Project Management

2UCC701

August 2022- December 2023

Module 3 : **Project Management Knowledge areas (12)**

CO3 : Understand Practices, Tools & Techniques in the area of Project Management.

- Project Integration Management
- Project Scope Management
- Project Time Management
- Project Cost Management
- Project Quality Management
- Project Human Resource Management
- Project Communication Management
- Project Risk Management
- Project Procurement Management

Module 3 : **Project Management Knowledge areas (9)**

Project Integration Management
Project Plan Development
Project Plan Execution
Integrated Change Control

Project Scope Management
Initiation
Scope Planning
Scope Definition
Scope Verification
Scope Change Control

Project Time Management
Activity Definition
Activity Sequencing
Activity Duration Estimating
Schedule Development
Schedule Control

Project Cost Management
Resource Planning
Cost Estimation
Cost Budgeting
Cost Control

Project Quality Management
Quality Planning
Quality Assurance
Quality Control

Project Human Resource Management
Organizational Planning
Staff Acquisition
Team Development

Project Communication Management
Communication Planning
Information Distribution
Performance Reporting
Administrative Disclosure

Project Risk Management
Risk Management Planning
Risk Identification
Qualitative Risk Analysis
Quantitative Risk Analysis
Risk Response Planning Risk Monitoring & Control

Project Procurement Management
Procurement Planning
Solicitation Planning
Solicitation
Source Selection
Contract Administration
Contract Closeout

Project Time Management

Major Processes:

- Activity Definition
- Activity Sequencing
- Activity Duration Estimation
- Schedule Development
- Schedule Control
- Gantt chart---

Project Time Management

Activity Definition

- **Inputs:**
  - Work Breakdown Structure
  - Scope Statements
  - Historical Information
  - Constraints
  - Assumptions
  - Expert Judgement
- **Tools & Techniques:**
  - Decomposition
  - Templates
- **Outputs:**
  - Activity List
  - Supporting Details
  - Work Breakdown structure updates

Project Time Management

Activity Definition

- **Work Breakdown Structure (WBS):** "A work breakdown structure defines all the things a project needs to accomplish, organized into multiple levels, and displayed graphically
- **Steps to create WBS**
    1. Define the project goals and objectives. Begin with the project charter—the scope, objectives and who is participating in the project—determine what it is and describe it.
    2. The next level down is the project phases: break the larger project statement of intent into a series of phases that will take it from conception to completion.
    3. What are your deliverables? List them all and note what is necessary for those deliverables to be deemed successfully delivered (sub-deliverables, work packages, resources, participants, etc.).
    4. Take your deliverables from above and break them down into every single task and subtask that is necessary to deliver them. Make a list of all those tasks.
    5. With the tasks now laid out, assign them to the team. Give each team member the tools, resources and authority they need to get the job done.

Activity Definition

- **Benefits of WBS Software**
  - Organize Deliverables and Tasks
  - Set Schedule Baselines
  - Visualize Project Schedule
  - List Subtasks and Dependencies
  - Estimate Each Task Duration
  - Identify Project Phases

Project Time Management

Activity Definition

- **Inputs:**
  - Work Breakdown Structure
  - **Scope Statements:** The project justification & project objectives contained in the scope statement must be considered explicitly during activity definition
  - Will contain explicitly **Project justification** (business needs that the project is undertaken to address), **Project's product** (characteristics of product or services that the project is undertaken to create), **Project deliverables** (list of summary level subproducts whose full or satisfactory delivery marks completion of the project), **Project Objectives** (quantifiable criteria that must be met for the project to be considered successful such cost, schedule & quality measures)

Project Time Management

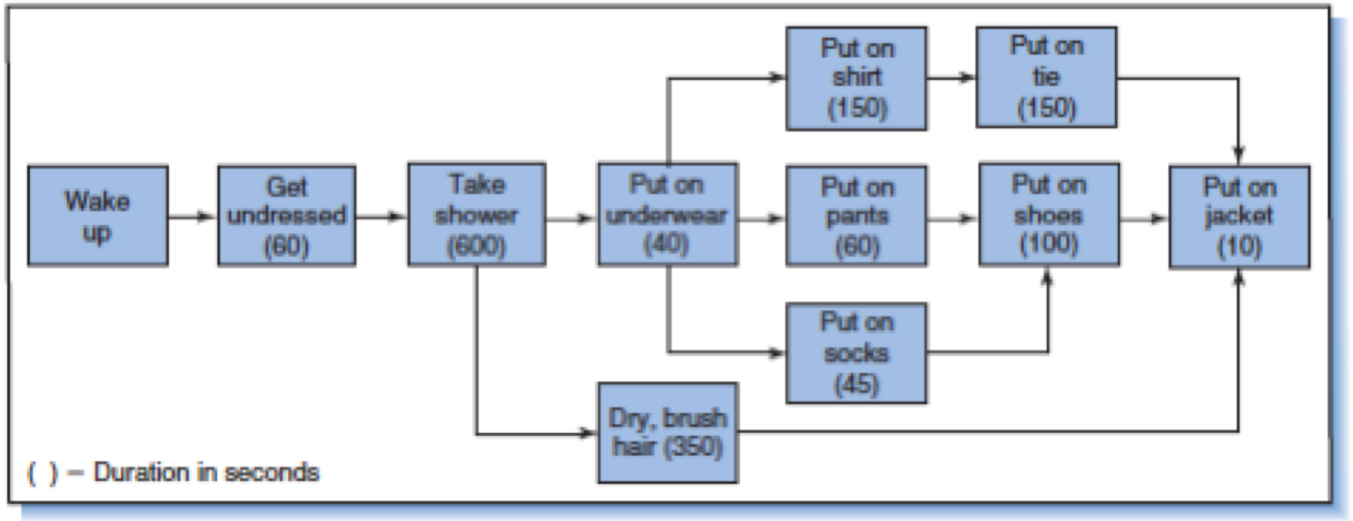
Activity Definition

- **Inputs:**
  - Work Breakdown Structure
  - Scope Statements
  - **Historical Information:** what activities were actually required on previous similar projects should be considered in defining project activities.
  - **Constraints:** factors that will limit the project management team's options (such as maximum activity duration, number of resources etc.)
  - Assumptions:
  - Expert Judgement

Project Time Management

Activity Definition

Logic diagram for getting up and getting dressed.



Project Time Management

Activity Definition

Table 6-1 Activities and immediate predecessors.

Activity	Immediate Predecessors	Duration (Seconds)
Get undressed	—	60
Take shower	Get undressed	600
Put on underwear	Take shower	40
Dry, brush hair	Take shower	350
Put on shirt	Put on underwear	150
Put on pants	Put on underwear	60
Put on socks	Put on underwear	45
Put on tie	Put on shirt	150
Put on shoes	Put on pants	100
	Put on socks	
Put on jacket	Put on tie	150
	Put on shoes	
	Dry, brush hair	

Project Time Management

Activity Defini

Table 6-3 Activities and immediate predecessors for LOGON project.

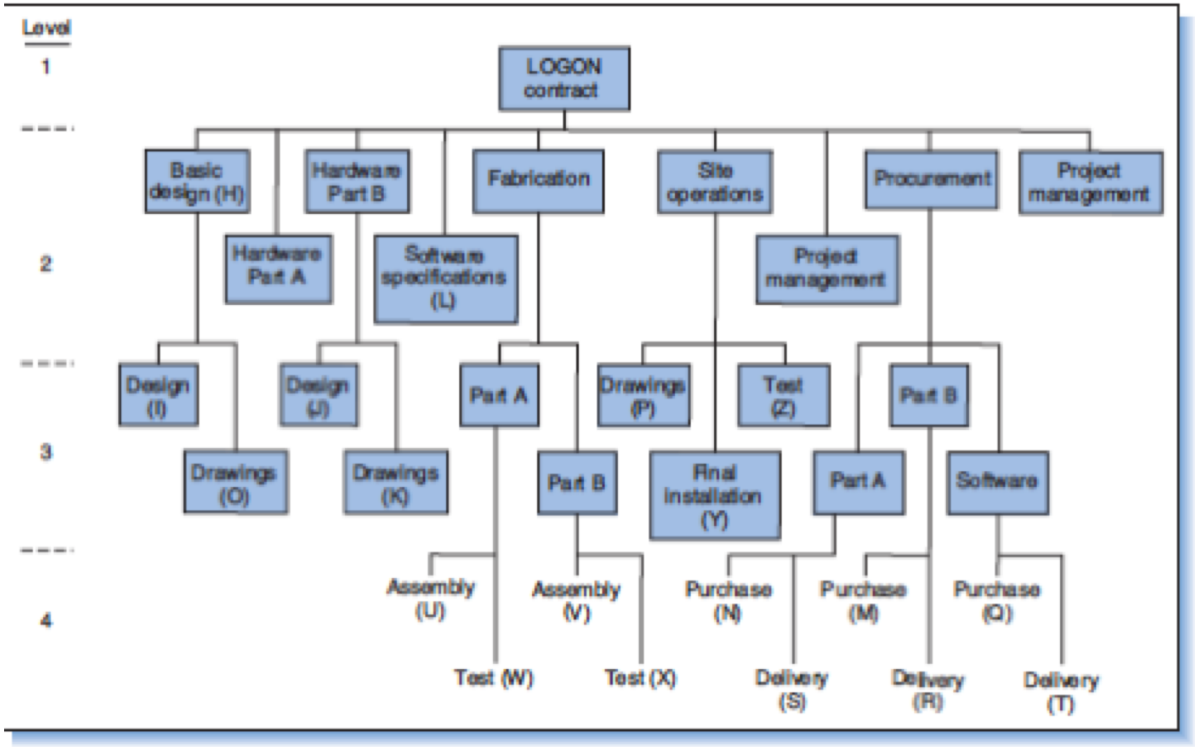
Activity	Description	Immediate Predecessors	Duration (Weeks)
H	Basic design	—	10
I	Hardware design for A	H	8
J	Hardware design for B	H	6
K	Drawings for B	J	4
L	Software specifications	J	2
M	Parts purchase for B	J	4
N	Parts purchase for A	I	4
O	Drawings for A	I	5
P	Installation drawings	I, J	5
Q	Software purchases	L	5
R	Delivery of parts for A	M	5
S	Delivery of parts for B	N	3
T	Software delivery	Q	3
U	Assembly of A	O, S	1
V	Assembly of B	K, R	5
W	Test A	U	2
X	Test B	V	3
Y	Final installation	P, W, X	8
Z	Final system test	Y, T	6

*Work packages from WBS, Figure 5-5.

Project Time Management

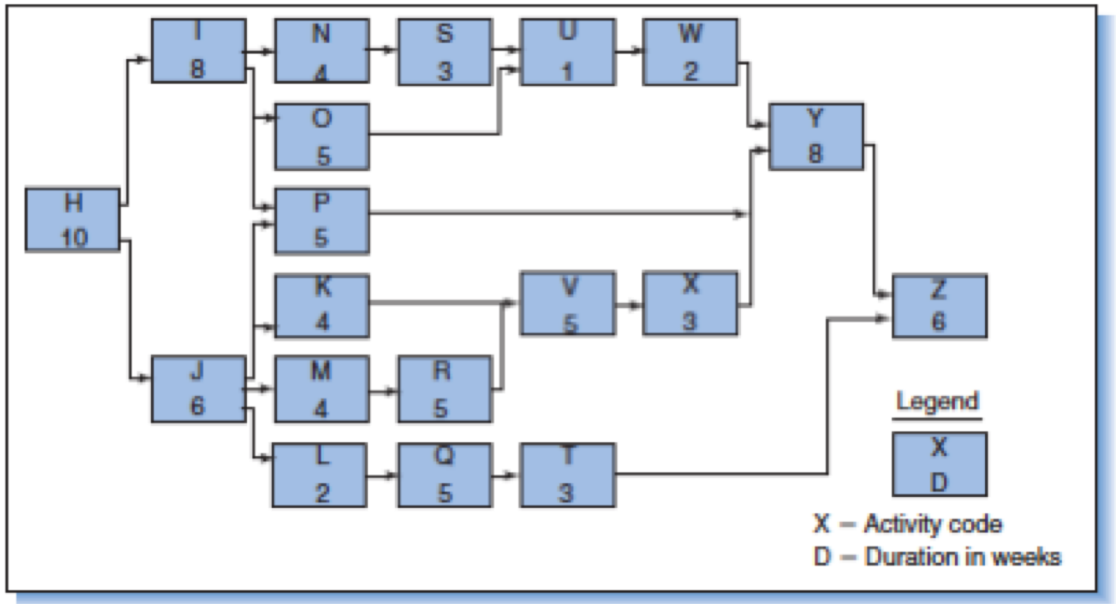
Activity Definition

WBS for the LOGON project. Work packages are lettered H through Z.



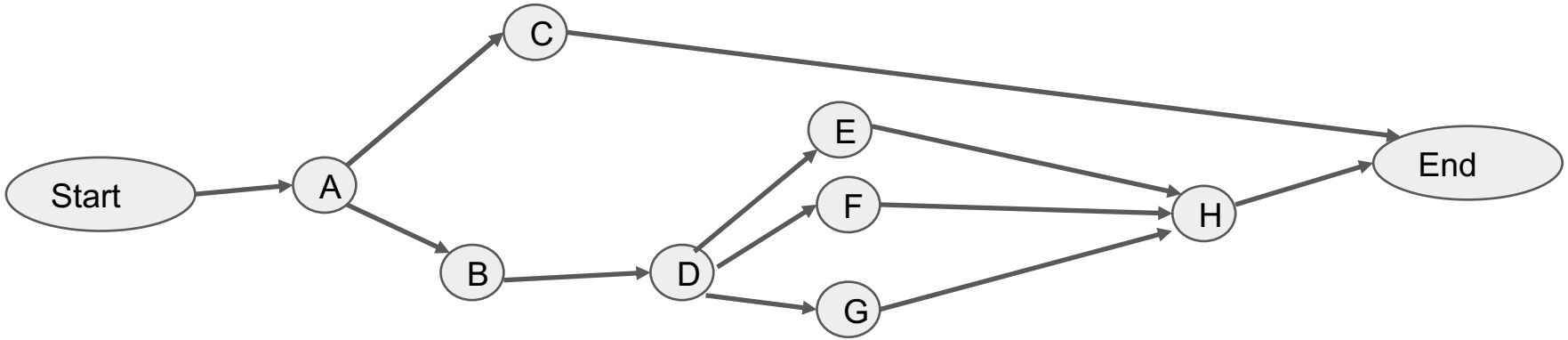
Project Time Management

Activity Definition AON



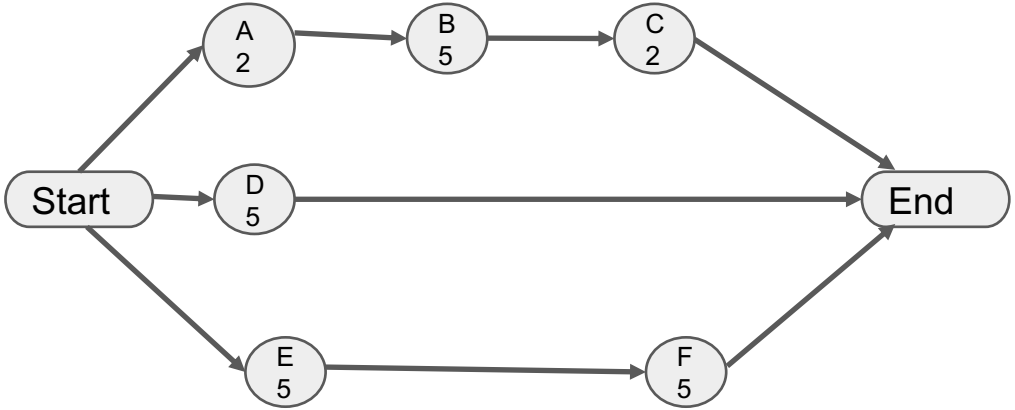
AON diagrams

Activity	Immediate Predecessor
A	—
B	A
C	A
D	B
E	D
F	D
G	D
H	E, F, G

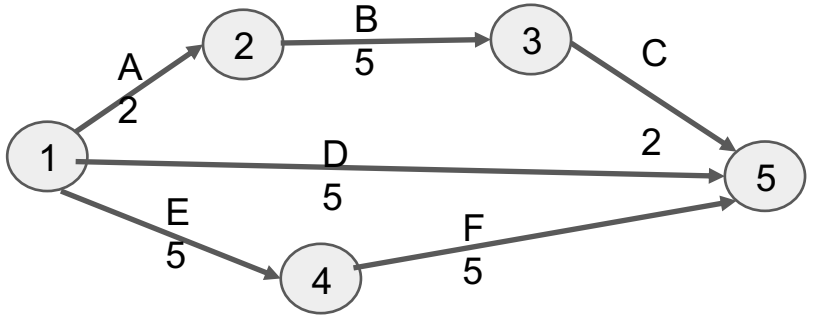


AON & AOA diagrams

Activity	Immediate Predecessor	Duration
A	-	2
B	A	5
C	B	2
D	-	5
E	-	5
F	E	5



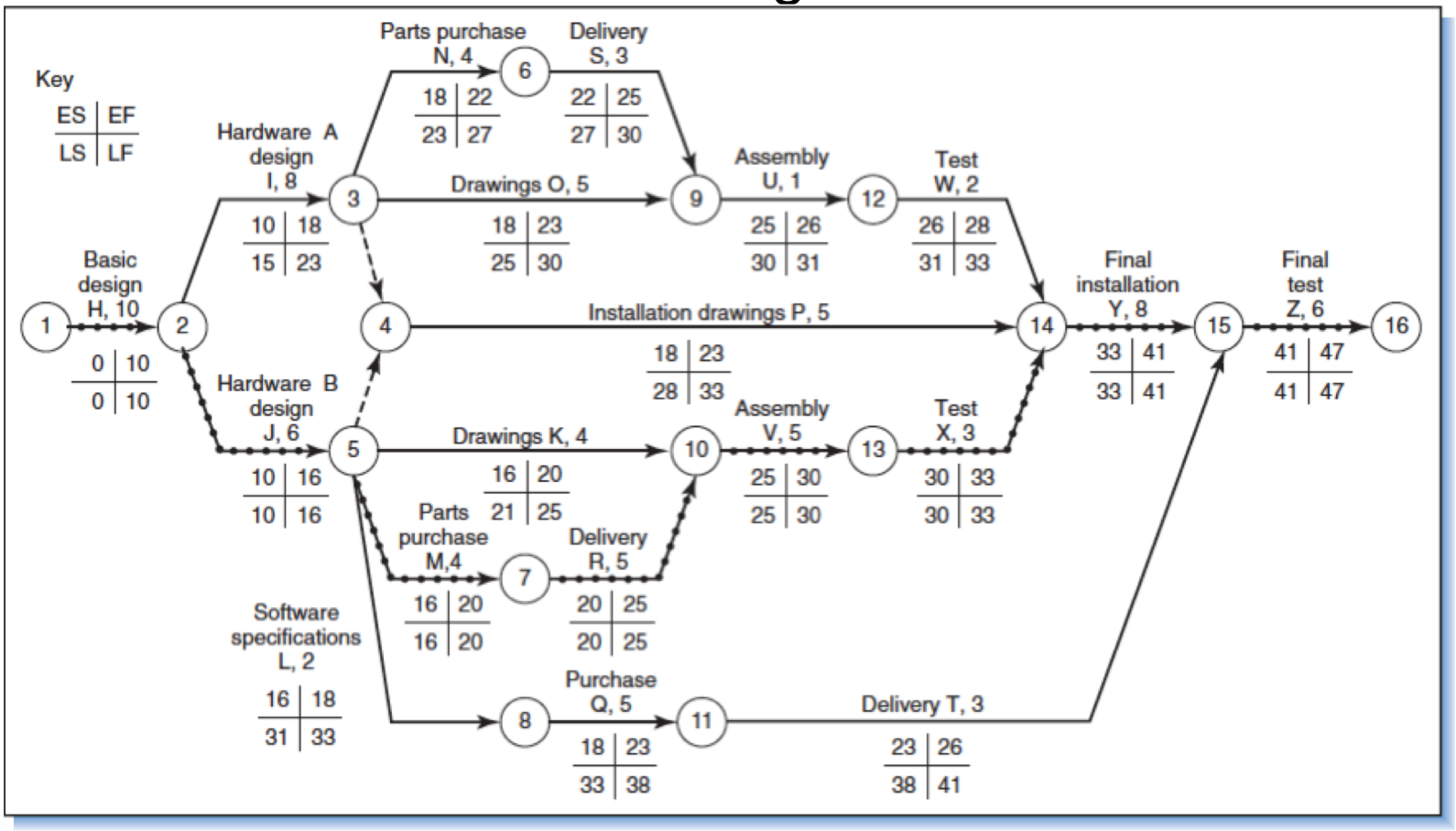
AON diagram



AOA diagram

Task ID	Imd Pred	Duration	ES	EF	LS	LF
H	-	10	0	10	0	10
I	H	8	10	18	15	23
J	H	6	10	16	10	16
K	J	4	16	20	21	25
L	J	2	16	18	31	33
M	J	4	16	20	16	20
N	I	4	18	22	23	27
O	I	5	18	23	25	30
P	I,J	5	(16,18) 18	23	28	33
Q	L	5	18	23	33	38
R	M	5	20	25	20	25
S	N	3	22	25	27	30
T	Q	3	23	26	38	41
U	O,S	1	(23,25) 25	26	30	31
V	K,R	5	(20,25) 25	30	25	30
W	U	2	26	28	31	33
X	V	3	30	33	30	33
Y	P,W,X	8	(23,28,33) 33	41	33	41
Z	Y,T	6	41	47	41	47

AOA diagram


Key
ES | EF
LS | LF
Basic design H, 10
0 | 10
0 | 10
Hardware A design I, 8
10 | 18
15 | 23
Hardware B design J, 6
10 | 16
10 | 16
Parts purchase N, 4
18 | 22
23 | 27
Delivery S, 3
22 | 25
27 | 30
Drawings O, 5
18 | 23
25 | 30
Assembly U, 1
25 | 26
30 | 31
Test W, 2
26 | 28
31 | 33
Installation drawings P, 5
18 | 23
28 | 33
Drawings K, 4
16 | 20
21 | 25
Assembly V, 5
25 | 30
25 | 30
Test X, 3
30 | 33
30 | 33
Parts purchase M,4
16 | 20
16 | 20
Delivery R, 5
20 | 25
20 | 25
Software specifications L, 2
16 | 18
31 | 33
Purchase Q, 5
18 | 23
33 | 38
Delivery T, 3
23 | 26
38 | 41
Final installation Y, 8
33 | 41
33 | 41
Final test Z, 6
41 | 47
41 | 47
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

Comparison of Late Start & Early Start

Write merits & limitations of AOA & AON

Comparison of Late Start & Early Start

Relationships between tasks

A-----> B

- **Start to Start :**

  B can start ONLY if A has (atleast Started)

- **Start to Finish:**

  B can Finish if A has atleast started

- **Finish to Start:**

  B can start ONLY when A is finished

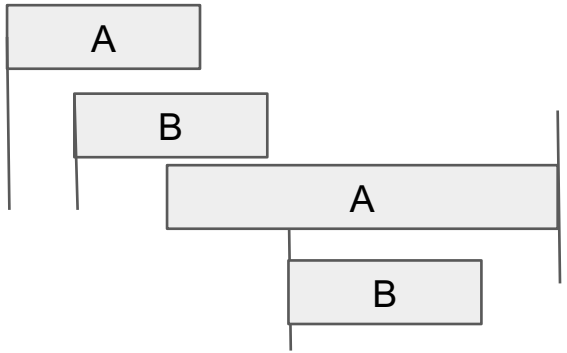
- **Finish to Finish:**

  B can finish only when A is finished (both can finish together)

Relationships between tasks

A-----> B

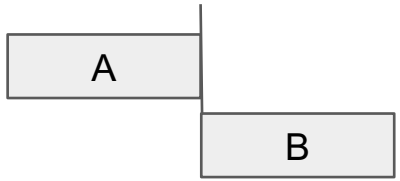
- **Start to Start :**



- **Start to Finish: A**

B can Finish if A has atleast started

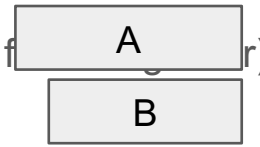
- **Finish to Start:**



B can start ONLY when A is finished

- **Finish to Finish:**

B can finish only when A is finished (both can f r)



Project Time Management

Activity Definition

- **Inputs:**
  - Work Breakdown Structure
  - Scope Statements
  - Historical Information
  - Constraints
  - Assumptions
  - Expert Judgement
- **Tools & Techniques:**
  - Decomposition
  - Templates
- **Outputs:**
  - Activity List
  - Supporting Details
  - Work Breakdown structure updates

Project Time Management

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Project Time Management

Activity Definition

- **Work Breakdown Structure:** "A work breakdown structure defines all the things a project needs to accomplish, organized into multiple levels, and displayed graphically
- **Scope Statements:** Project justification & objectives contained in the scope statement
- **Historical Information:** what activities are actually required from the previous similar projects
- **Constraints:** factors limiting the efforts of project management teams
- **Assumptions:**
- **Expert Judgement:**

- **Tools & Techniques:**
  - **Decomposition**
  - **Templates**
- **Outputs:**
  - **Activity List**
  - **Supporting Details**
  - **Work Breakdown structure updates**

Project Time Management

Major Processes:

- Activity Definition
- Activity Sequencing
- Activity Duration Estimation
- Schedule Development
- Schedule Control
- Gantt chart---

Project Time Management

Activity Sequencing

- **Inputs:**
  - Activity List
  - Product Description
  - Mandatory Dependencies
  - Discretionary Dependencies
  - External Dependencies
  - Milestones
- **Tools & Techniques:**
  - Precedence Diagramming Method (PDM)
  - Arrow Diagramming Method (ADM)
  - Conditional Diagramming Methods
  - Network Templates
- **Outputs:**
  - Project Network Diagram
  - Activity List Updates

Project Time Management

Activity Duration Estimation

- **Inputs:**
  - Activity List
  - Constraints
  - Assumptions
  - Resource requirements
  - Resource capabilities
  - Historical Information
  - Identified Risks
- **Tools & Techniques:**
  - Expert Judgement
  - Analogous Estimating
  - Quantitative based duration
  - Reserve time (Contingency)
- **Outputs:**
  - Activity duration estimates
  - Basis of estimates
  - Activity List Updates

Project Time Management

Schedule Development

- **Inputs:**
  - Project Network Diagram
  - Activity duration estimates
  - Resource requirement
  - Resource pool description
  - Calendar
  - Constraints
  - Assumptions
  - Leads & Lags
  - Risk management plans
  - Activity attributes
- **Tools & Techniques:**
  - Mathematical analysis
  - Duration compression
  - Simulation
  - Resource Levelling heuristics
  - Project management software
  - Coding structure
- **Outputs:**
  - Project Schedule
  - Supporting detail
  - Schedule management plan
  - Resource requirements updates

Project Time Management

Schedule Control:

- **Inputs:**
  - Project schedule
  - Performance reports
  - Change requests
  - Schedule management plan
- **Tools & Techniques:**
  - Schedule change control system
  - Performance measurement
  - Additional planning
  - Project management software
  - Variance analysis
- **Outputs:**
  - Schedule updates
  - Corrective actions
  - Lessons learned

Module 3 : **Project Management Knowledge areas (12)**

Project Integration Management:

- Ensures various elements of projects are properly coordinated
- Trade off between meeting project objectives & alternatives to meet or exceed the stakeholders needs & expectations

Major Processes:

- **Project Plan Development:** integrating & coordinating all project plans to create consistent, coherent document
- **Project Plan Execution:** carrying out the project plan by performing activities included therein
- **Integrated Change Control:** coordinating changes across the entire project

Project Integration Management

Project Plan Development:

- **Inputs:**
  - **Other planning outputs**
  - **Historical Information**
  - **Organizational Policies**
  - **Constraints**
  - **Assumptions**
- **Tools & Techniques:**
  - **Project Planning methodology**
  - **Stakeholders skill & knowledge**
  - **Project Management Information System (PIMS)**
  - **Earned Value Management (EVM)**
- **Outputs:**
  - **Project Plan**
  - **Supporting details**

Project Integration Management

Project Plan Development:

- **Inputs:**
  - **Other planning outputs:** All of the outputs of the planning processes in the other knowledge areas such as base documents, WBS, and supporting details such as cash flow forecasts
  - **Historical Information:** Estimating databases, records of the past projects performance, information to assist with verifying assumptions and assessing alternatives
  - **Organizational Policies:** Formal/ informal policies affecting the plan such as; quality management (process autis, continuous improvement targets), personnel administration (hiring & firing guidelines, employee performance reviews), financial control
  - **Constraints:** what will affect people/ performance
  - **Assumptions:** factors considered to be true while planning
- **Tools & Techniques:**
  - **Project Planning methodology:** Monte Carlo analysis of schedule
  - **Stakeholders skill & knowledge:** team efforts (assigning appropriate type of work to individual member)
  - **Project Management Information System (PIMS)**
  - **Earned Value Management (EVM) :** technique used to integrate scope, schedule and resources to measure and report project performance from initiation to closure.

Project Integration Management

Project Plan Development:

- **Outputs:**
  - **Project Plan:** Formal approved document used to manage project execution. PRoject schedule mentioning planned dates for performing various activities, meeting milestones identified in plan. Project plan would change during the execution of the activities (due to changed requirements, performance different than planned etc.)
  - **Project plan can be presented as Project charter:**
  - summary of individual management plans from the other knowledge areas, scope statement, WBS, cost estimates, performance measurement baseline (schedule, cost and time), major milestone & target dates of each, key/required staff with their cost, risk management plan, open issues & pending decisions
  - **Supporting details:** Additional information not included in plans from other knowledge areas, additional documents generated during constraints & assumptions , documentation of relevant standards

Project Integration Management

Project Plan Execution:

- **Inputs:**
  - **Project Plan**
  - **Supporting detail**
  - **Organizational policies**
  - **Preventive action:** action that reduces the probability of potential consequences of project risk events
  - **Corrective action**: anything done to bring expected future project performance. (output of various control processes)
- **Tools & Techniques:**
  - **General Management skills:** Leadership, communicating & negotiating .
  - **Product skills & knowledge:** access to appropriate set of skills and knowledge of the product
  - **Work authorization system:**
  - **Status review meetings**
  - **Project Management Information System (PIMS)**
  - **Organizational Procedures**
- **Outputs:**
  - **Work Results**
  - **Change Requests**

Module 3 : **Project Management Knowledge areas (12)**

Project Cost Management:

- Ensures project is completed with the approved budget

Major Processes:

- **Resource Planning:** Determining what resources (people, equipment & material) and in what quantity each should be used to perform project activities
- **Cost Estimating:** Developing an approximation (estimate) of the cost of the resources needed to complete the project activities
- **Cost Budgeting:** Allocation of overall cost estimate to individual work activities
- **Cost Control:** Controlling changes to the project budget

Project Cost Management

Resource Planning:

- **Inputs:**
  - **Work Breakdown Structure**
  - **Historical Information**
  - **Scope statement**
  - **Resource pool description**
  - **Organizational policies**
  - **Activity duration estimates**
- **Tools & Techniques:**
  - **Expert judgement**
  - **Alternatives identifications**
  - **Project Management Software**
- **Outputs:**
  - **Resource Requirements**

Project Cost Management

Cost Estimating:

- **Inputs:**
  - **Work Breakdown Structure**
  - **Resource Requirements**
  - **Resource rate**
  - **Activity duration estimates**
  - **Estimating publications**
  - **Historical information**
  - **Charts of accounts**
  - **Risks**
- **Tools & Techniques:**
  - **Analogous Estimates**
  - **Parametric modelling**
  - **Bottom- up estimating**
  - **Computerised tools**
  - **Other cost estimating methods**
- **Outputs:**
  - **Cost estimates**
  - **Supporting details**
  - **Cost Management plan**

Project Cost Management

Cost Budgeting:

- **Inputs:**
  - **Cost estimates**
  - **Work Breakdown Structure**
  - **Project Schedule**
  - **Risk Management Plan**
- **Tools & Techniques:**
  - **Cost budgeting tools & techniques**
- **Outputs:**
  - **Cost baselines**

Project Cost Management

Cost Estimates & Budgeting:

- **Components of Project expenses**
  - **Direct labour expenses:** charges of the labour of the project , based on the number of hours of the activity and the rates of the resources
  - **Direct Non labour expenses:** charges applied directly to the tasks. Raw material, equipments used **specifically for the project ,** installation & operations. Sometimes calculated for individual work package or some percent say 5% of the direct labour expenses
  - **Overhead expenses (indirect expenses) & General & Administration expenses: :** not specific to the tasks but related to doing business such whatever necessary to house & support the labour, building rents, utilities, electricity, clerical assistance, insurance , equipment etc.
  - **Profit & total billing:** amount left after all expenses are covered (usually don't appear in lower level budgets)
  - **Contingency Amount:** Buffer amount kept reserved incase of any unforeseen events occurs

Project Cost Management

Cost Budgeting:

Indirect cost apportionment approaches:

- **Total indirect proportional to total direct cost**
- **OH proportionate to direct labour only and G & A proportionate to all direct costs**
- **OH proportionate to direct labour only and G & A proportionate to DL & OH & DNL**

Cost Budgeting:

Indirect cost apportionment approaches:

Overhead:(rent, utilities, clerical & equipment) OH : 200

General & Administration G&A (upper management, staff, benefits etc.) G&A: 60

Total Indirect : 260

Project Costs	Project A	Project B	Total
Direct Labour (DL)	85	150	235
Direct Non Labour (DNL)	65	110	175
		Direct Cost	**410**

Total indirect proportional to total direct cost

Type of cost	Project A	Project B
DL + NDL	85+65 = 150	150+110 = 260
OH & G&A	=150/410*260 = 95	260 /410 *260 = 165
Total	**245**	**425**

Cost Budgeting:

Indirect cost apportionment approaches:

Overhead:(rent, utilities, clerical & equipment) OH : 200

General & Administration G&A (upper management, staff, benefits etc.) G&A: 60

Project Costs	Project A	Project B	Total
Direct Labour (DL)	85	150	235
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		Direct Cost	**410**

Total Indirect : 260

- **OH proportionate to direct labour only and G & A proportional to all direct costs**

Type of cost	Project A	Project B
DL + NDL	85+65 = 150	150+110 = 260
OH	=200*85/235 = 72	260 /410 *260 = 128
G&A	=60*150/410 = 22	=60*260/410 =38
Total	**244**	**426**

Cost Budgeting:

Indirect cost apportionment approaches:

Overhead:(rent, utilities, clerical & equipment) OH : 200

General & Administration G&A (upper management, staff, benefits etc.) G&A: 60

Total Indirect : 260

Project Costs	Project A	Project B	Total
Direct Labour (DL)	85	150	235
Direct Non Labour (DNL)	65	110	175
		Direct Cost	**410**

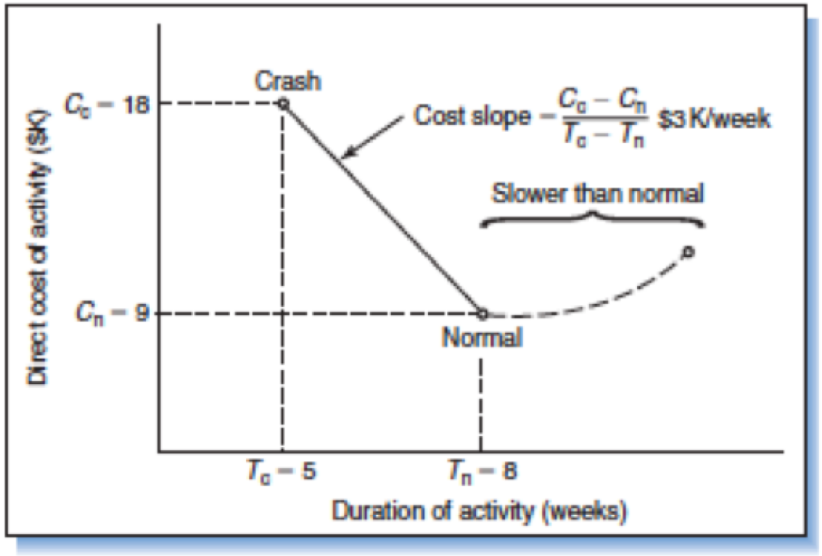
- **OH proportionate to direct labour only and G & A proportionate to DL & OH & DNL**

Type of cost	Project A	Project B
DL + NDL	85+65 = 150	150+110 = 260
OH	=200*85/235 = 72	260*150 /235 = 128
G&A	=60*(85+65+72)/610 = 22	=60*(150+110+127)/610 =38
Total	**245**	**425**

Project Cost Management

Cost Budgeting:

Time cost Relationship



Project Cost Management

Time cost Relationship : Time in days & cost in 1000

Task Id	Predecessor	Normal Time Tn	Normal Cost Cn	Crash time Tc	Crash Cost Cc	Slope
A	-	6	6	3	9	
B	-	9	9	5	12	
C	A, B	3	4.5	2	7	
D	B	5	10	2	16	
E	C	2	2	2	2	
F	D	4	6	1	10	
G	F,E	8	8	5	10	

For the given project:

a) Calculate the time & cost required to complete the project in normal circumstances

b) How will you reduce the duration of the project by 1 day with minimum increase in cost?

c) Calculate the least possible duration for completion of the project in the least possible increased cost.

Project Cost Management

Time cost Relationship : Time in days & cost in 1000

Task Id	Predecessor	Normal Time Tn	Normal Cost Cn	Crash time Tc	Crash Cost Cc	Slope= (Cc-Cn)/(Tc-Tn)
A	-	6	6	3	9	1
B	-	9	9	5	12	0.75
C	A, B	3	4.5	2	7	2.5
D	B	5	10	2	16	2
E	C	2	2	2	2	-
F	D	4	6	1	10	1.66
G	F,E	8	8	5	10	0.66

1. Identify number of paths, duration
2. Identify Critical Path
3. Calculate slope for each task
4. Reduce the task **ON CRITICAL** path having the least slope
5. Repeat the steps 2,3 & 4 till you get the minimum possible duration.

Project Cost Management

Time cost Relationship :

1. **Calculate the cost of the project as addition of all Normal Cost =** 35.5 K
2. **Identify number of paths:**
   i) A-C-F-G = 6+3+4+8 = 21
   ii) B-C-F-G = 9+3+4+8= 24
   iii) B-D-E-G = 9+5+2+8 =24
1. **Identify Critical Path:**
   B-C-F-G AS WELL AS B-D-E-G
1. **Calculate slope for each task**

1. **Reduce the task ON CRITICAL path having the least slope**
   Duration = Critical -1 = 24 -1 = 23 days
   Reducing by 1 day will reduce the duration by 1 day with additional cost of 0.75 (slope value)
   = 35.5 +0.75 = 36.25 K

1. **Repeat the steps 2,3 & 4 till you get the minimum possible duration.**

Project Cost Management

Time cost Relationship : Time in days & cost in 1000

Task Id	Predecessor	Normal Time Tn	Normal Cost Cn	Crash time Tc	Crash Cost Cc	Slope
A	-	6	6	3	9	
B	-	9	9	5	12	
C	A, B	3	4.5	2	7	
D	B	5	10	2	16	
E	C	2	2	2	2	
F	D	4	6	1	10	
G	F,E	8	8	5	10	

For the given project:

a) Calculate the time & cost required to complete the project in normal circumstances

b) How will you reduce the duration of the project by 1 day with minimum increase in cost?

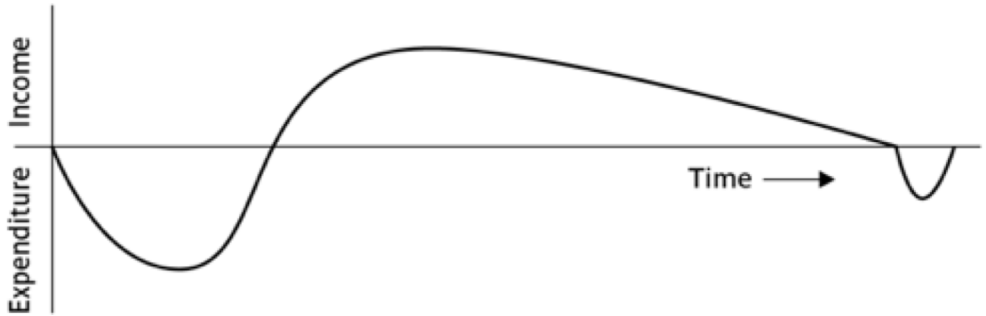
c) Calculate the least possible duration for completion of the project in the least possible increased cost.

Refer Chapter 7 of John M . Nicholas, " Project Management for Business & Technology, Principles & Practice", 3rd edition

Project Cost Management

Cash flow Analysis /Cost Benefit Analysis

- A project many need money to be invested in installments rather than investing money at the start of the project
- Cash flow analysis will help to understand when & how much money will be needed to be invested as well as how the returns will be made available
- Cost Benefit Analysis will help in comparing two project (options of the same project) to find which option is better



Project Cost Management

Cost Benefit Analysis:

1. Net Profit: Profit or Loss at the end of the project Life
2. Payback period: Period (duration) needed to recover all invested money
3. Return of Investment: RoI = (Average annual Profit)/Total investment *100
4. Net Present Value (NPV):
5. Internal Rate of Return: (IRR) is the discount rate that would produce an NPV of 0 for the project

   Can be used to compare different investment opportunities

Project Cost Management

Cost Benefit Analysis:

1. Net Profit: Profit or Loss at the end of the project Life

Year	Proposal A	Proposal B
0	-100000	-150000
1	-50000	-50000
2	10000	25000
3	10000	50000
4	50000	150000
5	100000	150000
Net Profit	20000	175000

Project Cost Management

Cost Benefit Analysis:

2. Payback period

Year	Proposal A	Proposal B
0	-100000	-150000
1	-50000	-50000
2	10000	25000
3	10000	50000
4	50000	150000
5	100000	150000

Project Cost Management

Cost Benefit Analysis:

3. Return of Investment = Average annual Profit/ Total investment *100

	Proposal A	Proposal B
Net Investment	150000	200000
Total Profit	20000	175000
Average Annual Profit	20000/5 =4000	175000/5 =35000
ROI	2.66	17.5

Project Cost Management

Cost Benefit Analysis:

4. Net Present Value:

Discount factor:

df = 1/ (1+r)^t where r is the rate of interest and t is number of years

If r = 10%

t	df
1	1/(1+0.10) = 0.9091
2	1/(1+0.10)^2 = 0.8294

Means receiving 90.91 TODAY is same as receiving 100 after one year if rate is 10%

Project Cost Management

Cost Benefit Analysis:

4. Net Present Value:

Discount factor:

t	9	10	12	15	20
1	0.9174	0.9091	0.8929	0.8696	0.8333
2	0.8417	0.8264	0.7972	0.7561	0.6944
3	0.7722	0.7513	0.7118	0.6575	0.5787
4	0.7084	0.6830	0.6355	0.5718	0.4823
5	0.6499	0.6209	0.5674	0.4972	0.4019
6	0.5963	0.5645	0.5066	0.4323	0.3349
7	0.5470	0.5132	0.4523	0.3759	0.2791
8	0.5019	0.4665	0.4039	0.3269	0.2326
9	0.4604	0.4241	0.3606	0.2843	0.1938
10	0.4224	0.3855	0.3220	0.2472	0.1615
15	0.2745	0.2394	0.1827	0.1229	0.0649

Project Cost Management

Cost Benefit Analysis:

4. Net Present Value:

				R = 10%	
t	Plan A	Plan B	10	Plan A	Plan B
0	-100000	-150000	1	-100000	-150000
1	-50000	-50000	0.9091	-45455	-45455
2	10000	25000	0.8264	8264	20661
3	10000	50000	0.7513	7513	37566
4	50000	150000	0.6830	34151	102452
5	100000	150000	0.6209	62092	93138
		Profit		20000	175000
		NPV		-33434	58363

Project Cost Management

Cost Benefit Analysis:

5. IRR calcultion:

Year	Proposal A	Proposal B
0	-100000	-150000
1	-50000	-50000
2	10000	25000
3	10000	50000
4	50000	150000
5	100000	150000

Project Cost Management

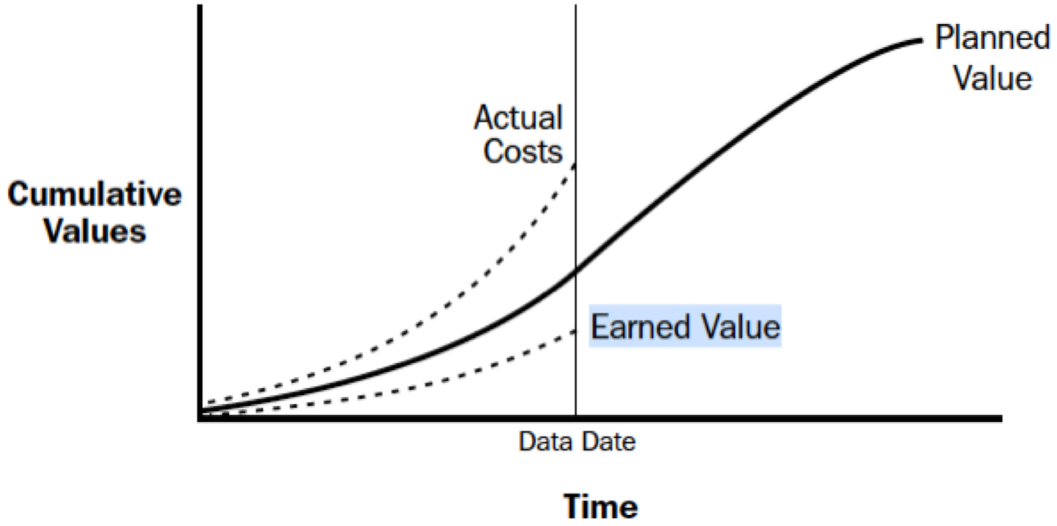
Cost Control:

- **Inputs:**
  - **Cost baselines**
  - **Performance reports**
  - **Change requests**
  - **Cost management plan**
- **Tools & Techniques:**
  - **Cost change control system**
  - **Performance measurement**
  - **Earned Value Management (EVM)**
  - **Additional planning**
  - **Computerized tools**
- **Outputs:**
  - **Revised Cost estimates**
  - **Budget updates**
  - **Corrective actions**
  - **Estimates at completion**
  - **Project closeouts**
  - **Lessons learnt**

Project Cost Management

Cost Control:

- **Performance Measurement: most common method to method is Earned Value Analysis**
- **EV involves calculation of**



Project Cost Management

EV involves calculation of

- **Planned value (PV) also called as budgeted cost of work scheduled (BCWS): is the portion of approved cost estimate planned to be spent on the activity during given period**
- **Actual Cost (AC) also called as Actual Cost of Work Performed (ACWP): the total costs incurred in completing the activities in the given period**
- **Earned Value (EV) also called Budgeted Cost of Work Performed (BCWP): value of the work actual completed**
- **Cost Variance (CV)= EV- AC or BCWP - ACWP**
- **Schedule variance (SV) = EV- PV or BCWP - BCWS**
- **Cost Performance Index (CPI) = EV/AC or BCWP/ ACWP**
- **Schedule Performance Index (SPI) = EV/PV or BCWP/ BCWS**

Module 3 : **Project Management Knowledge areas (9)**

Project Scope Management:

- Include the processes required to ensure that the project includes all the work required AND ONLY th work required to complete the project successfully

Major Processes:

1. **Initiation:** Authorizing the project or phases
2. **Scope Planning:** Developing the written scope statement as the basis for further project decisions
3. **Scope Definition:** Subdividing the major product deliverables into smaller, more manageable components
4. **Scope Verification:** formalizing acceptance of the project scope
5. **Scope Change Control:** controlling changes to project scope

Project Scope Management

1. Initiation:

- **Inputs:**
  - Product description
  - Strategic plan
  - Project selection criteria
  - Historical Information
- **Tools & Techniques:**
  - Project selection methods
  - Experts judgement
- **Outputs:**
  - Project Charter
  - Project manager identified/Assigned
  - Constraints
  - Assumptions

Project Scope Management

2. Scope Planning:

- **Inputs:**
  - Product description
  - Project Charter
  - Constraints
  - Assumptions
- **Tools & Techniques:**
  - Product Analysis
  - Benefits/ cost analysis
  - Alternative identification
  - Experts judgement
- **Outputs:**
  - Scope statement
  - Supporting details
  - Scope management plan

Project Scope Management

3. Scope Definition:

- **Inputs:**
  - Scope statement
  - Constraints
  - Assumptions
  - Other planning outputs
  - Historical information
- **Tools & Techniques:**
  - Work breakdown structure template
  - Decomposition
- **Outputs:**
  - Work breakdown structure
  - Scope statement updates

Project Scope Management

4. Scope Verification:

- **Inputs:**
  - Work results
  - Product documentation
  - Work breakdown structure
  - Scope statement
  - Project Plan
- **Tools & Techniques:**
  - Inspection
- **Outputs:**
  - Formal acceptance

Project Scope Management

5. Scope Change Control:

- **Inputs:**
  - Work breakdown structure
  - Performance report
  - Change requests
  - Scope management Plan
- **Tools & Techniques:**
  - Scope change control system
  - Performance measurement
  - Additional planning
- **Outputs:**
  - Scope changes
  - Corrective actions
  - Lessons learnt
  - Adjusted baseline

Module 3 : **Project Management Knowledge areas (9)**

Project Quality Management:

- Processes sure that the project will satisfy the needs for which it was undertaken
- Ensure that the project delivers and follows process compiling the quality requirements

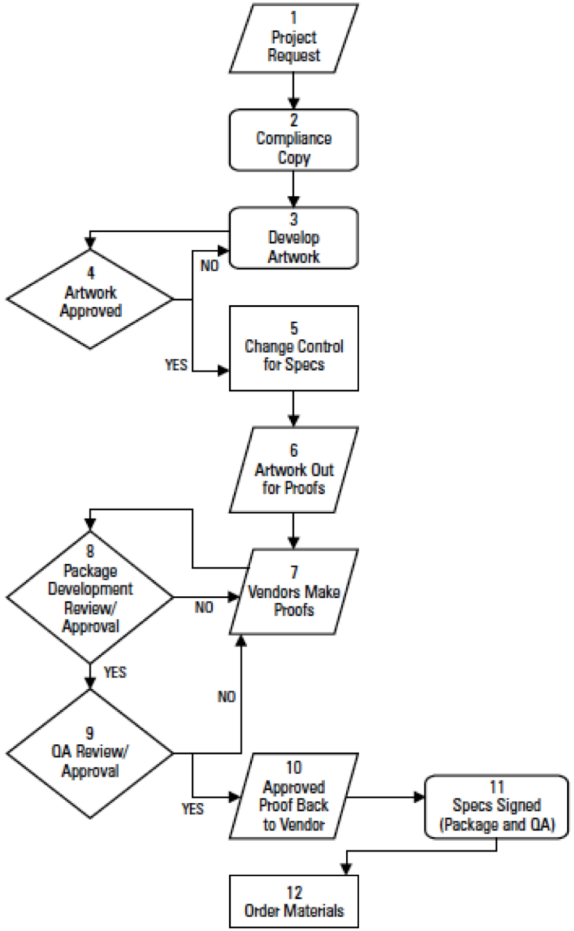
Major Processes:

- **Quality Planning:** Identifying which quality standards are relevant to the project and determine how to satisfy them
- **Quality Assurance:** Evaluating overall project performance on a regular basis to provide confidence that the project will satisfy the relevant quality standards
- **Quality Control:** Monitoring specific project results to determine if they comply with relevant quality standards and identifying ways to eliminate causes of unsatisfactory performance

Project Quality Management

Quality Planning:

- **Inputs:**
  - **Quality Policy**
  - **Scope statement**
  - **Product descriptions**
  - **Standards & regulations**
  - **Other process outputs**
- **Tools & Techniques:**
  - **Benefit/ cost analysis**
  - **Benchmarking**
  - **Flow-charting (cause effect diagram)**
  - **Design of experiments**
  - **Cost of quality**
- **Outputs:**
  - **Quality management plan**
  - **Operational definitions**
  - **Checklists**
  - **Inputs to other process**



Sample Process Flowchart

Project Quality Management

Quality Assurance:

- **Inputs:**
  - **Quality management plan**
  - **Results of quality control measurements**
  - **Operational definitions**
- **Tools & Techniques:**
  - **Quality planning tools & Techniques:**
    - **Inspection**
    - **Control Chart**
    - **Pareto Charts: histogram ordered by frequency of occurrence , showing type of category of identified cause,**
    - **Statistical sampling**
  - **Quality audits**
- **Outputs:**
  - **Quality improvement**

Project Quality Management

Quality Control:

- **Inputs:**
  - **Work results**
  - **Quality Management Plan**
  - **Operational Definitions**
  - **Checklists**
- **Tools & Techniques:**
  - **Inspection**
  - **Control Chart**
  - **Pareto Charts: histogram ordered by frequency of occurrence , showing type of category of identified cause,**
  - **Statistical sampling**
  - **Flow charting**
  - **Trend analysis**
- **Outputs:**
  - **Quality improvement**
  - **Acceptance Decisions**
  - **Rework**
  - **Completed Checklists**
  - **Process Adjustments**

Module 3 : **Project Management Knowledge areas (9)**

Project Human Resource Management:

Major Processes:

- **Organizational Planning:** Identifying, documenting and assigning project roles, responsibilities and reporting relationships
- **Staff acquisition:** Getting human resources needed and assigned to and working on the project
- **Team development**: Developing individual and group competencies to enhance project performance

Project Human Resource Management

Organizational Planning:

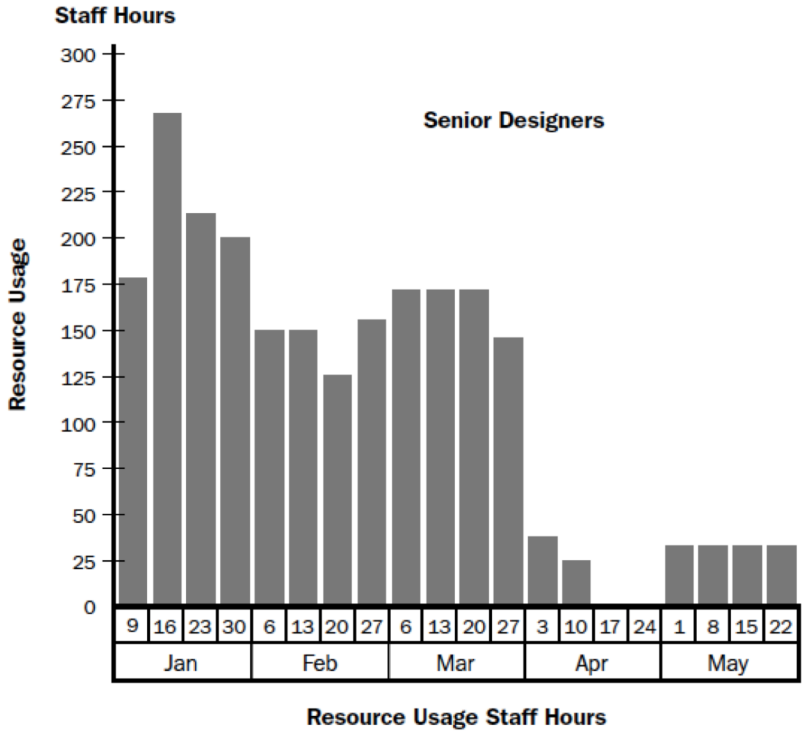
- **Inputs:**
  - Project interfaces
  - Staffing requirements
  - Constraints
- **Tools & Techniques:**
  - Template
  - Human resource practices
  - Organizational theory
  - Stakeholder analysis
- **Outputs:**
  - Role and responsibility assignments
  - Staffing management plan
  - Organizational chart
  - Support details

PERSON / PHASE	A	B	C	D	E	F	...
Requirements	S	R	A	P	P		
Functional	S		A	P		P	
Design	S		R	A	I		P
Development		R	S	A		P	P
Testing			S	P	I	A	P

P = Participant A = Accountable R = Review Required
I = Input Required S = Sign-off Required

Responsibility / Role Assignment matrix

- Staff management planning
- Projectized organizational structure:
  - Hire and Fire
  - Remove/ eliminate uncertainty about future employment opportunity
  - Reduce the cost by reducing or eliminating the tendency to “make work” to fill the time gap between current assignment and the next
  -


Staff Hours
Senior Designers
Resource Usage
300
275
250
225
200
175
150
125
100
75
50
25
0
9 16 23 30 6 13 20 27 6 13 20 27 3 10 17 24 1 8 15 22
Jan
Feb
Mar
Apr
May
Resource Usage Staff Hours

Project Human Resource Management

Staff acquisition :

- **Inputs:**
  - Staffing management plan
  - Staffing pool description
  - Recruitment practices
- **Tools & Techniques:**
  - Negotiations
  - Pre-assignment
  - Procurement
- **Outputs:**
  - Project staff assigned
  - Project team directory

Project Human Resource Management

Team development:

- **Inputs:**
  - Project Staff
  - Project Plan
  - Staffing management plan
  - Performance report
  - External feedback
- **Tools & Techniques:**
  - Team-building activities
  - General management skills
  - Reward and recognition systems
  - Collocation
  - Training
- **Outputs:**
  - Performance improvements
  - Input to performance appraisals

Module 3 : **Project Management Knowledge areas (9)**

Project Communication Management:

Major Points

- **Communication Planning:** Determining the information and communications needs of the stakeholders: who needs what information, when will that be needed and how will that be given
- **Information Distribution:** making needed information available to project stakeholders in a timely manner
- **Performance Reporting:** collecting and disseminating performance information, such as status reporting, progress measurement and forecasting
- **Administrative closure:** generating, gathering and disseminating information to formalise a phase or project closure

Project Communication Management

Communication Planning:

- **Inputs:**
  - Communication requirements
  - Communication Technology
  - Constraints
  - Assumptions
- **Tools & Techniques:**
  - Stakeholder analysis
- **Outputs:**
  - Communication management plan

Project Communication Management

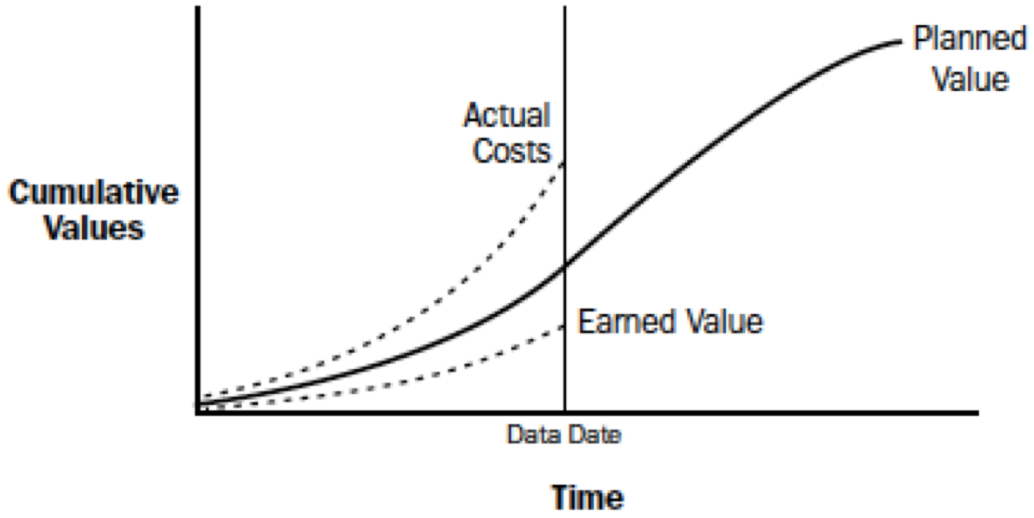
Information Distribution:

- **Inputs:**
  - Work results
  - Communication management plan
  - Project Plan
- **Tools & Techniques:**
  - Communication skills
  - Information retrieval systems
  - Information distribution methods
- **Outputs:**
  - Project records
  - Project reports
  - Project presentations

Project Communication Management

Performance reporting:

- **Inputs:**
  - Project Plan
  - Work results
  - Other project records
- **Tools & Techniques:**
  - Performance reviews
  - Variance analysis
  - Trend analysis
  - Earned value analysis
  - Information distribution tools and techniques
- **Outputs:**
  - Performance reports
  - Change requests



Illustrative Graphic Performance Report

Project Communication Management

Administrative closure :

- **Inputs:**
  - Performance measurement documents
  - Product documents
  - Other project records
- **Tools & Techniques:**
  - Performance reporting tools and techniques
  - Project reports
  - Project presentations
- **Outputs:**
  - Project archives
  - Project closure
  - Lessons learned

Module 3 : **Project Management Knowledge areas (9)**

Project Procurement Management:

Major Processes:

- **Procurement Planning:** Determining what to procure and when
- **Solicitation Planning:** Documenting product requirements and identifying potential sources
- **Solicitation:** obtaining quotations, bids, offers, proposals, as appropriate
- **Source selection:** Choosing from among potential sellers
- **Contract administration:** Managing the relationship with the seller
- **Contract closeout:** Completion and settlement of the contract including resolution of open items

Project Procurement Management

Procurement planning:

- **Inputs:**
  - Scope statement
  - Product description
  - Procurement resources
  - Market conditions
  - Other planning outputs
  - Constraints
  - Assumptions
- **Tools & Techniques:**
  - Make or buy analysis
  - Expert judgement
  - Contract type selection
- **Outputs:**
  - Procurement management plan
  - Statement(s) of work

Procurement Management plan

- Mentions how the process of solicitation planning through contract closure will be executed:
  - What type of contract ?
  - Need of independent estimates such as evaluation criteria, who will prepare that and when etc.
  - Incase of an existence of a separate procurement department, role and responsibly of project team.
  - Managing multiple providers
  - Coordinating the activity of procurement from multiple vendors/ suppliers

Project Procurement Management

Procurement planning:

- **Inputs:**
  - Procurement management plan
  - Statement(s) of work
  - Other planning tools
- **Tools & Techniques:**
  - Standard forms
  - Expert judgement
- **Outputs:**
  - Procurement documents
  - Evaluation criteria
  - Statement(s) of work updates

Project Procurement Management

Solicitation(obtaining quotations, bids, offers, proposals, as appropriate) :

- **Inputs:**
  - Procurement documents
  - Qualified seller lists
  - Other planning tools
- **Tools & Techniques:**
  - Bidder conferences
  - Advertising
- **Outputs:**
  - Proposals

Project Procurement Management

- **Source selection:** Choosing from among potential sellers
  - **Inputs:**
    - Proposals
    - Evaluation criteria
    - Organizational policies
  - **Tools & Techniques:**
    - Contract negotiations
    - Weighting systems
    - Screening systems
    - Independent estimates
  - **Outputs:**
    - Contract(s)

Project Procurement Management

- **Contract administration:** Managing the relationship with the seller
  - **Inputs:**
    - Contracts
    - Work results
    - Change requests
    - Seller invoices
  - **Tools & Techniques:**
    - Contract change control systems
    - Performance reporting
    - Payment systems
  - **Outputs:**
    - Correspondence
    - Contract changes
    - Payment requests

Project Procurement Management

- **Contract closeout:** Completion and settlement of the contract including resolution of open items
  - **Inputs:**
    - Contract documents
  - **Tools & Techniques:**
    - Procurement audits
  - **Outputs:**
    - Contract files
    - Formal Acceptance and closure

Module 3 : **Project Management Knowledge areas (9)**

Project Risk Management:

Major Processes:

- **Risk management Planning:** Deciding how to approach and plan the risk management activities for a project
- **Risk Identification:** Determine which risk might affect the project and documenting their characteristics
- **Qualitative risk analysis:** Performing a qualitative analysis of risk and conditions to prioritise their effects on project objectives
- **Quantitative risk analysis:** measuring the probability and consequences of risks and estimating their implications for project objectives
- **Risk response planning :** developing procedures and techniques to enhance opportunities and reduce threats to project's objectives
- **Risk monitoring and control:** monitoring residual risks, identifying new risks, executing risk reduction plans and evaluating their effectiveness throughout the project life cycle.

Project Risk Management

Risk management Planning: Deciding how to approach and plan the risk management activities for a project

- **Inputs:**
  - Project charter
  - Organization's risk management policies
  - Defined roles and responsibilities
  - Stakeholders' risk tolerance
  - Template for organization's risk management plan
  - Work Breakdown structure (WBS)
- **Tools & Techniques:**
  - Planning meetings
- **Outputs:**
  - Risk management plan

Project Risk Management

Risk Identification: Determine which risk might affect the project and documenting their characteristics

- **Inputs:**
  - Risk management plan
  - Project planning outputs
  - Risk categories
  - Historical information
- **Tools & Techniques:**
  - Documentation reviews
  - Information gathering techniques
  - Checklists
  - Assumptions analysis
  - Diagramming technique
- **Outputs:**
  - Risks
  - Trigger
  - Inputs to other processes

Project Risk Management

Qualitative risk analysis: Performing a qualitative analysis of risk and conditions to prioritise their effects on project objectives

Inputs:

- Risk management plan
- Identified risks
- Project status
- Project type
- Data precision
- Scales of probability and impact
- Assumptions

- **Tools & Techniques:**
  - Risk probability and impact
  - Probability / impact risk rating matrix
  - Project assumptions testing
  - Data precision ranking
- **Outputs:**
  - Overall risk ranking for the project
  - List of prioritized risks
  - List of risks for additional analysis and management
  - Trends in qualitative risk analysis results

Project Risk Management

Quantitative risk analysis: measuring the probability and consequences of risks and estimating their implications for project objectives

- **Inputs:**
  - Risk management plan
  - Identified risks
  - List of prioritized risks
  - List of risks for additional analysis and management
  - Historical information
  - Experts' judgement
  - Other planning outputs
- **Tools & Techniques:**
  - Interviewing
  - Sensitivity analysis
  - Decision tree analysis
  - Simulations
- **Outputs:**
  - Prioritized list of quantitative risks
  - Probabilistic analysis of the project
  - Probability of achieving the cost and time objectives
  - Trends in quantitative risk analysis results

Project Risk Management

Risk response planning : developing procedures and techniques to enhance opportunities and reduce threats to project's objectives

- **Inputs:**
  - Risk management plan
  - List of prioritized risks
  - Risk ranking for the project
  - Prioritized list of quantitative risks
  - Probabilistic analysis of the project
  - Probability of achieving the cost and time objectives
  - List of potential responses
  - Risk threshold
  - Risk Owners
  - Common risk causes
  - Trends in qualitative and quantitative risk analysis results
- **Tools & Techniques:**
  - Avoidance
  - Transference
  - Mitigation
  - Acceptance
- **Outputs:**
  - Risk response plan
  - Residual risks
  - Secondary risks
  - Contractual agreements
  - Contingency reserve amounts needed
  - Inputs to other processes
  - Inputs to a revised project plan

Project Risk Management

Risk monitoring and control: monitoring residual risks, identifying new risks, executing risk reduction plans and evaluating their effectiveness throughout the project life cycle.

- **Inputs:**
  - Risk management plan
  - Risk response plan
  - Project communication
  - Additional risk identification and analysis
  - Scope change
- **Tools & Techniques:**
  - Project risk response audits
  - Periodic project risk reviews
  - Earned value analysis
  - Technical performance measurement
  - Additional risk resource planning
- **Outputs:**
  - Workaround plans
  - Corrective actions
  - Project change requests
  - Updates to the risk response plan
  - Risk database
  - Updates to risk identification checklists