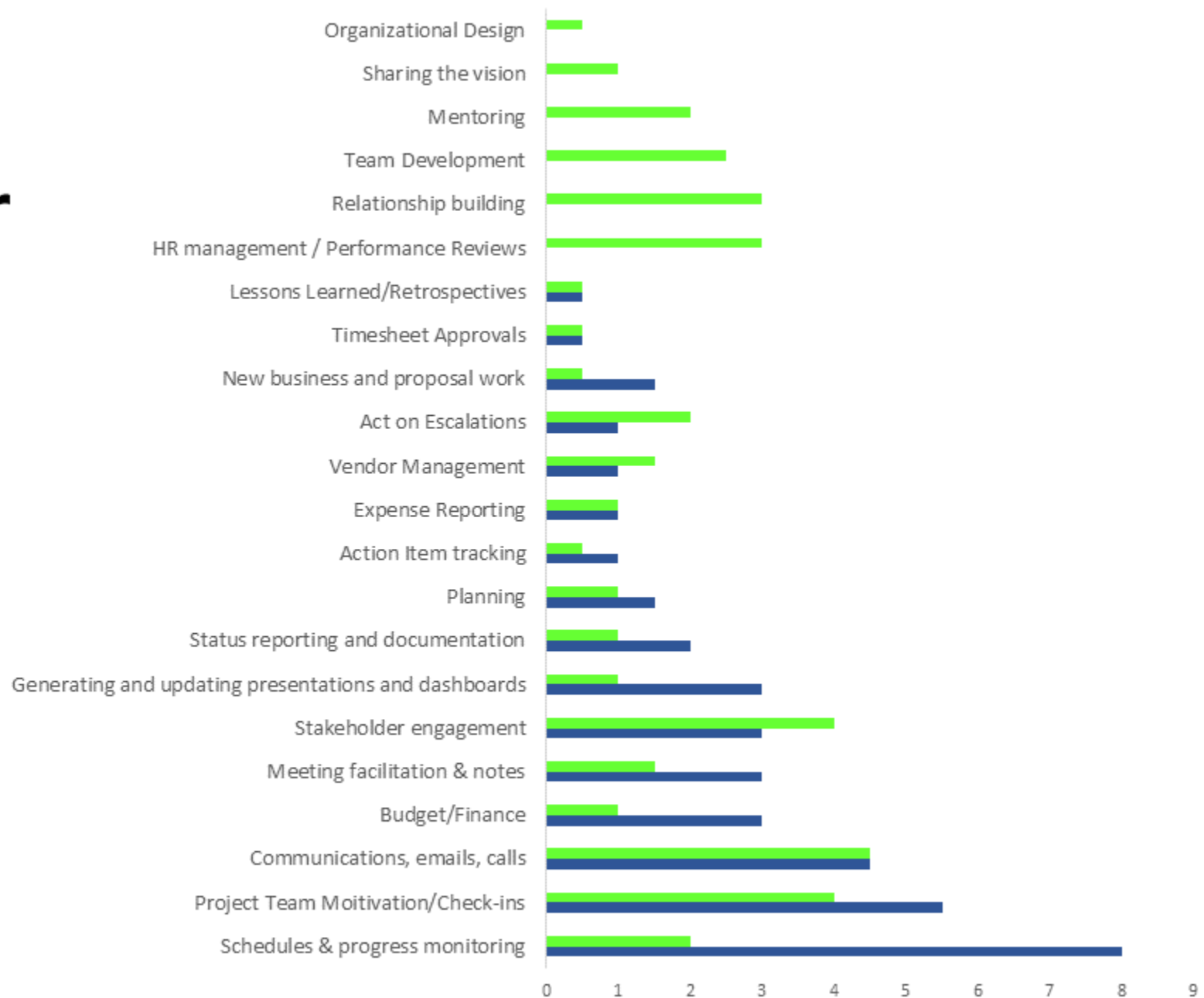
What does a Project Manager do all day?

Or: "Day in the life of a PM"

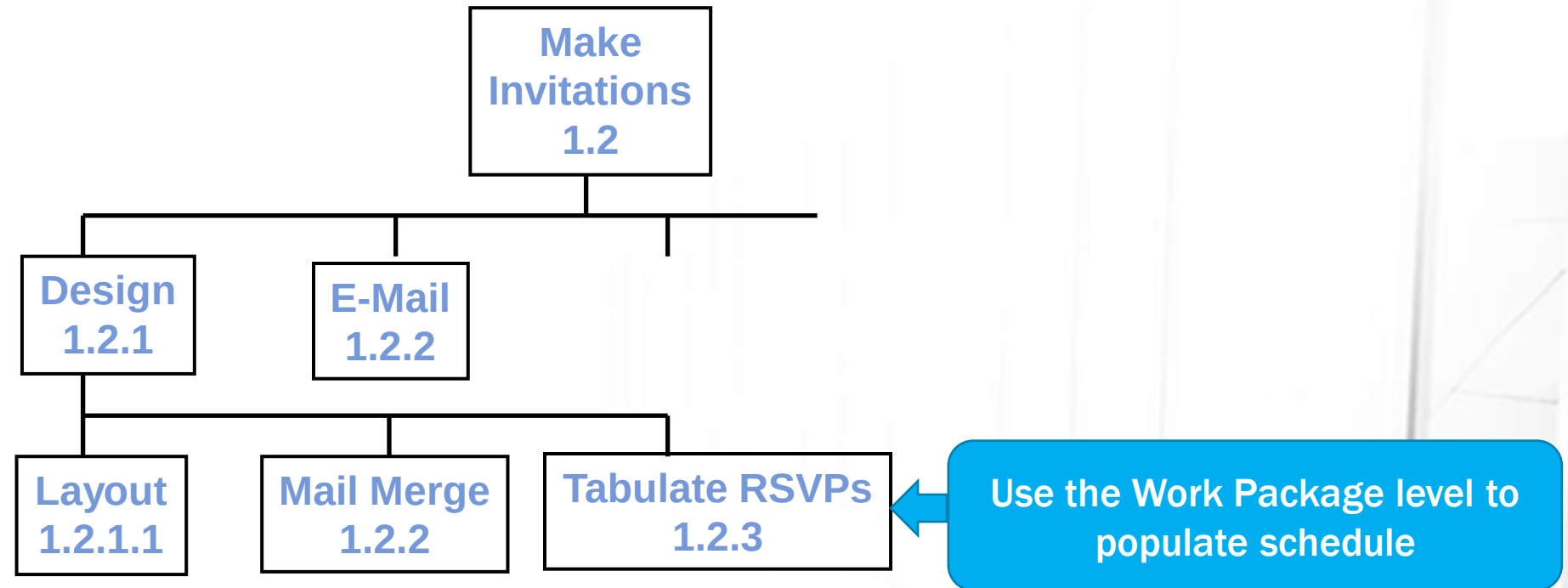
Early Career



Current Focus

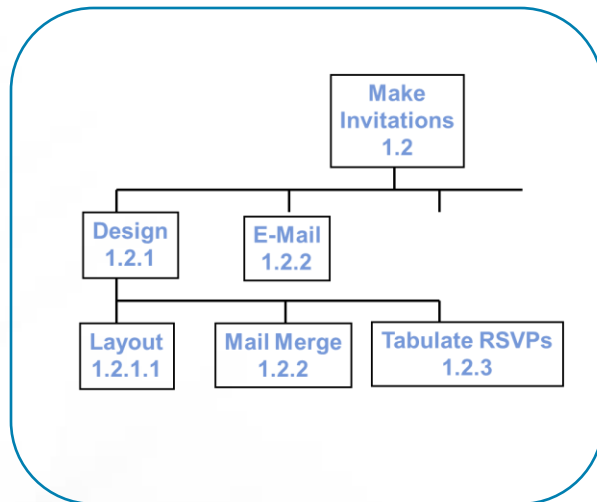


WBS Decomposition

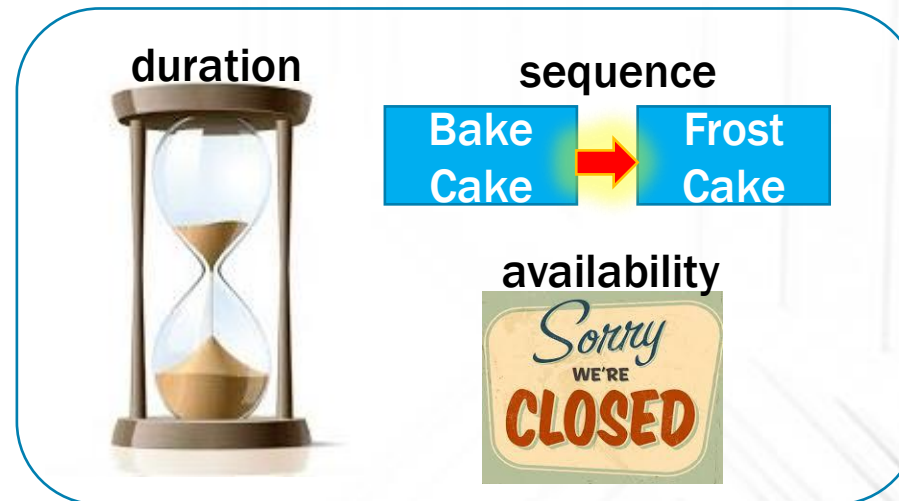


Develop the Project Schedule

- Start with the WBS and *add* the information regarding durations, availability, and sequence (dependency)



plus



The Project Network (or network diagram)

- A flow chart that graphically depicts the sequence, interdependencies, and start and finish times of the project
- It will reveal two key things about your project:
 - The critical path (or paths)*
 - Tasks that have float (aka slack) time

*"Critical" refers only to time. All tasks are critical or they wouldn't be on the WBS and thus in the network!

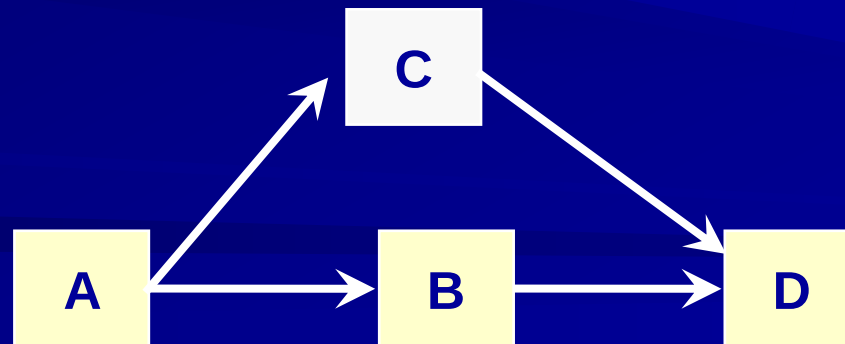
Terminology

Path:

A sequence of connected, dependent activities.

Parallel (Concurrent) Activities:

Activities that can occur at the same time. (If desired)



Event

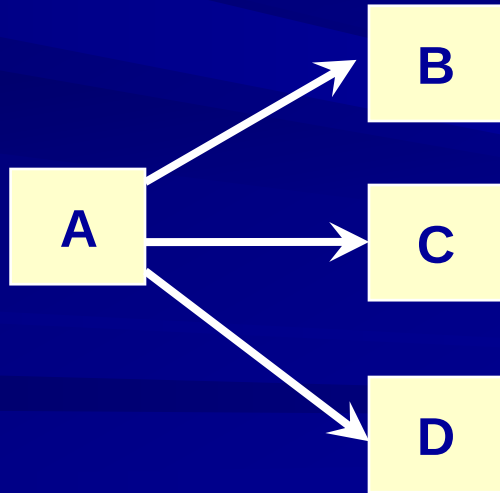
**A point in time when an
activity is started or
completed**

It does not consume time

Milestones are events

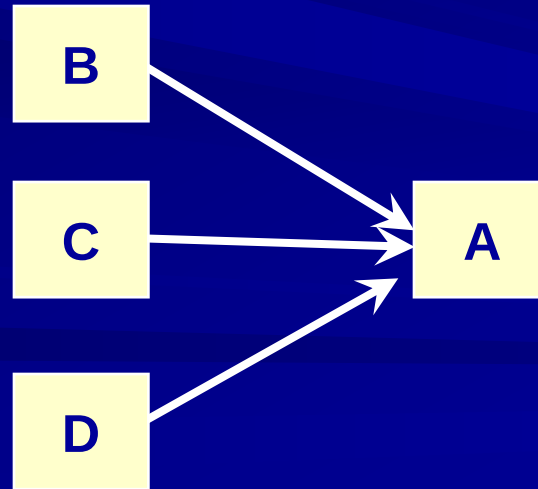
Burst Activity

An activity that has more than one activity immediately following it (more than one dependency arrow flowing from it).



Merge Activity

An activity that has more than one activity immediately following it (more than one dependency arrow flowing from it).



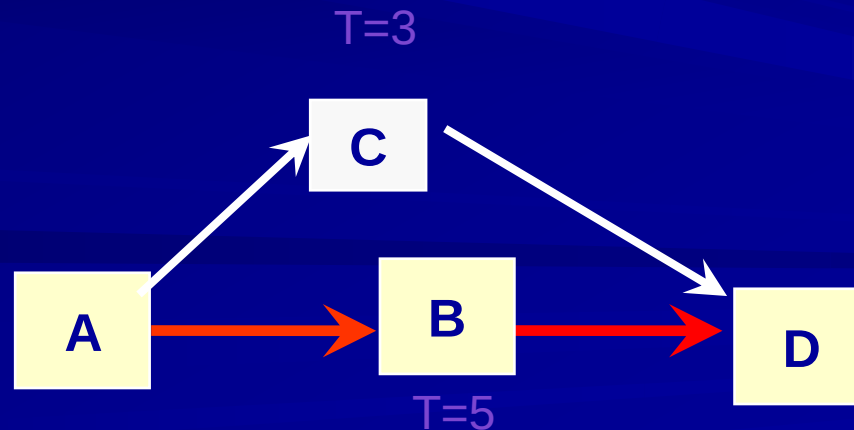


Critical Path

The critical path is the network path(s) that has (have) the least slack in common.

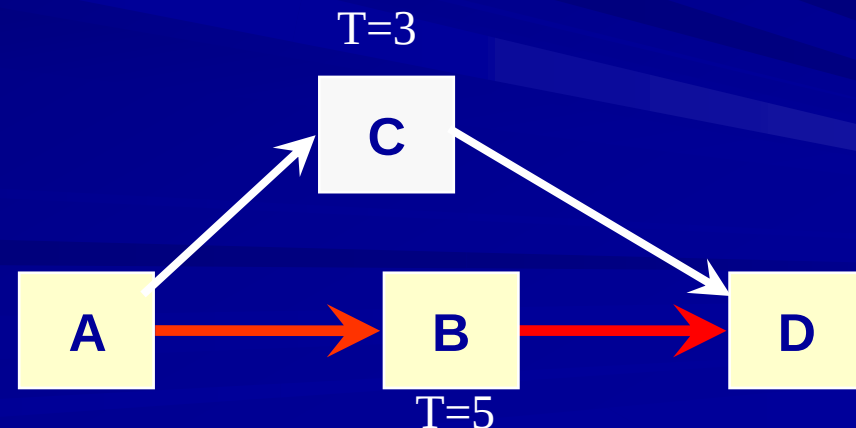
Critical Path

- the longest path through the network that allows for the completion of all activities
- the shortest expected time in which the entire project can be completed. Delays on the critical path will delay completion of the entire project.



Critical Path ~ 10%

- Assign best people to critical activities
- Prioritize (and eliminate) critical activities
- Risk assessment on critical activities
- Visit people working on critical activities
- Can I borrow Joe?
- Overtime, technology
- Schedule changes $\pm$
- Roll up non criticals



Basic Network Rules

- Networks typically flow from left to right.
- An activity cannot begin until all of its predecessor activities are complete.
- Arrows indicate precedence and flow and can cross over each other.
- Identify each activity with a unique number; this number must be greater than its predecessors.
- Looping is not allowed.
- Conditional statements are not allowed.
- Use common start and stop nodes.

Lags

- **The minimum amount of time a dependent activity must be delayed to begin or end.**
 - **Lengthy activities are broken down to reduce the delay in the start of successor activities.**

MS Project

<http://www.customguide.com/pdf/project-quick-reference-2007.pdf>

Microsoft®

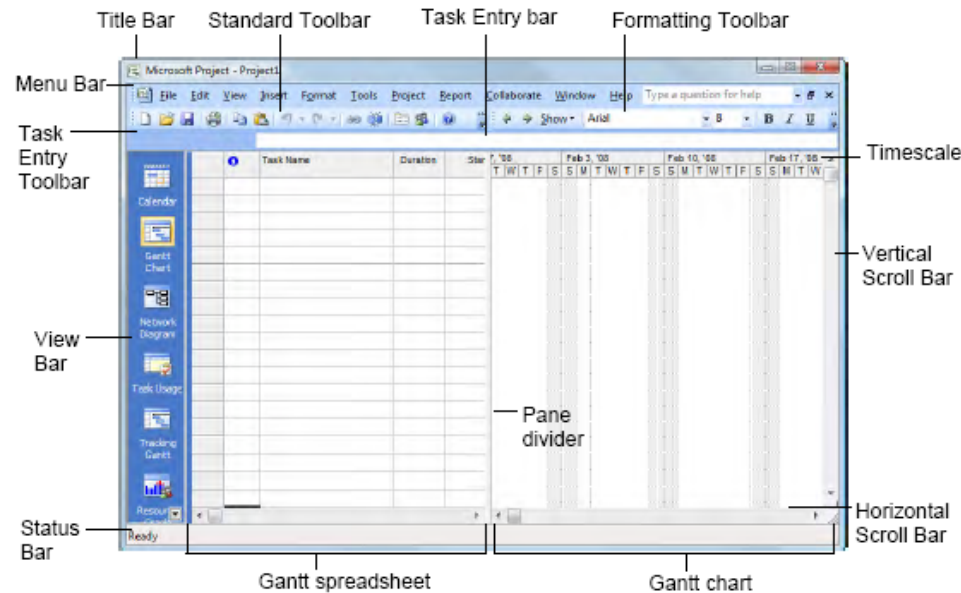
Project 2007 Quick Reference Card



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Project 2007 Screen



Common Views

To Display a View: Select **View** from the menu bar and select a view from the menu, or select a view from the View Bar.

Calendar: Displays tasks and durations in a monthly calendar.

Gantt Chart: Default view. Displays a list of tasks with bar chart information.

Network Diagram: Displays a sequence or logic diagram that shows the project's tasks and dependencies.

Task Usage: Displays a list of tasks showing assigned resources under each task.

Tracking Gantt: Displays a list of tasks with a baseline schedule and Gantt bars.

Resource Graph: Displays a graph of resources and their costs, etc. over time.

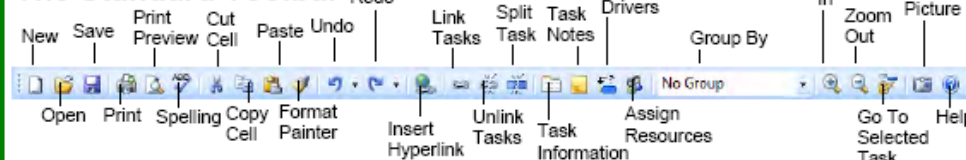
Resource Sheet: Displays a list of resources and their details in rows and columns.

Resource Usage: Displays assigned tasks grouped under each resource.

More Views: Choose from a list of more advanced and specific views.

The Fundamentals

The Standard Toolbar

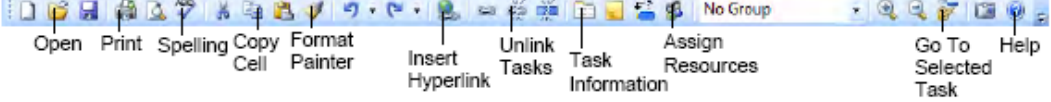


Keystroke Shortcuts

Task or Resource Information **<Shift> + <F2>**

MS Project

<http://www.customguide.com/pdf/project-quick-reference-2007.pdf>



- **To Create a New Project:** Click the **New** button on the Standard toolbar, or select **File** → **New** from the menu, or press **<Ctrl> + <N>**.
- **To Use a Template:** Select **File** → **New** from the menu, click the **On my computer** link in the task pane and select a template in the dialog box.
- **To View Information About the Project:** Select **Project** → **Project Information** from the menu.
- **Set the Working Time Calendar:** Select **Tools** → **Change Working Time** from the menu. Select the date(s) you want to change and select a new calendar, or enter the new working hours in the **From:** and **To:** boxes.
- **To Use Spelling, Undo and Redo:** Click the **Spelling** button, **Undo** button and **Redo** button on the Standard toolbar.
- **To Open the Timescale Dialog Box:** Select **Format** → **Timescale** from the menu, or double-click inside the timescale header.
- **To Adjust the Timescale:** Change the options in the Timescale dialog box, or select **View** → **Zoom** from the menu and select the time scale you want to view.

- **To Save a Project File:** Click the **Save** button on the Standard toolbar, select **File** → **Save** from the menu, or press **<Ctrl> + <S>**.
- **To Save a Baseline Plan:** Select **Tools** → **Tracking** → **Save Baseline** from the menu. Click the **Save Baseline** option, save the plan for the entire project or selected tasks, click **OK**.
- **To Save an Interim Plan:** Select **Tools** → **Tracking** → **Set Baseline** from the menu. Click the **Save Interim plan** option, name the plan, save the plan for the entire project or selected tasks, and click **OK**.
- **To Show or Hide the Project Guide:** Select **View** → **Turn on Project Guide** or **Turn off Project Guide** the menu.
- **To Show or Hide the View Bar:** Select **View** → **View Bar** from the menu.
- **To View a Task's Chart bar:** Select the task and click the **Go To Selected Task** button on the Standard toolbar.
- **To Get Help:** Press **<F1>** to open the Project Help task pane, type your question, and click the **Start searching** button.

Keystroke Shortcuts

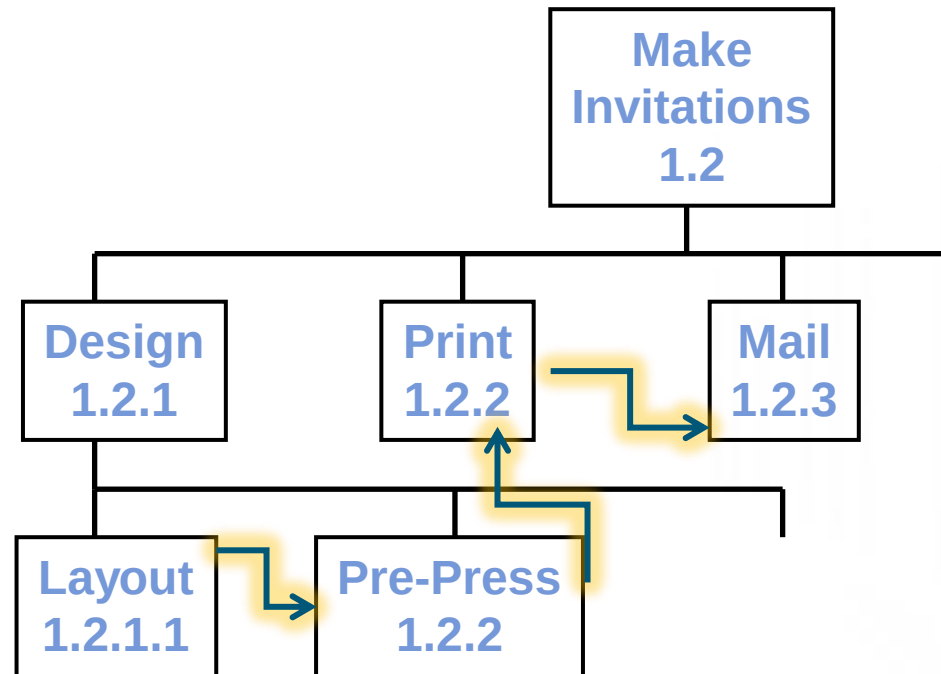
Task or Resource Information	<Shift> + <F2>
Assign Resources	<Alt> + <F10>
Copy	<Ctrl> + <C>
Cut	<Ctrl> + <X>
Paste	<Ctrl> + <V>
Help	<F1>
View Context-Sensitive Help	<Shift> + <F1>
Go To Selected Task	<Ctrl> + <Shift> + <F5>
Link Selected Task	<Ctrl> + <F2>
Unlink Selected Task	<Ctrl> + <Shift> + <F2>
Create a Hyperlink	<Ctrl> + <K>
Zoom In	<Ctrl> + <+>
Zoom Out	<Ctrl> + <Shift> + <+>
Undo/Redo	<Ctrl> + <Z>
Bold	<Ctrl> +
Italics	<Ctrl> + <I>
Underline	<Ctrl> + <U>

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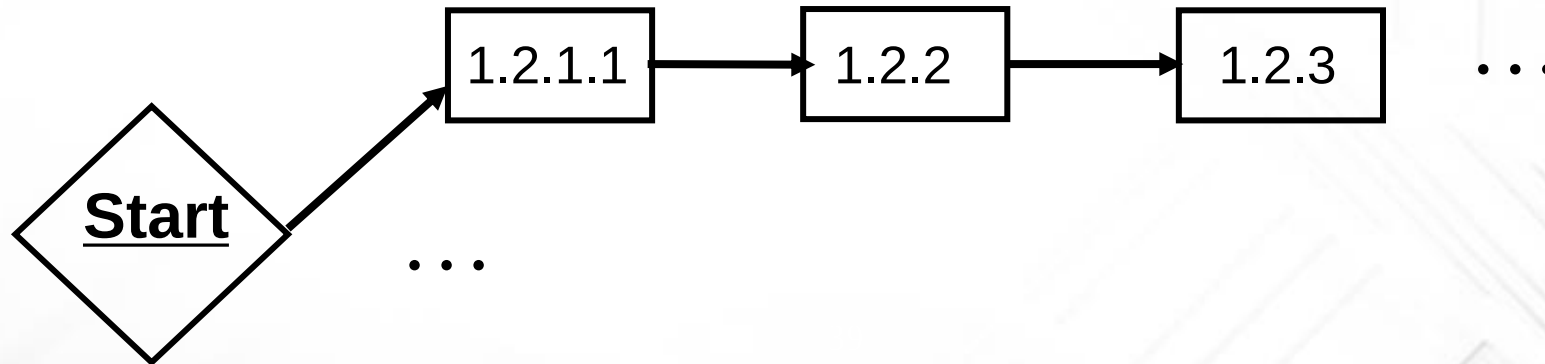
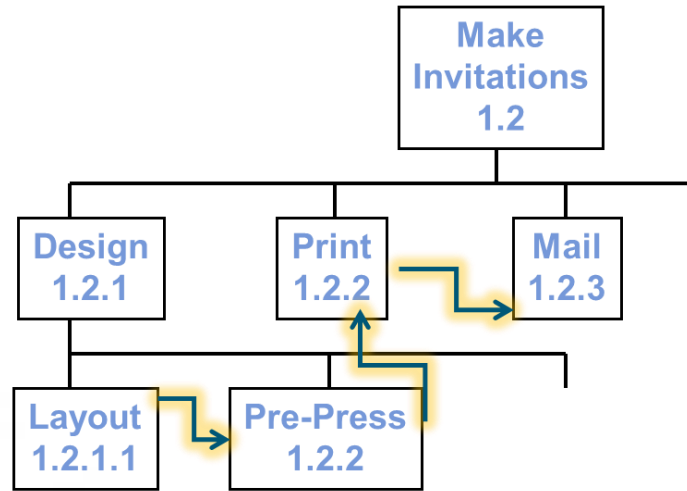
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Adding sequence

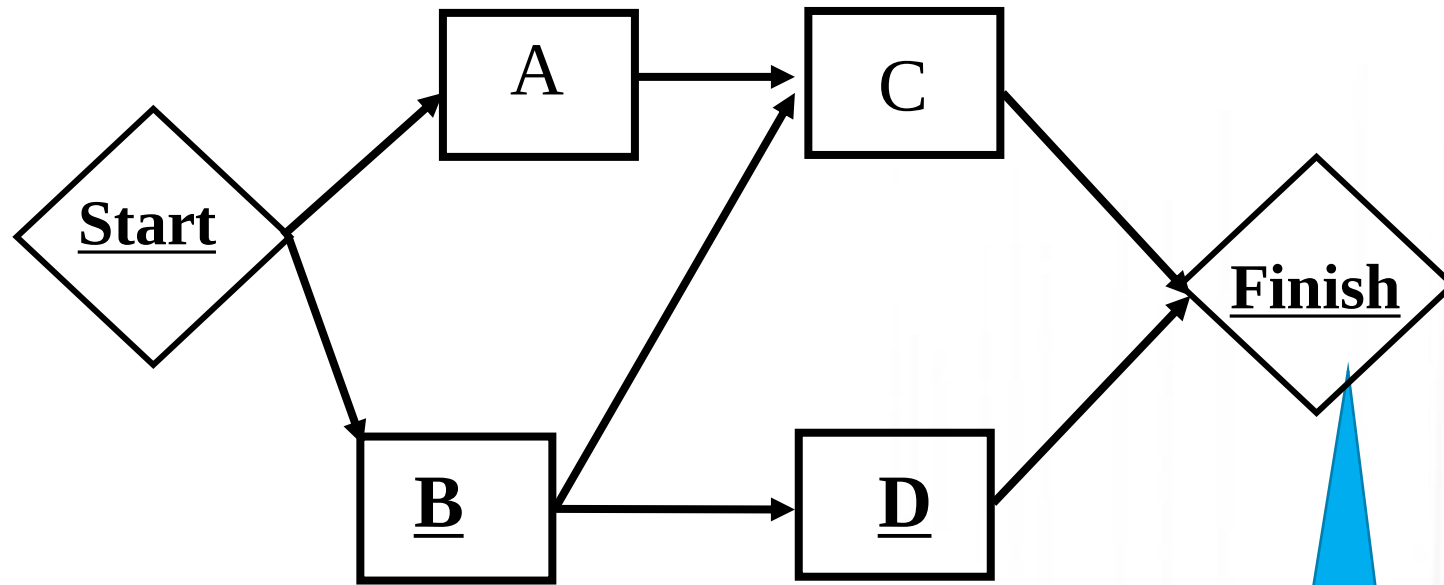


The following packages are networked in sequence ..
Layout, Pre-Press, Print and Mail.

Building the network



From Work Package to Network



A and B execute in parallel

Project does not Finish unless C and D both are complete

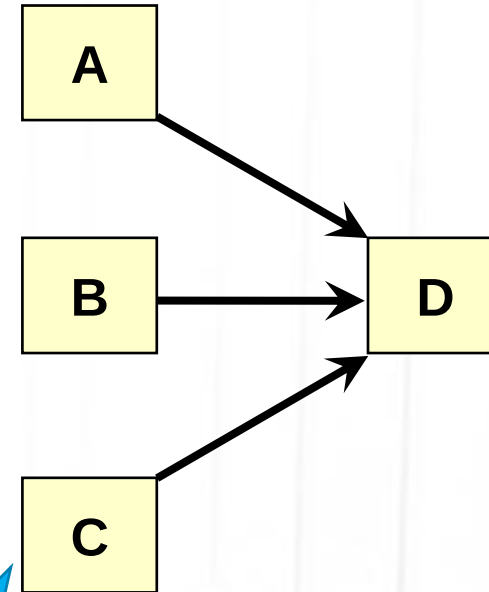
Constructing a Project Network

Activity or task:

**An element of the project
that requires time**

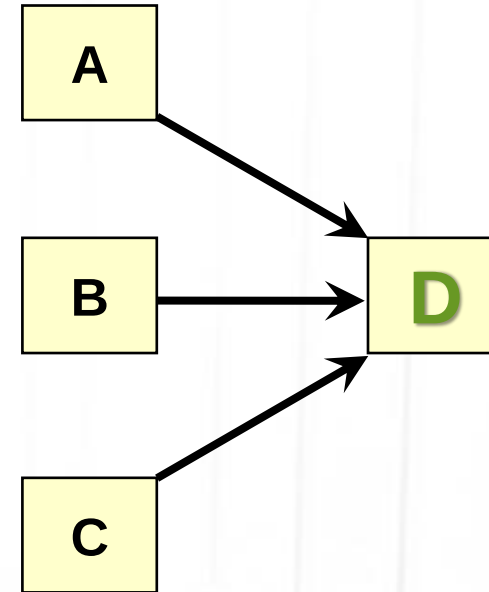
Milestones are shown as diamonds and do
NOT consume any time.
Start and Finish are examples of Milestones

A, B and C
are activities



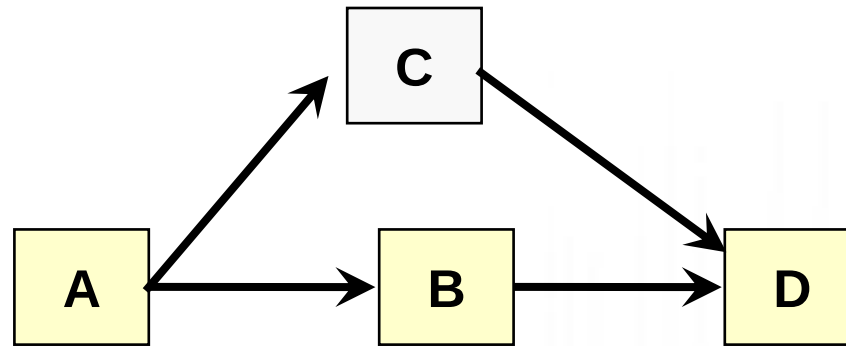
The all-knowing, all-important “Arrow”

D cannot start until
A, B, and C have
been *completed*



Path

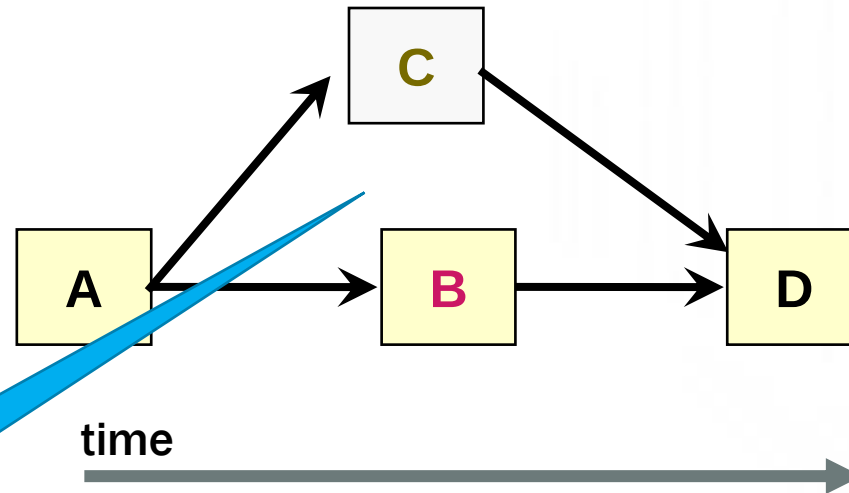
A sequence of connected, dependent activities.



There are two paths
– ACD and ABD

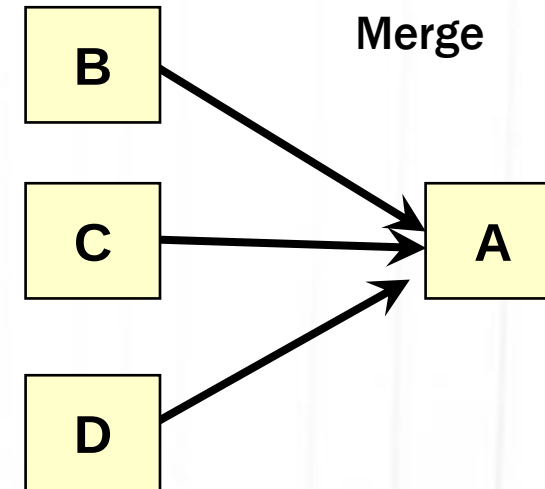
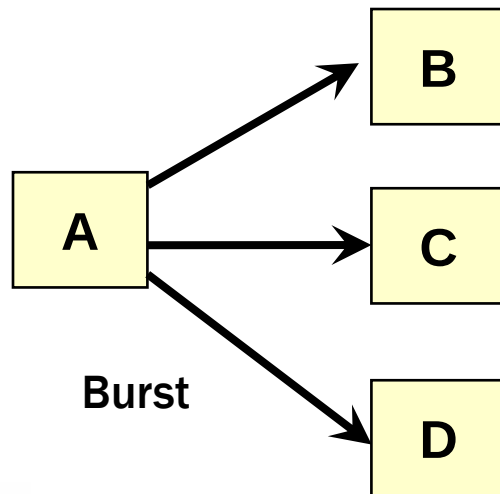
Parallel Activities

Activities that can occur at the same time. (If desired)



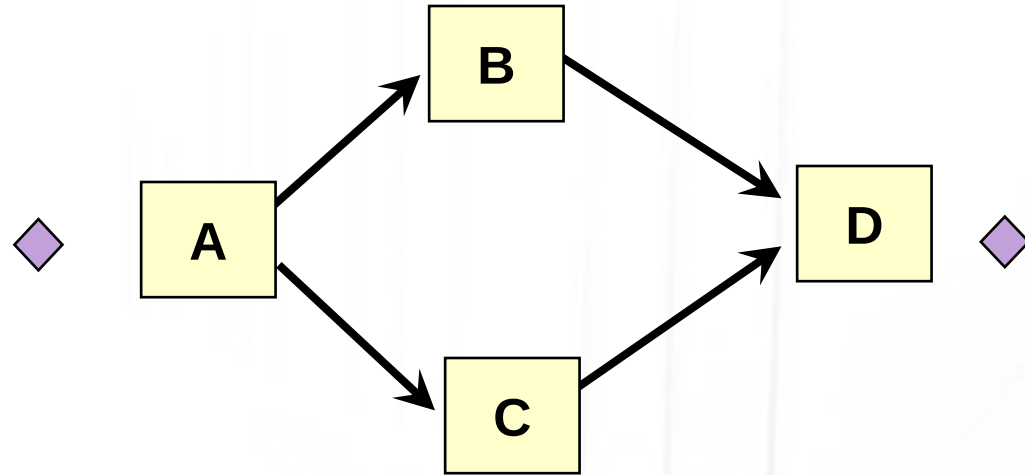
B and C can
run at the
same time

Bursts and Merges



Simple Example with Burst & Merge

Activity	Predecessor	Time
A	None	5
B	A	15
C	A	10
D	B,C	30

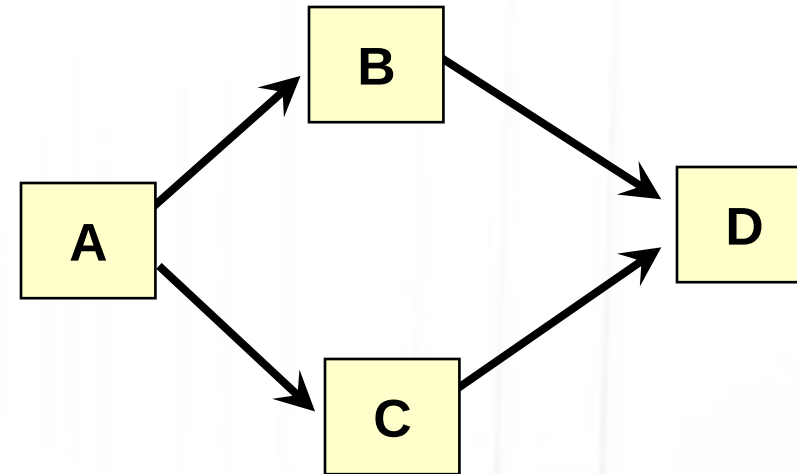


Note: Start and End milestones are not always shown

You should gain the skill of going from the table on the left to the diagram on the right, in particular if you are interested in attaining the PMP® credential.

Goal – Calculate the Critical Path

Activity	Predecessor	Time
A	None	5
B	A	15
C	A	10
D	B,C	30



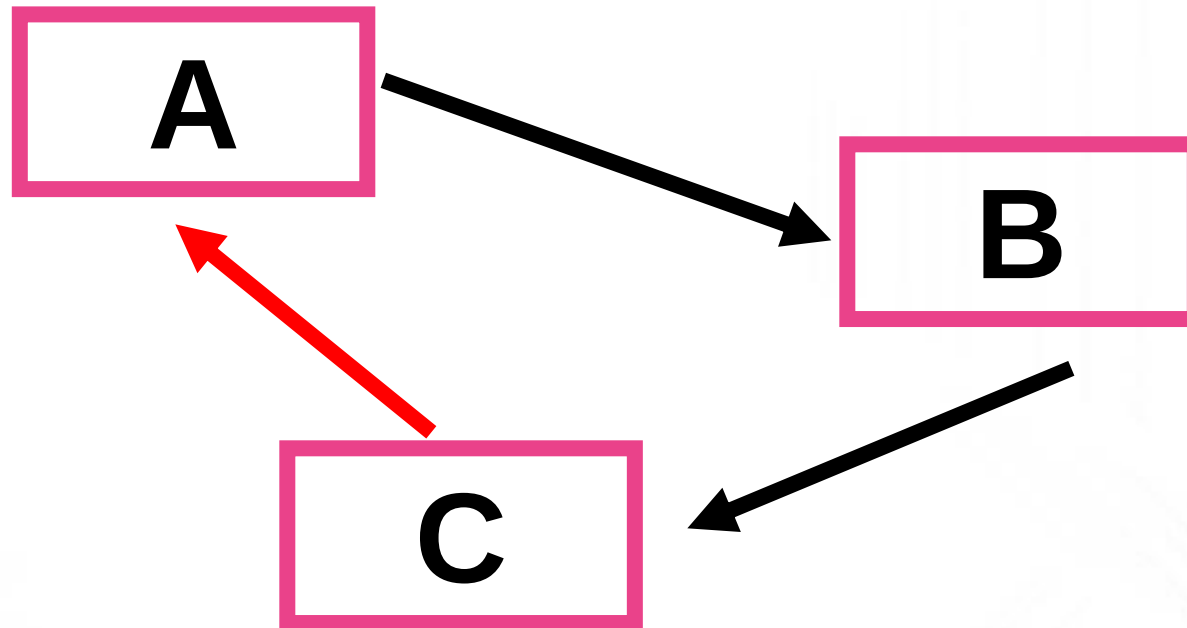
Basic Network Rules

- Networks typically flow from left to right. Time is generally represented left to right, but not on a detailed scale. TIME comes later. COST comes last – in general.
- An activity cannot begin until all of its predecessor activities are complete.
- Arrows indicate precedence and flow and can cross over each other.

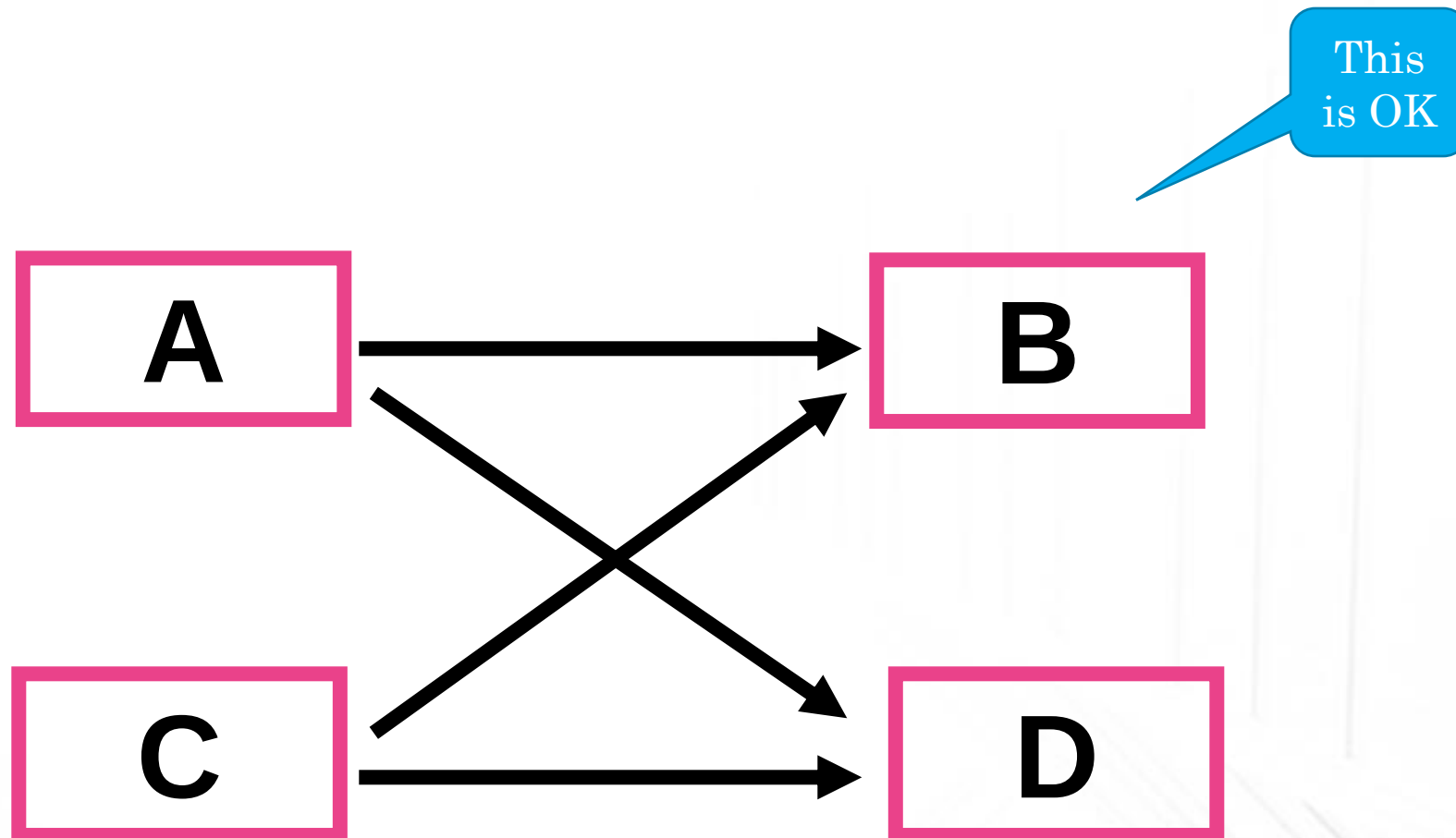
Basic Network Rules

- Identify each activity with a unique name, often in exercises these will be letters.
- Looping is not allowed.
- Conditional statements (if-then) are not allowed. That's for flow charts. Network Diagrams are NOT flow charts, they are drawings showing sequences of activities to get to an end date.
- Use common start and stop nodes.

No. Nope. Don't do that.



Arrows May Cross



Network Computation Process

- Forward Pass Yields the Earliest Times
 - **How soon can the activity start?**
 - Earliest start — ES
 - **How soon can the activity finish?**
 - Earliest finish — EF

Network Computation Process

Backward Pass — yields the Latest Times

- **How late can the activity start?**
 - **Latest start — LS**
- **How late can the activity finish?**
 - **Latest finish — LF**
- **Which activities represent the critical path?**
- **How long can the task be delayed?**
 - **Slack or float — F**

A common notation for labeling tasks with detail

Early Start Duration Early Finish

ES	DUR	EF
Task Name		
LS	F	LF

Late Start Float/Slack Late Finish

Forward Pass Computation*

- Add activity times along each path in the network ($ES + \text{Duration} = EF$).
- Carry the early finish (EF) to the next activity where it becomes its early start (ES) *unless...*
- The next succeeding activity is a merge activity, in which case the largest EF of all preceding activities is selected.

*In the “1” method I will show you , instead of starting at “Day 0” or “Week 0” we start with Day 1 or week 1, so we’ll subtract 1 from this total in the forward pass. This will become clearer in the upcoming animation.

Backward Pass Computation

- Subtract activity times along each path in the network (LF - Duration = LS).
- Carry the late start (LS) to the next activity where it becomes its late finish (LF) *unless*
- The next succeeding activity is a burst activity, in which case the smallest LF of all preceding activities is selected.

*In the “1” method I will show you , instead of starting at “Day 0” or “Week 0” we start with Day 1 or week 1, so we’ll add 1 from this total in the backward pass. This will become clearer in the upcoming animation.

Determining Slack (or Float)

- **Slack (or Float)**
 - The amount of time an activity can be delayed after the start of a longer parallel activity or activities.
- **Total slack**
 - The amount of time an activity can be delayed without delaying the entire project.

Dependencies

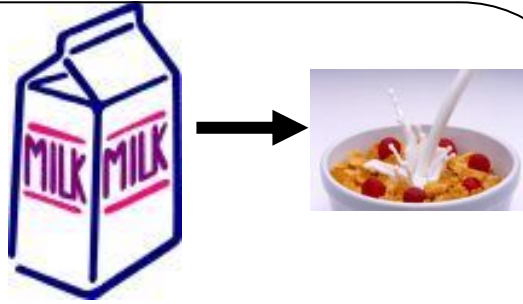
- Usually are “finish to start”
- Show how the tasks relate
- i.e. **First coat must be dry** before **second coat is applied**

(finish)

(start)

Precedence Relationships (Dependencies)

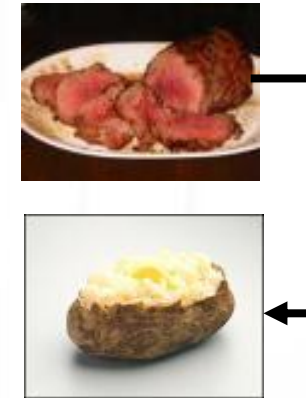
FS: You finish opening the milk carton before you start pouring it.



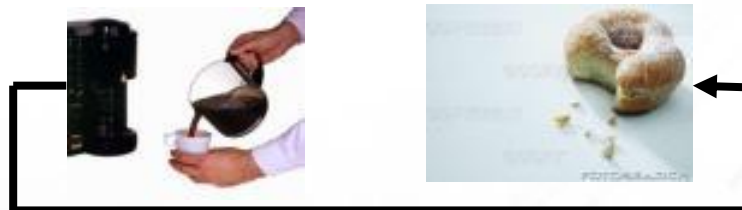
SS: You start your coffee at the same time you start your toast.



FF: Your main course must finish cooking at the same time as the side dish finishes.



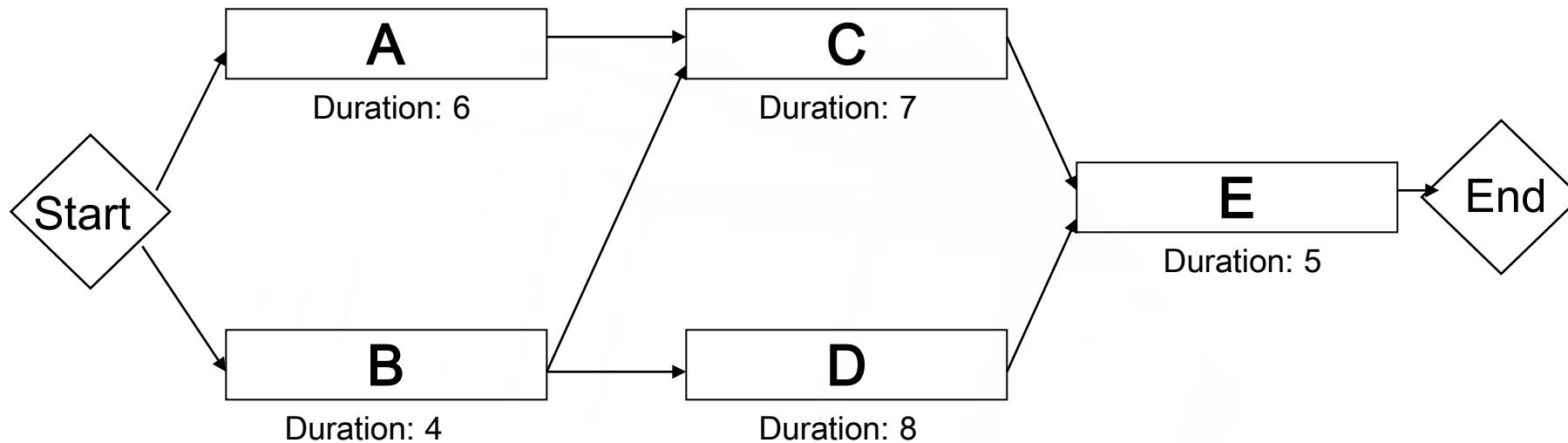
SF: (very rare): I won't finish eating the donut until you start pouring the coffee.



List of Tasks – creating the network diagram

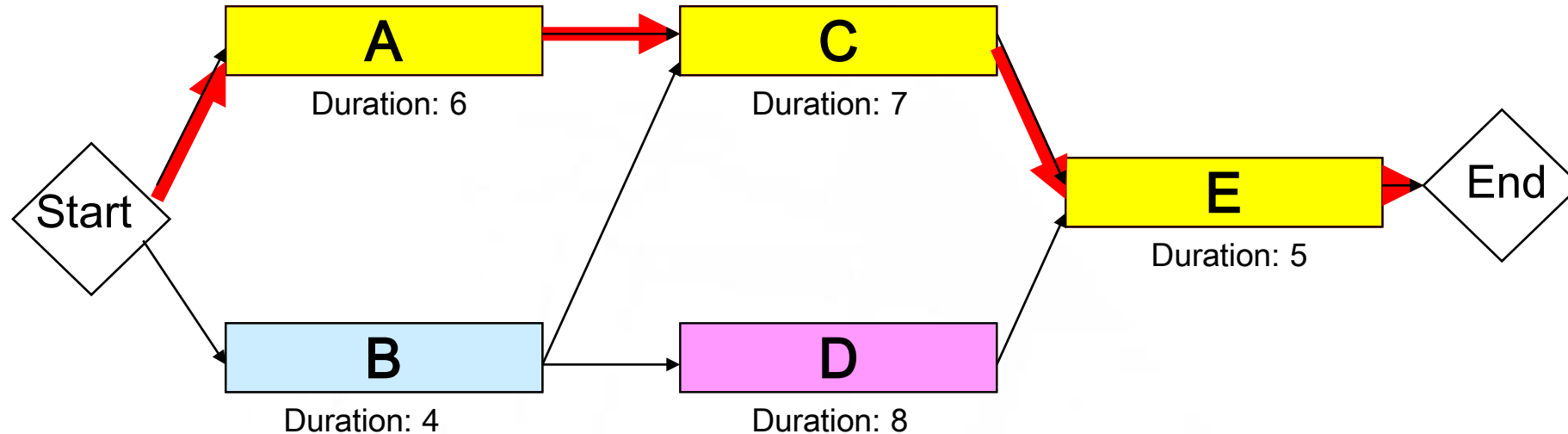
<u>Task Name</u>	<u>Duration</u>	<u>Predecessors</u>
Start	0	None
A	6	Start
B	4	Start
C	7	A and B
D	8	B
E	5	C and D
End	0	E

A basic network diagram



A basic network diagram – finding the critical path

Note: this slide is intended to be viewed in PowerPoint SlideShow mode



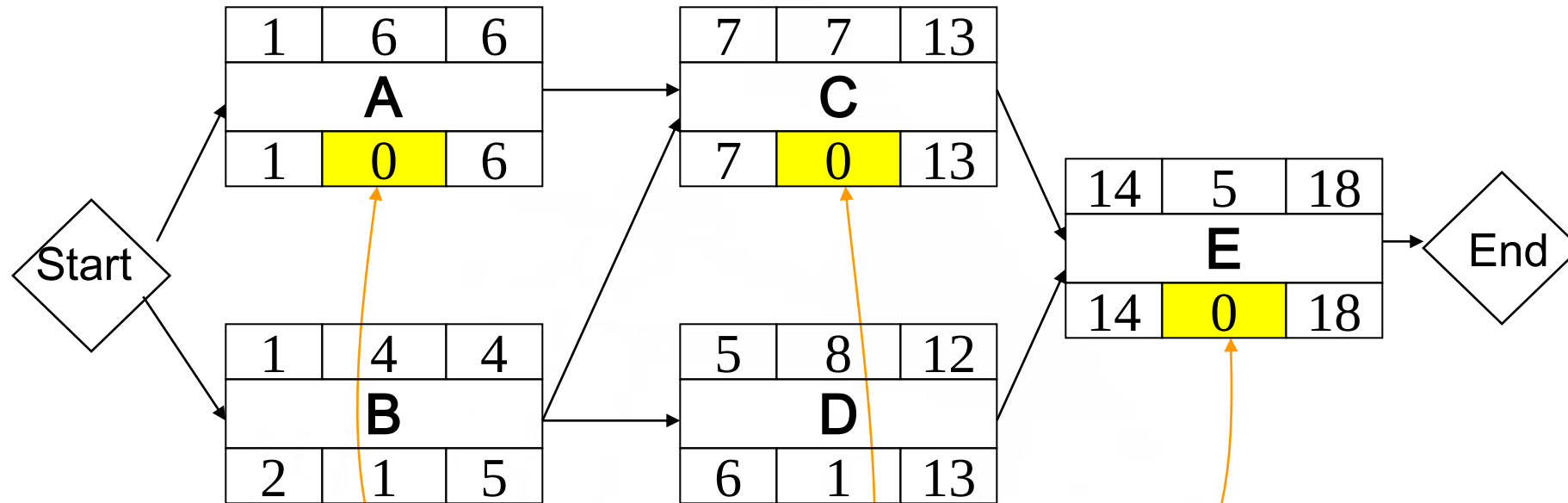
Path **Start - A - C - E - End** has duration 18

Path **Start - B - C - E - End** has duration 16

Path **Start - B - D - E - End** has duration 17

So the longest path through the network is **Start-A-C-E-End**. This is the critical path, and the shortest time in which the overall project can be completed is 18. The critical path is usually highlighted in bold or in red.

Calculating the forward and backward pass



Observe that the critical path will have float of 0

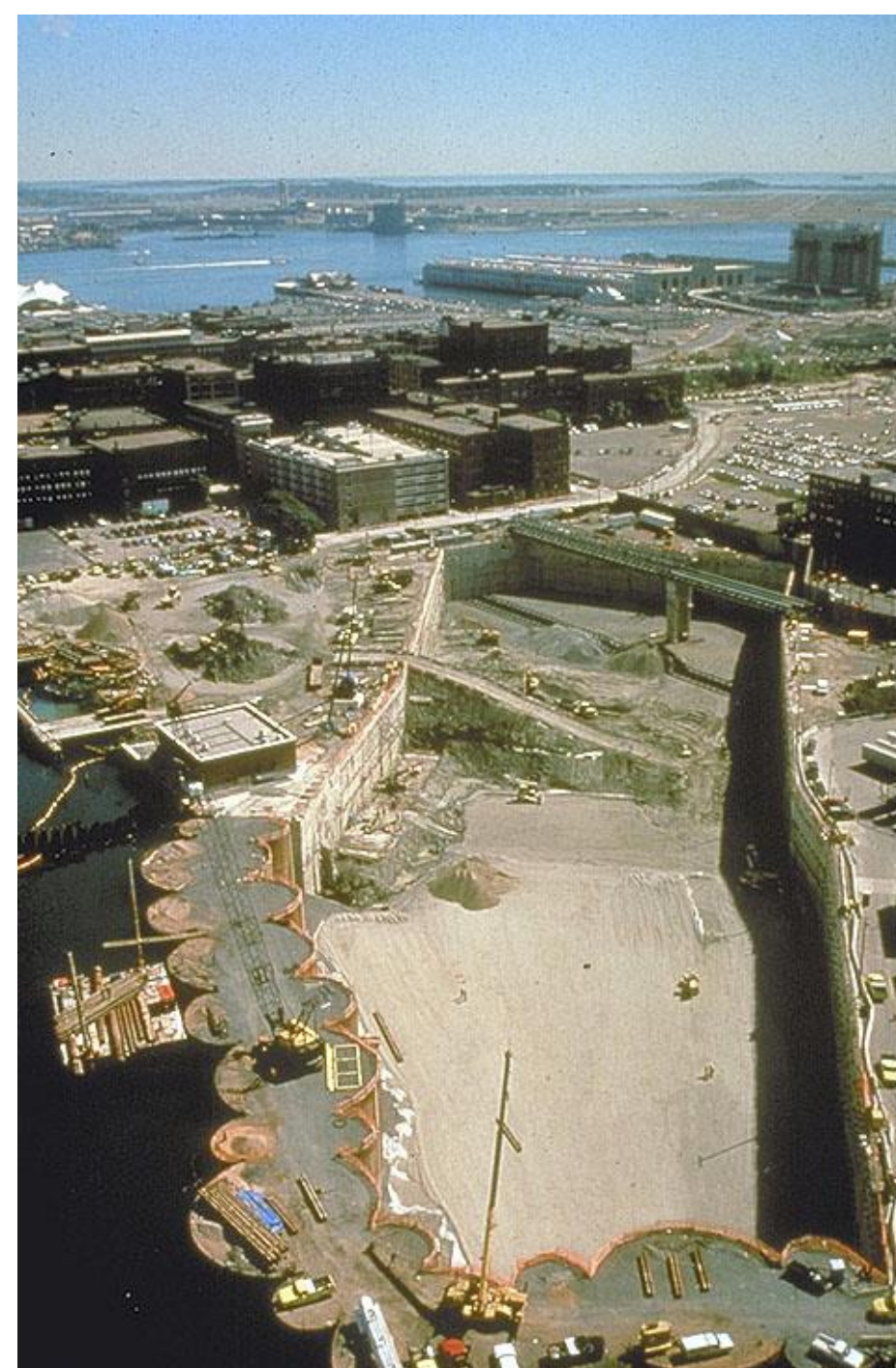
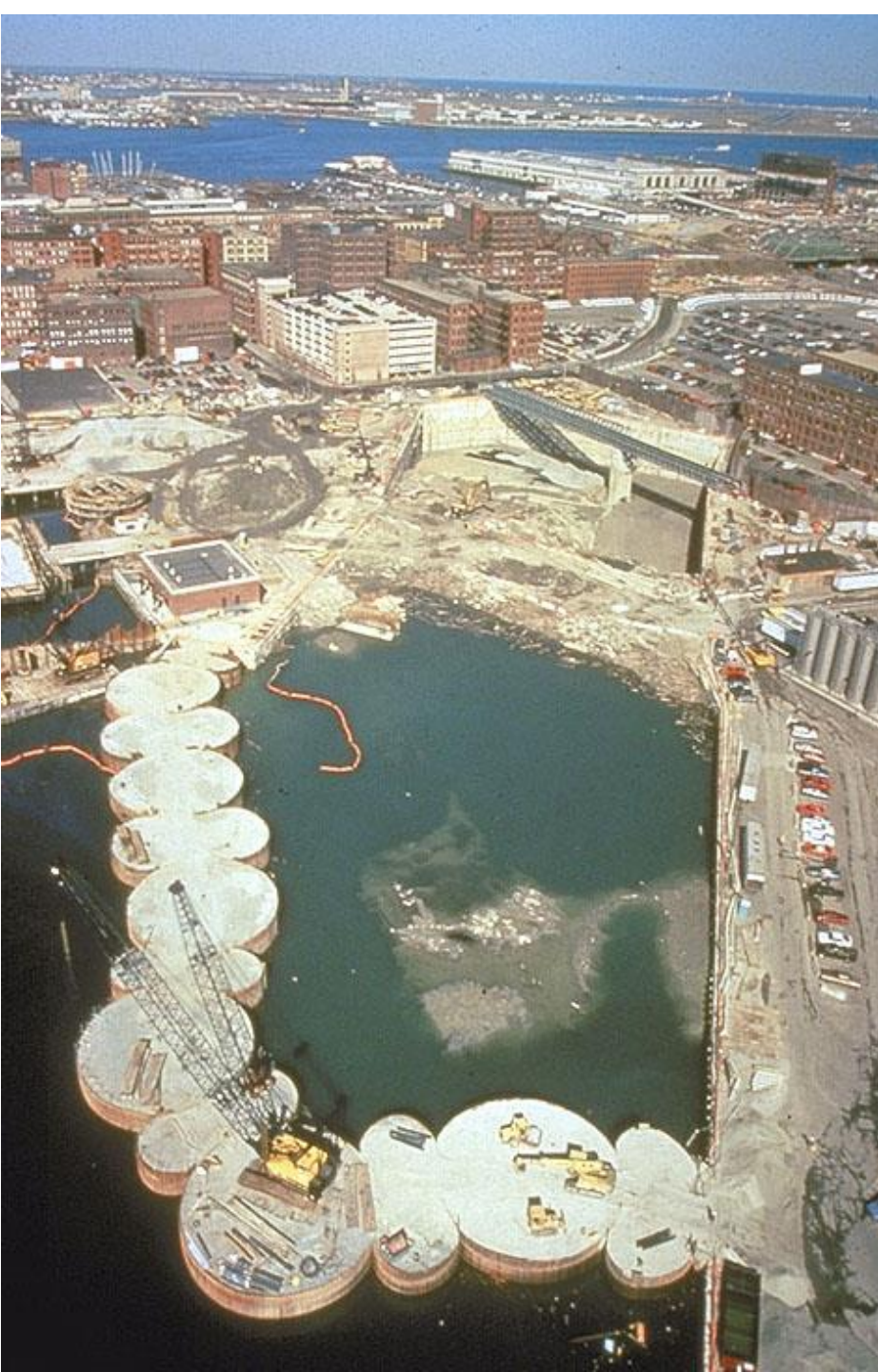
This slide is intended to be viewed in Powerpoint SlideShow mode
This slide uses the CPM 1 method

Key

Early Start	Duration	Early Finish
ES	DUR	EF
Task Name		
LS	F	LF
Late Start	Float/Slack	Late Finish

Critical Path

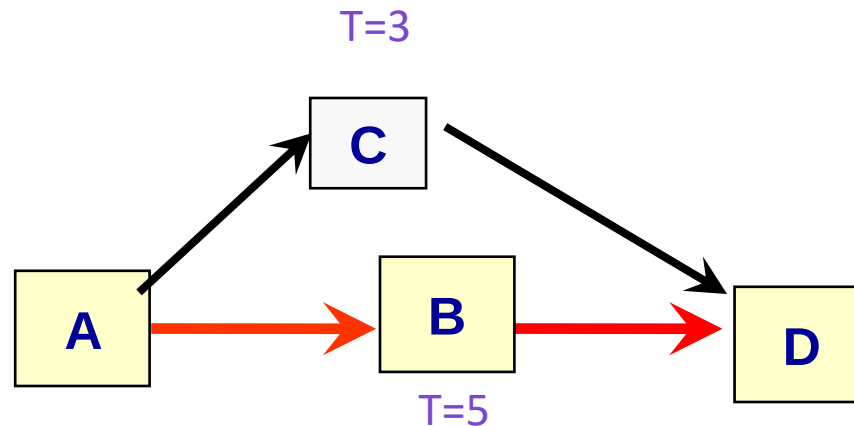
- The network path(s) that has (have) the least slack in common.
- It is the longest path through the network.
- The tasks on the Critical Path are critical from a TIME perspective
- More than one Critical Path is possible especially in large projects. This introduces more risk because more tasks are time-critical to the project's end-date.



The Big Dig Fort Point Channel
Source:
Greiman, V. A. (2013)
Megaproject
Management:
Lessons on Risk and
Project Management
from the Big Dig, John
Wiley & Sons,
Publisher, Hoboken,
NJ

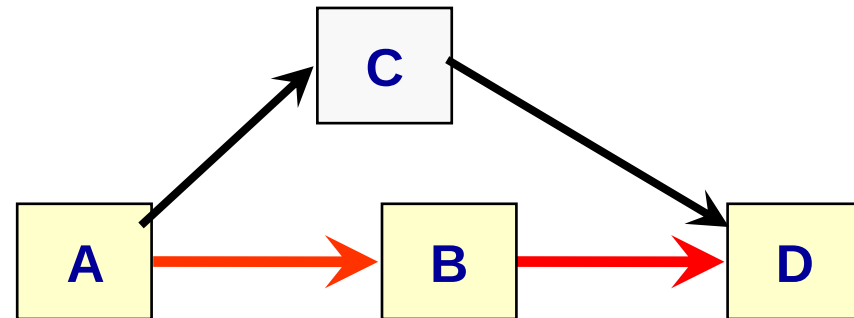
Critical Path

- the longest path through the network that allows for the completion of all activities
- the shortest expected time in which the entire project can be completed. Delays on the critical path will delay completion of the entire project.



Critical Path ~ 10%

- Assign best people to critical activities
- Prioritize (and eliminate) critical activities
- Risk assessment on critical activities
- Visit people working on critical activities
- Can I borrow Joe?
- Overtime, technology
- Schedule changes $\pm$
- Roll up non criticals



Free Float versus Total Float (or Float...or Slack)

- Reminder: Float = Slack = Total Float
- Free float is different
 - **FREE FLOAT** is the amount of time you can delay a task without delaying subsequent tasks on that path. It is free of the critical path.

Total Float versus Free Float

- **Total Float:** the total amount of time (float) an activity on the schedule network diagram can be delayed without affecting **the project finish date**
- Total Float is for activities NOT on the critical path
- **Total Float = $LF - EF$ (or $LS - ES$)**
where ES = Early Start, EF = Early Finish, LS = Late Start, LF = Late Finish

- **Free Float:** the amount of time (float) an activity on the schedule network diagram can be freely delayed without affecting **the early start of the of following/successor activity**
- Free Float is also for activities NOT on the critical path
- Free Float can only be non-zero when two or more activities have a common successor activity
- **Free Float = ES of successor activity - EF** *where ES = Early Start, EF = Early Finish*

Credit: <https://edward-designer.com/web/free-float-vs-total-float-for-pmp-exam>

Other Dependencies

- A mandatory dependency is based on the nature of the work.
- A discretionary dependency is based on a best practice or preferred way of doing something.
- An external dependency is based on relationships outside the project.

Extended Network Techniques: Laddering

- **Activities are further decomposed into pieces of work that may be able to start early (lead) and prevent or reduce delay of the work**

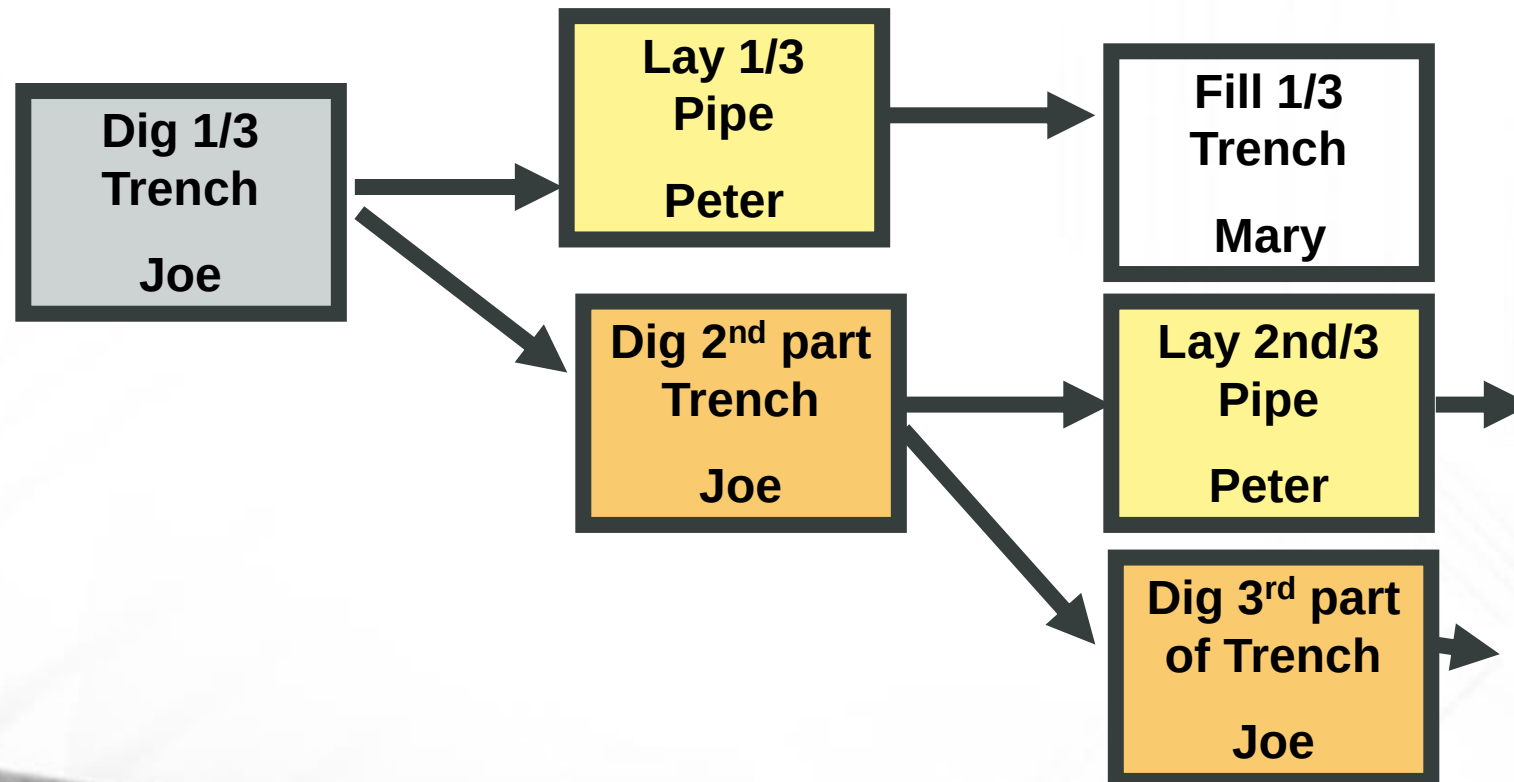
Example of Laddering



If you have three workers (resources), each assigned to one task, waiting for the first task (Dig Trench) **to be 100% complete** before you start the next task (Lay Pipe) is too restrictive – and this would promulgate through the network to *Fill Trench*.

Example of Laddering

So when the first task (dig hole) is 33% complete you start the next task (lay pipe), and so forth.



Extended Network Techniques: Lags

Definition of a Lag: The minimum amount of time a dependent (successor) activity must be delayed to begin or end.

- **Make this easy to understand by thinking about it in *natural* terms: glue drying, grass growing, cement hardening**
- **Lengthy activities are broken down to reduce the delay in the start of successor activities.**

Use of Lags

Finish-to-Start Lag



Typical:

e.g., Ordering Materials

- Order Activity is 1 day
- Material takes 5 days to arrive
- Then you assemble in one Day.

Project Duration is LONG but Effort is only 2 days.

Use of Lags

Start-to-Start Relationship

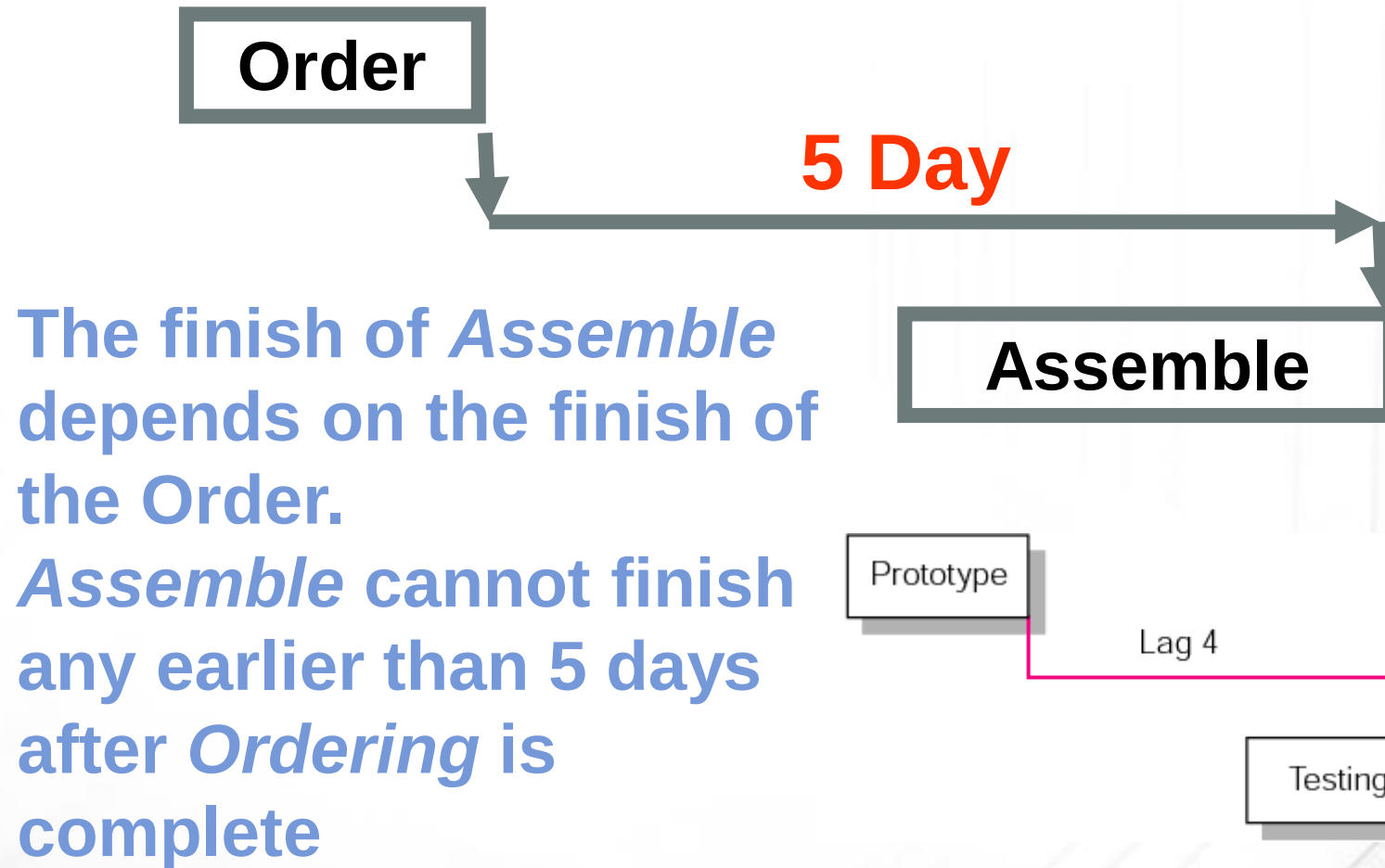


Assemble cannot begin until 5 days after *Order* begins. You can begin *Assemble* after a portion of the items (if they're the right ones) arrive.

e.g., pipe laying, partial design

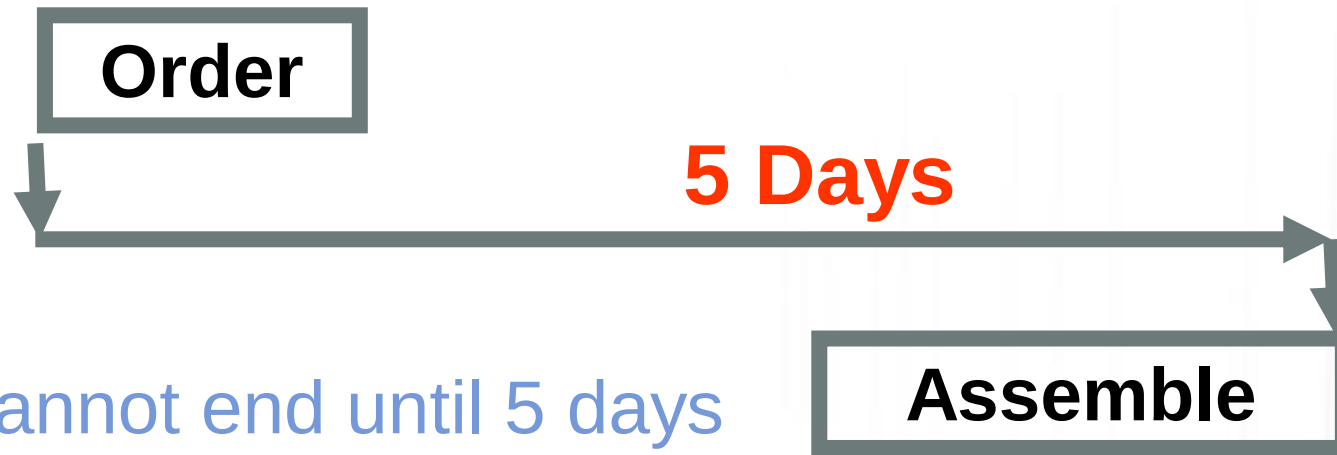
Use of Lags

Finish-to-Finish Relationship



Use of Lags

Start-to-Finish Relationship



Assemble cannot end until 5 days after *Ordering* has started.

(Because information to *Assemble* is available after the first 5 days of *Ordering*.)

Next Week: Week 6

Lecture 6: Cost Estimation and Schedule Estimation

Zoom Room Meetings 4:30 – 5:15

**Today you will work on Team Assignment 3
in the Live Class!**

**For Assignment 3 you will prepare the
network diagram by hand incorporating the
WBS activities into your schedule.**