

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



GE 404

Engineering Management

LECTURE #13

Outlines of Microsoft Project Software

Contents

- Objectives of the present lecture
- Basic Interface of Microsoft Project 2013
- **Defining Project Information and Project Properties**
- Creating and Assigning Calendar to the Project
- Entering and Editing Project Tasks (or Activities)
- Assigning, Leveling and Allocating Resources
- Creating Baseline, Tracking Progress and Rescheduling Tasks
- **Cash Flow and Project Reports**
- Demo Problems

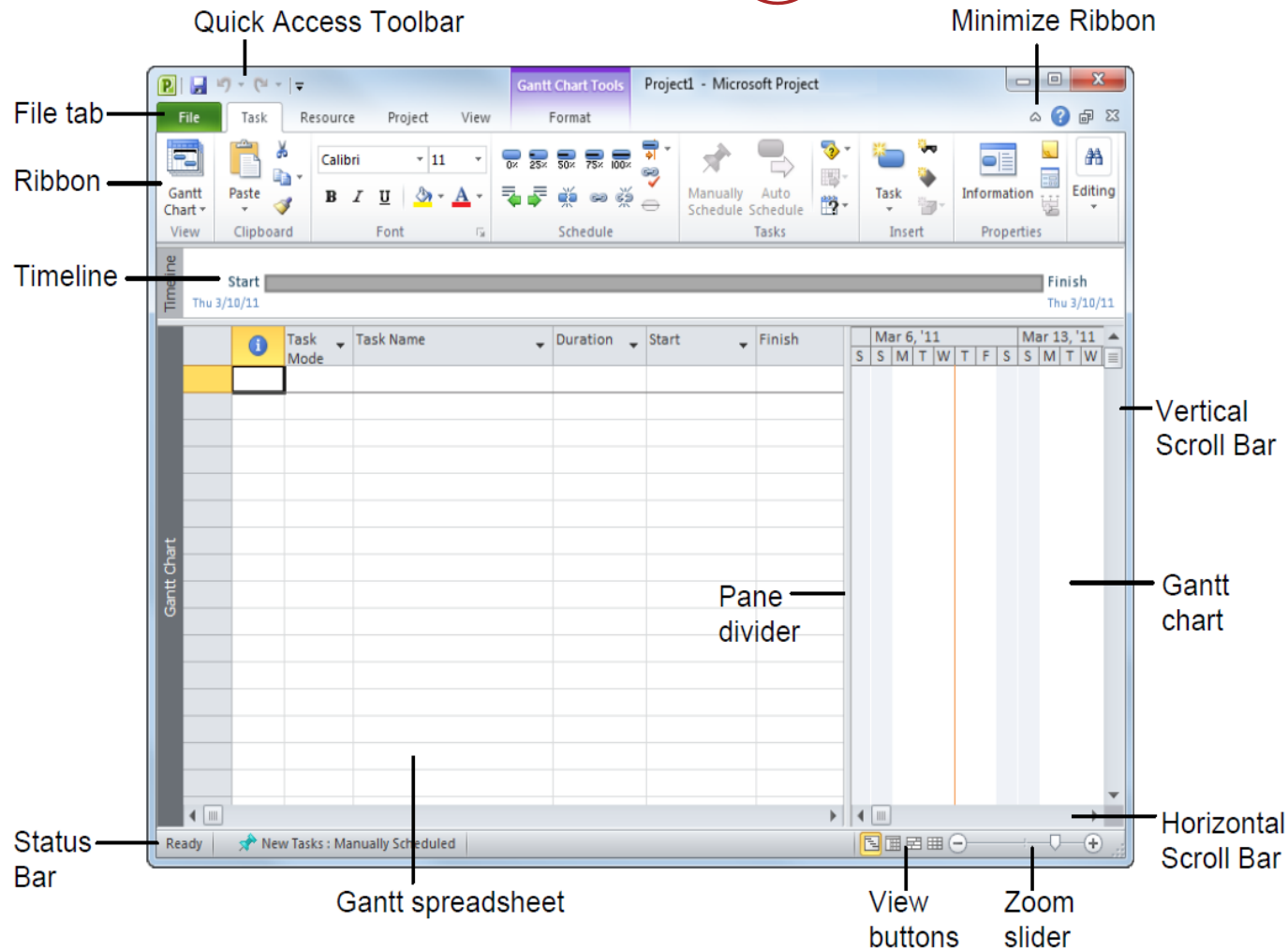
Objectives of the Present lecture

3

- To give an outline of MS Project 2013 software
- To explain some of the tools of MS Project 2013
- To demonstrate helpfulness of MS Project 2013 in solving various Engineering management problems.

Basic Interface of MS Project

4



Note: The shown interface is for Microsoft Project 2010. Similar interface exists for Microsoft Project 2013

Defining Project Information and Project Properties

5

- Create a New Project:
 - File → New → Blank Project
- Project Information
 - Project → Properties → Project Information (Enter dates e.g. start date, finish date; status date; current date etc.)
- To set ES or LS based schedule
 - Schedule From → Project start date (all tasks begin on ES i.e. as soon as possible)
 - Schedule From → Project Finish date (all tasks begin on LS i.e. as late as possible)
- Project Properties (e.g. Project title, Project manager etc.)
 - File → Info → Project Information → Advanced Properties

Creating and Assigning Calendar to the Project

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- Create New Calendar
 - Project → Change working time → Create New calendar
 - Work Weeks → Details → Set days to working times (or Set days to nonworking time)
 - To Set Working Time: Enter the working time e.g. : 8:00 AM – 12:00 PM; 1:00 PM-5:00 PM
- Assign ‘new calendar’ to the Project
 - Project → Properties → Project Information → Calendar (Select the defined calendar)


Entering and Editing Project Tasks (or Activities)

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- Entering tasks
 - Task → Gantt Chart → Gantt Chart or Task sheet (Enter the tasks)
- Organizing tasks into phases
 - In the entered tasks use indent to create phases
- Adding a recurring tasks
 - Task → Insert → +Task → Recurring task
- Displaying WBS Codes
 - In the work sheet add new Column → Select the Name → WBS

Contd.

8

- Defining predecessors
 - In a cell of Predecessor column → Right click → Information → Predecessors → Enter Task ID, Type and Lag
- Splitting tasks
 - Task → Schedule → Split task 
- Setting task constraints
 - In a cell → Right click → Information → Advanced → Enter constraint information
- Setting milestones
 - Enter in the worksheet a task with zero duration

Precedence Diagram and Critical Tasks

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- Seeing Critical Tasks
 - Task →view → Gantt Chart → Format →Critical Tasks
- To see Total slack and/or Free slack
 - In a work sheet select new column and in the top cell (click twice)→Total Slack
- To see Network diagram
 - Task →view → Gantt Chart → Network Diagram
- To Print Network diagram
 - File→ Print→ Page setup →Fit to 1 pages wide by 1 tall →Print

Assigning, Leveling and Allocating Resources

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- Adding Resources
 - View → Resource views → Resource Sheet (Enter resource Name, Type Cost (rate /hour or /day) etc.)
- Assigning resources to tasks
 - View → Gantt Chart → Go to Resource names → Right click to go to Information → Enter the resources
 - To not have leveling during assigning resources go to resource tab and clear leveling
- View the resource Graph
 - View → Other views → Resource Graph
- Resource leveling and allocation
 - Resource → Level → Leveling Options → (To perform leveling without effecting the project duration, select “level only within the available slack”)
 - Resource → Level → Level Resource → Level Now

Creating Baseline, Tracking Progress and Rescheduling Tasks

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- To compare how project is changing over time *Baselines* are set
 - Project → Schedule → Set Baseline
- To see the variance with respect to Baseline
 - View → Data → Tables → Variance
- Tracking a Project as scheduled
 - Add one column in task sheet to show % complete
 - Project → Status → Status Date
 - Project → Status → Update Project
- Entering actual values for tasks
 - View → Data → Tables → Work
- Rescheduling uncompleted Tasks
 - Project → Status → Update Project → Reschedule uncompleted work to start after

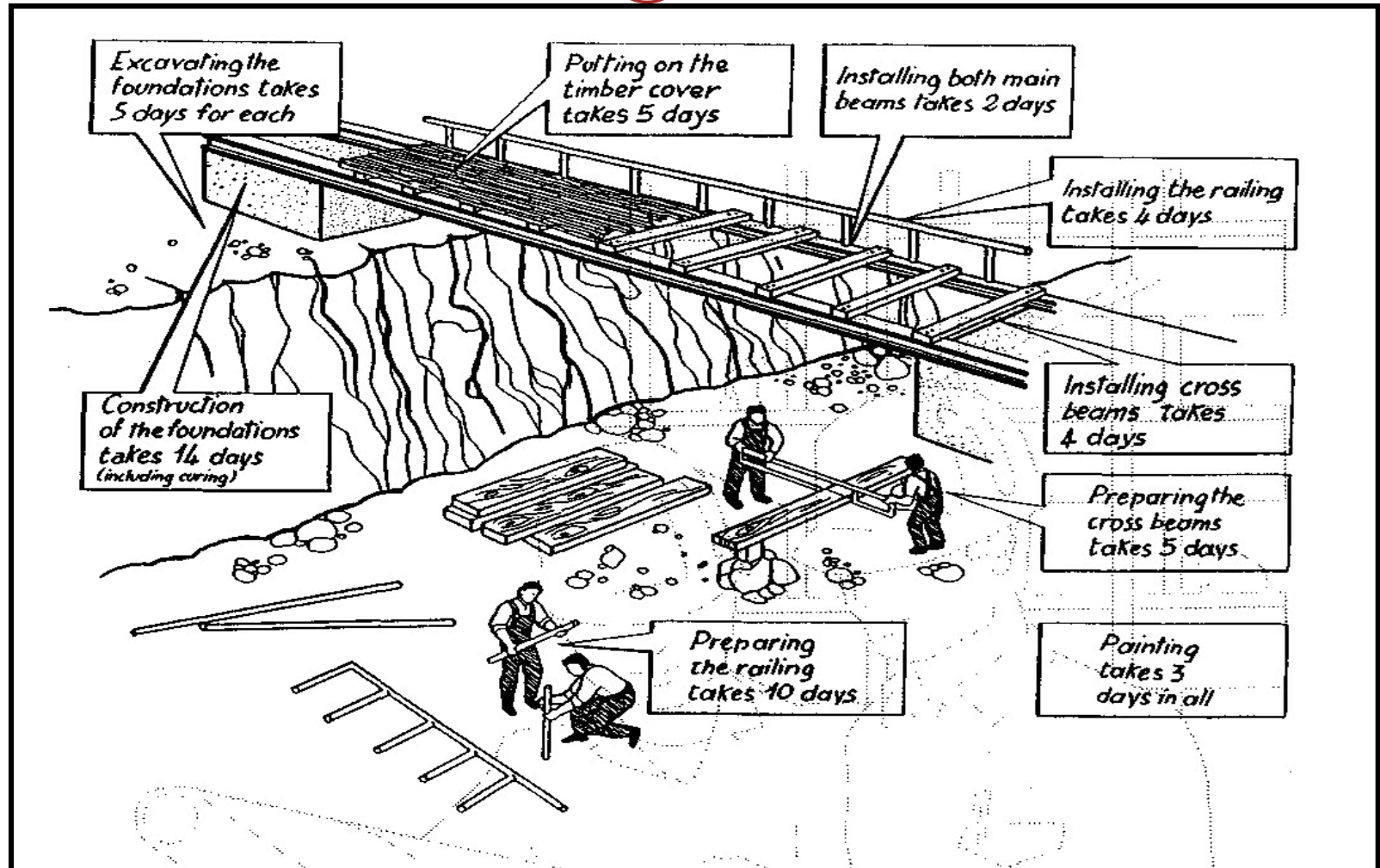
Cash Flow and Project Reports

12

- To view reports
 - Report → View Reports → Costs → Cash Flow
- To print the report
 - File → Print → Print Entire Project

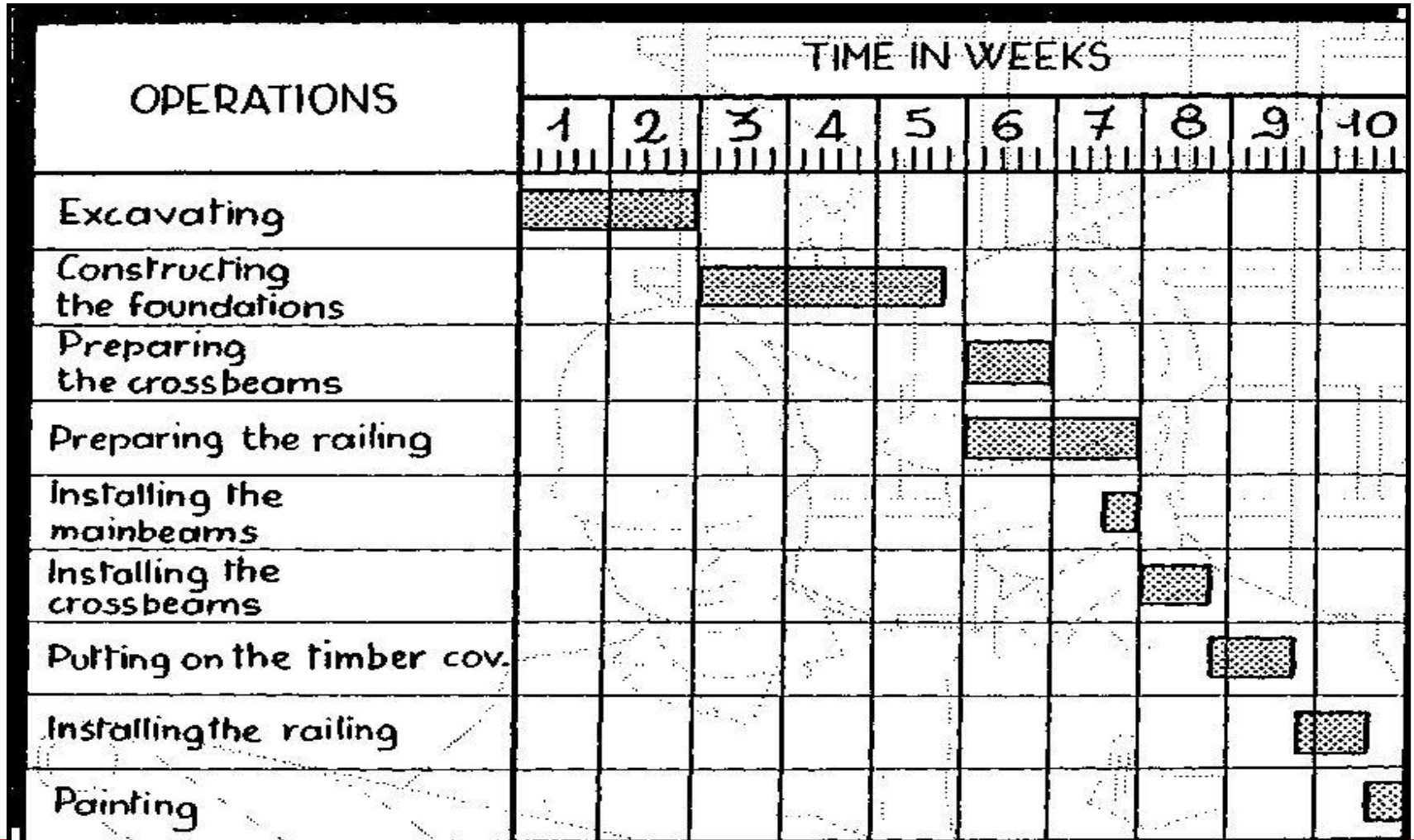
Building a Bridge

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Bar Chart

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Demo Problem-1 (Bar Chart)

15

The following table shows the durations (in days) and dependencies for eight activities marked A to H for an engineering project.

- (a) Draw the Gantt Bar Chart
- (b) Determine the critical path
- (c) Determine the earliest period of completing the project (i.e. Project Duration).

Activity	Duration (days)	Dependency
A	2	-
B	4	-
C	3	F
D	2	A
E	5	B and D
F	4	A
G	3	E and C
H	2	G

Manual Solution

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Activity (Duration)	Pre.	Days														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A (2)	None	→														
B (4)	None	→														
C (3)	F							→								
D (2)	A			→												
E (5)	B, D					→										
F (4)	A			→												
G (3)	E, C										→					
H (2)	G												→			

(b) Critical Paths are:

A-D-E-G-H

A-F-C-G-H

B-E-G-H

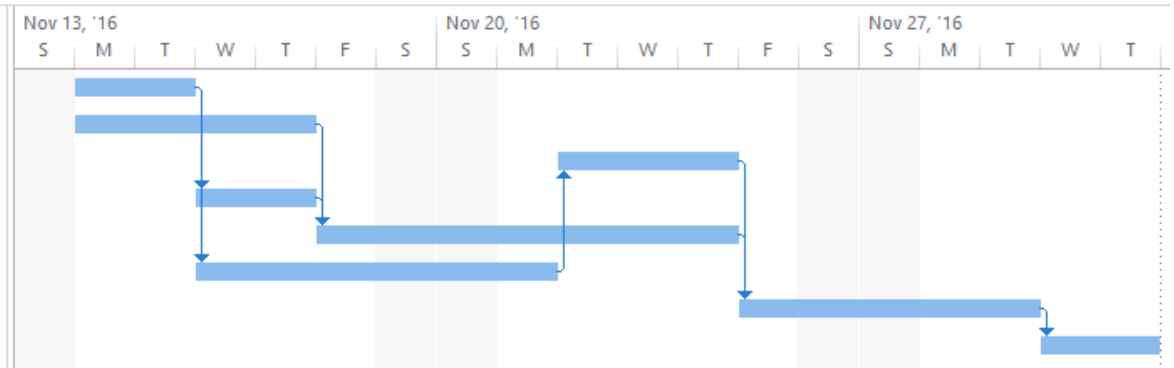
Note: *All the activities are critical.*

(c) Project Duration is: **14 days**

Solution of Microsoft Project

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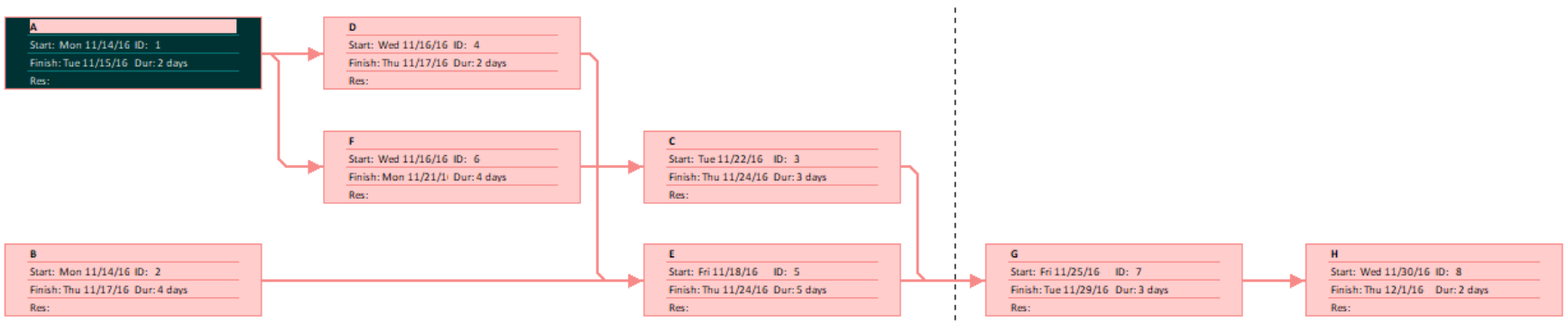
Task Mode	Task Name	Duration	Predecessors
1	A	2 days	
2	B	4 days	
3	C	3 days	6
4	D	2 days	1
5	E	5 days	2,4
6	F	4 days	1
7	G	3 days	3,5
8	H	2 days	7



Project Duration = 2 weeks+4 days= 14+4 = 18 calendar days

Project Duration = 18-2×2 = 14 Working days

Network diagram indicates all activities are critical.



Demo Problem-2 (AON and Floats)

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Consider the various activities given in the table.

(a) Draw AON (Activity-On-Node) diagram and calculate free float and total float for each activity.

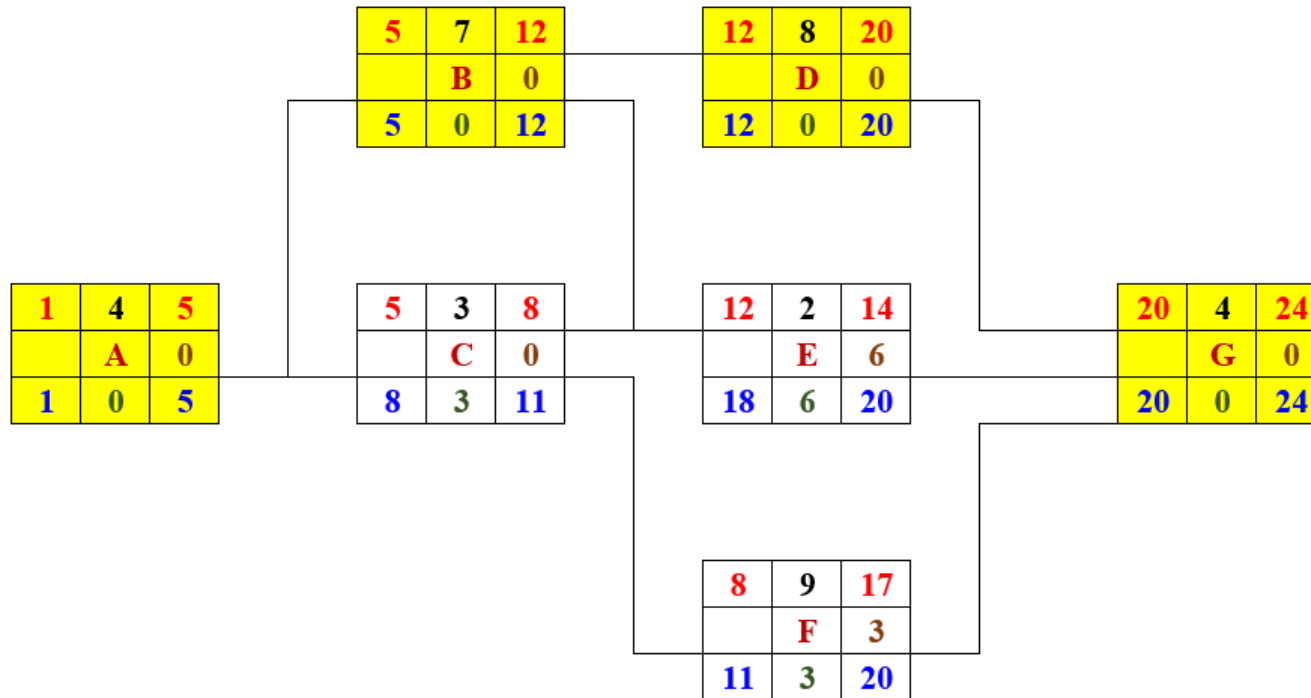
(b) Show the critical activities and critical path in the above network diagram.

Activity	Predecessors	Durations (Days)
A	--	4
B	A	7
C	A	3
D	B	8
E	B, C	2
F	C	9
G	D, E, F	4

Manual Solution

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(a) AON and floats for each activity.



LEGENDS

ES	D	EF
	#	FF
LS	TF	LF

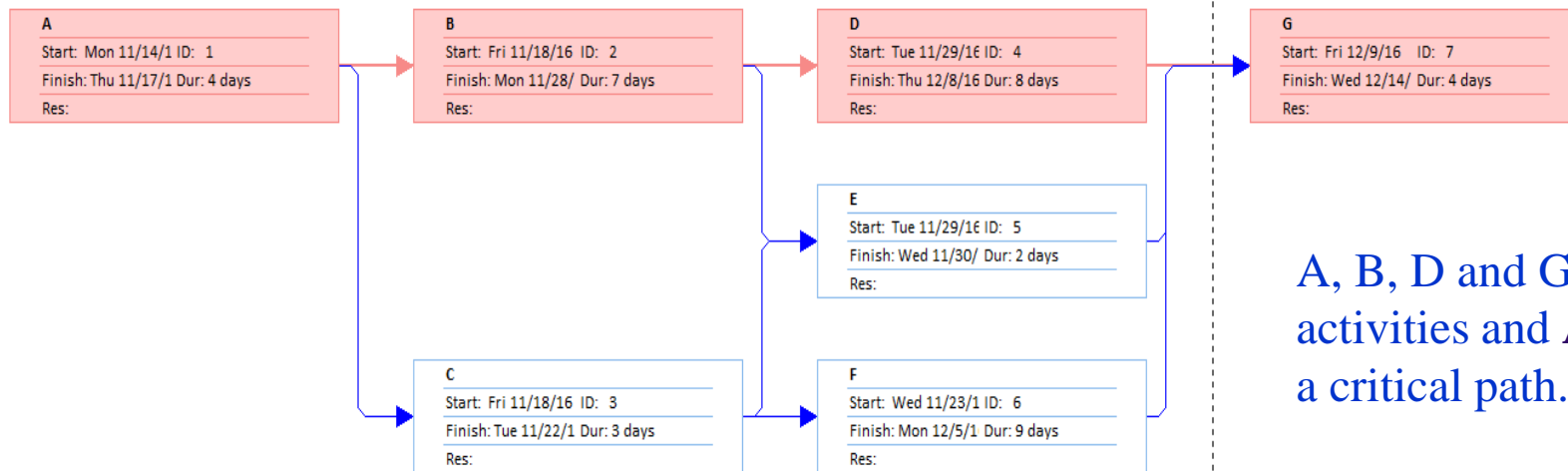
(b) A, B, D and G are critical activities and A-B-D-G is a critical path.

Solution of Microsoft Project

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Total and free floats(slacks) for each activity.

		Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resou Name	Total Slack	Free Slack
1			A	4 days	Mon 11/14/16	Thu 11/17/16			0 days	0 days
2			B	7 days	Fri 11/18/16	Mon 11/28/16	1		0 days	0 days
3			C	3 days	Fri 11/18/16	Tue 11/22/16	1		3 days	0 days
4			D	8 days	Tue 11/29/16	Thu 12/8/16	2		0 days	0 days
5			E	2 days	Tue 11/29/16	Wed 11/30/16	2,3		6 days	6 days
6			F	9 days	Wed 11/23/16	Mon 12/5/16	3		3 days	3 days
7			G	4 days	Fri 12/9/16	Wed 12/14/16	4,5,6		0 days	0 days



A, B, D and G are critical activities and A-B-D-G is a critical path.

Demo Problem-3 (Precedence diagram)

21

Consider the same activities as given in the demo problem-2 but with some lead-lag relationships as given below the table.

(a) Draw AON (Activity-On-Node) diagram and calculate free float and total float for each activity.

(b) Show the critical activities and critical path in the above network diagram.

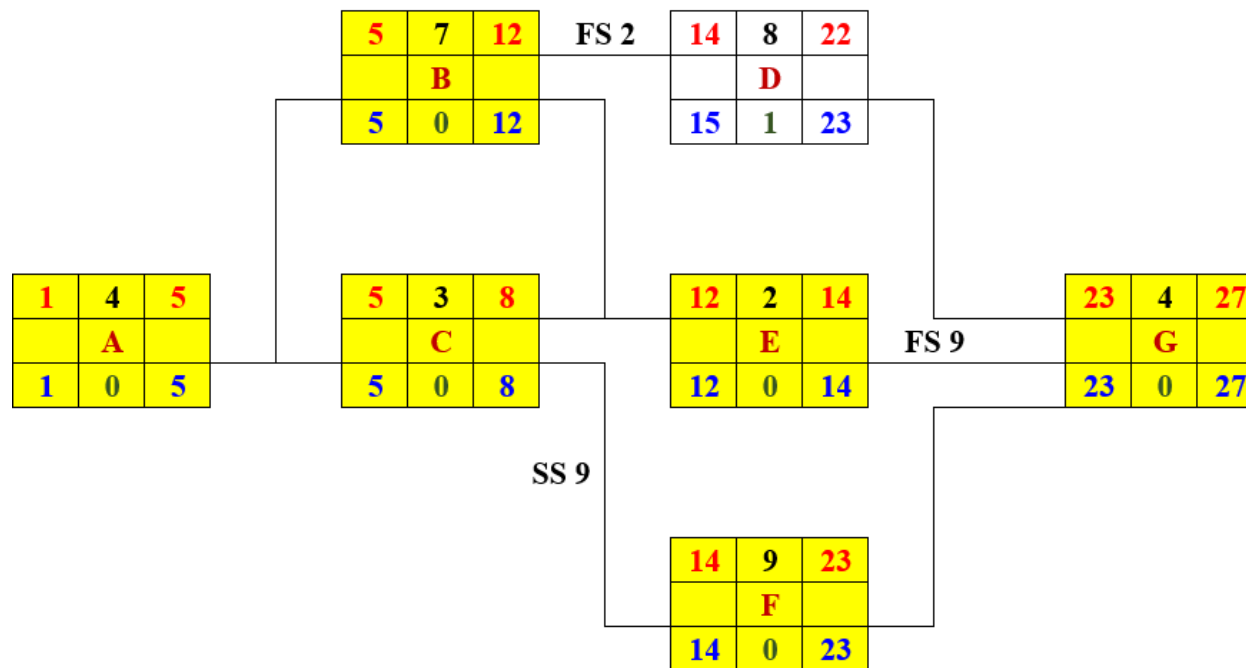
Activity	Predecessors	Durations (Days)
A	--	4
B	A	7
C	A	3
D	B	8
E	B, C	2
F	C	9
G	D, E, F	4

Related activities	Lead-Lag relationships
B-D	FS = 2
C-F	SS = 9
E-G	FS = 9

Manual Solution

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(a) Precedence diagram and floats for each activity.



LEGENDS

ES	D	EF
	#	FF
LS	TF	LF

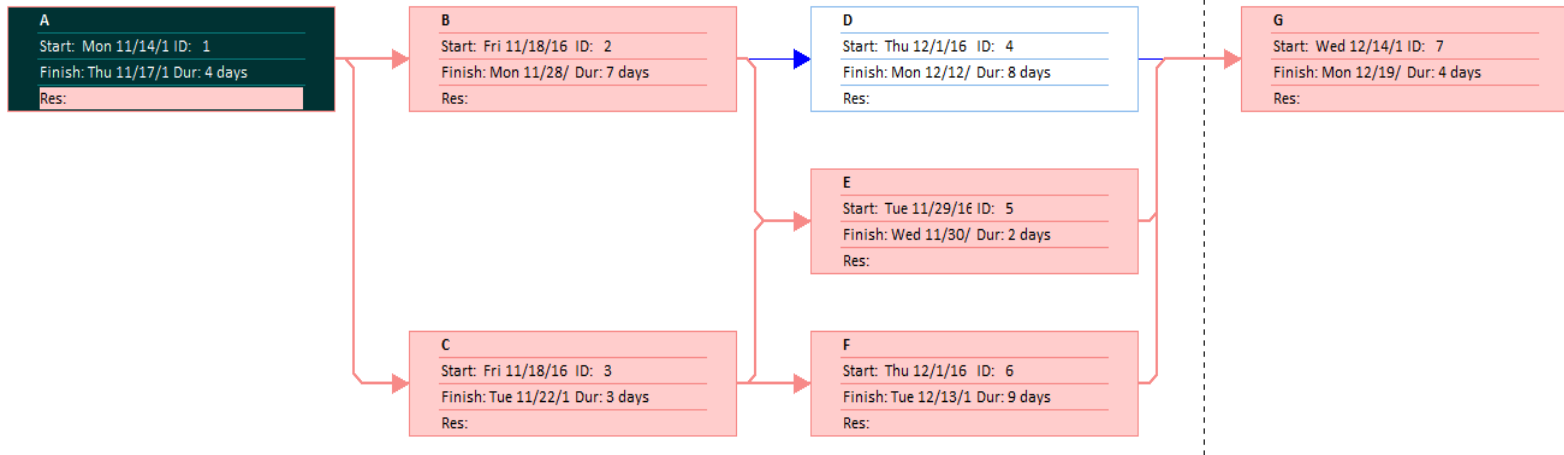
(b) Except D all activities are critical, and **A-B-E-G**; **A-C-E-G**; **A-C-F-G** are critical paths.

Solution of Microsoft Project

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Total and free floats(slacks) for each activity.

	i	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resou Nam	Total Slack	Free Slack
1			A	4 days	Mon 11/14/16	Thu 11/17/16			0 days	0 days
2			B	7 days	Fri 11/18/16	Mon 11/28/16	1		0 days	0 days
3			C	3 days	Fri 11/18/16	Tue 11/22/16	1		0 days	0 days
4			D	8 days	Thu 12/1/16	Mon 12/12/16	2FS+2 days		1 day	1 day
5			E	2 days	Tue 11/29/16	Wed 11/30/16	2,3		0 days	0 days
6			F	9 days	Thu 12/1/16	Tue 12/13/16	3SS+9 days		0 days	0 days
7			G	4 days	Wed 12/14/16	Mon 12/19/16	4,5FS+9 days,6		0 days	0 days



Except D all activities are critical, and **A-B-E-G**; **A-C-E-G**; **A-C-F-G** are critical paths.

Demo Problem-4 (Resource Levelling)

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The following activity list represents the job logic, the durations of activities and resource demands of each activity on each day for a small project.

(a) Draw Early Start Time-scaled schedule for the project and show the resource requirement for each day.

(b) Using Estimated method of levelling procedure, level the resources in maximum two trials. Assume there is no resource constraint for any activity.

Activity	Predecessor (s)	Duration (days)	Resource requirement (per day)
A	None	3	3
B	A	2	3
C	A	2	2
D	B	3	3
E	D	6	7
F	C, D	5	2
G	A	3	4
H	E	6	3

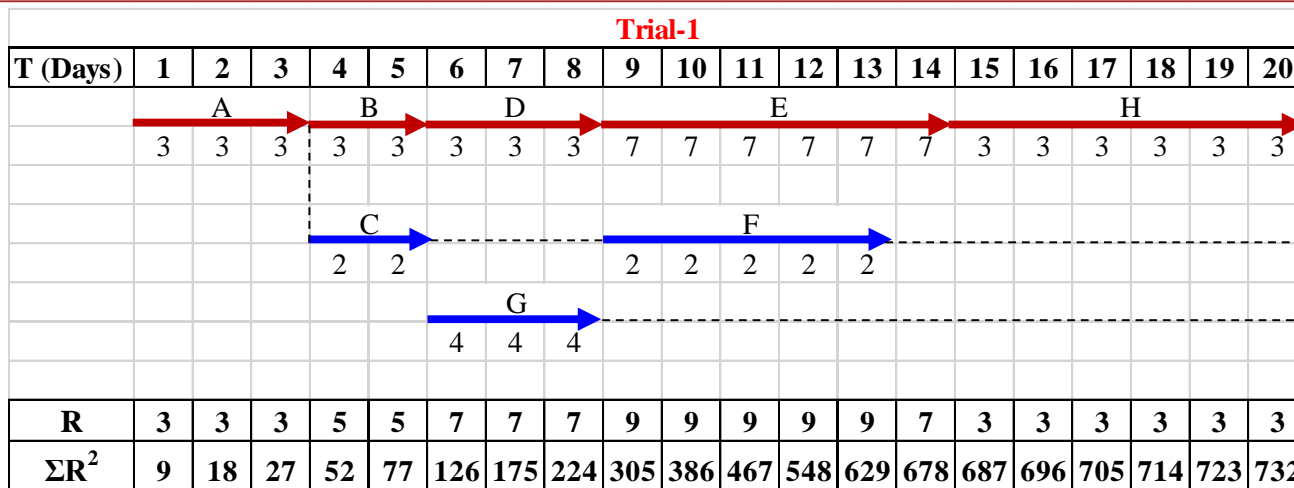
Manual Solution

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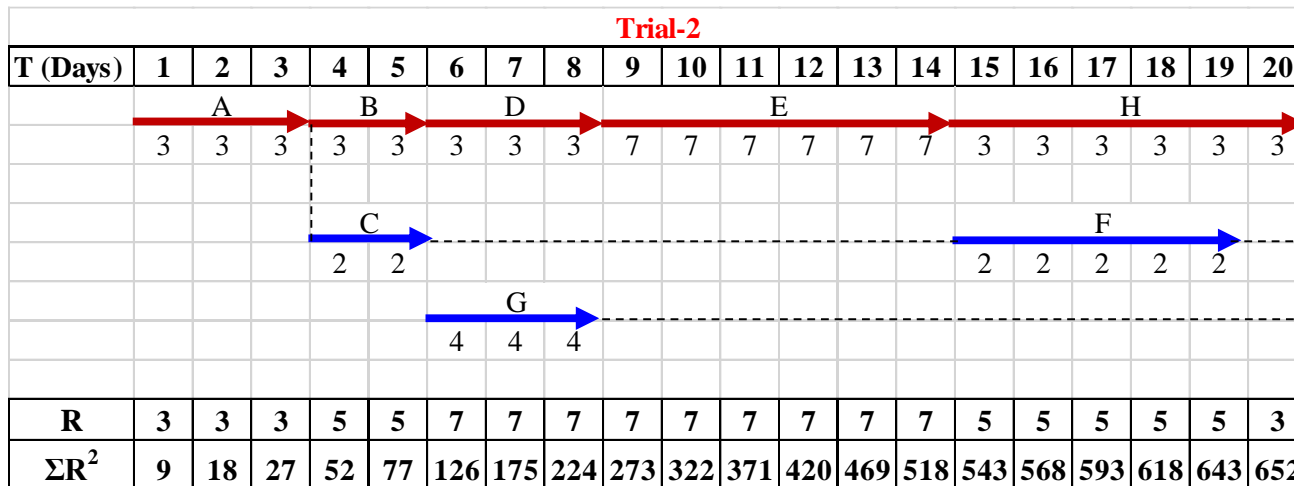
(a) Early start based Time-scaled schedule

T (Days)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
	A →			B →		D →			E →						H →						
	3	3	3	3	3	3	3	3	7	7	7	7	7	7	3	3	3	3	3	3	
				C →					F →												
				2	2				2	2	2	2	2								
				G →																	
				4	4	4															
R	3	3	3	9	9	7	3	3	9	9	9	9	9	7	3	3	3	3	3	3	
ΣR²	9	18	27	108	189	238	247	256	337	418	499	580	661	710	719	728	737	746	755	764	

(b) Resource leveling



ΣR^2 is decreased from 764 to 732.



ΣR^2 is reduced from 732 to 652.

As ΣR^2 is minimum in the second trial, the schedule shown above in trial-2 is having the most leveled resources.

Solution of Microsoft Project

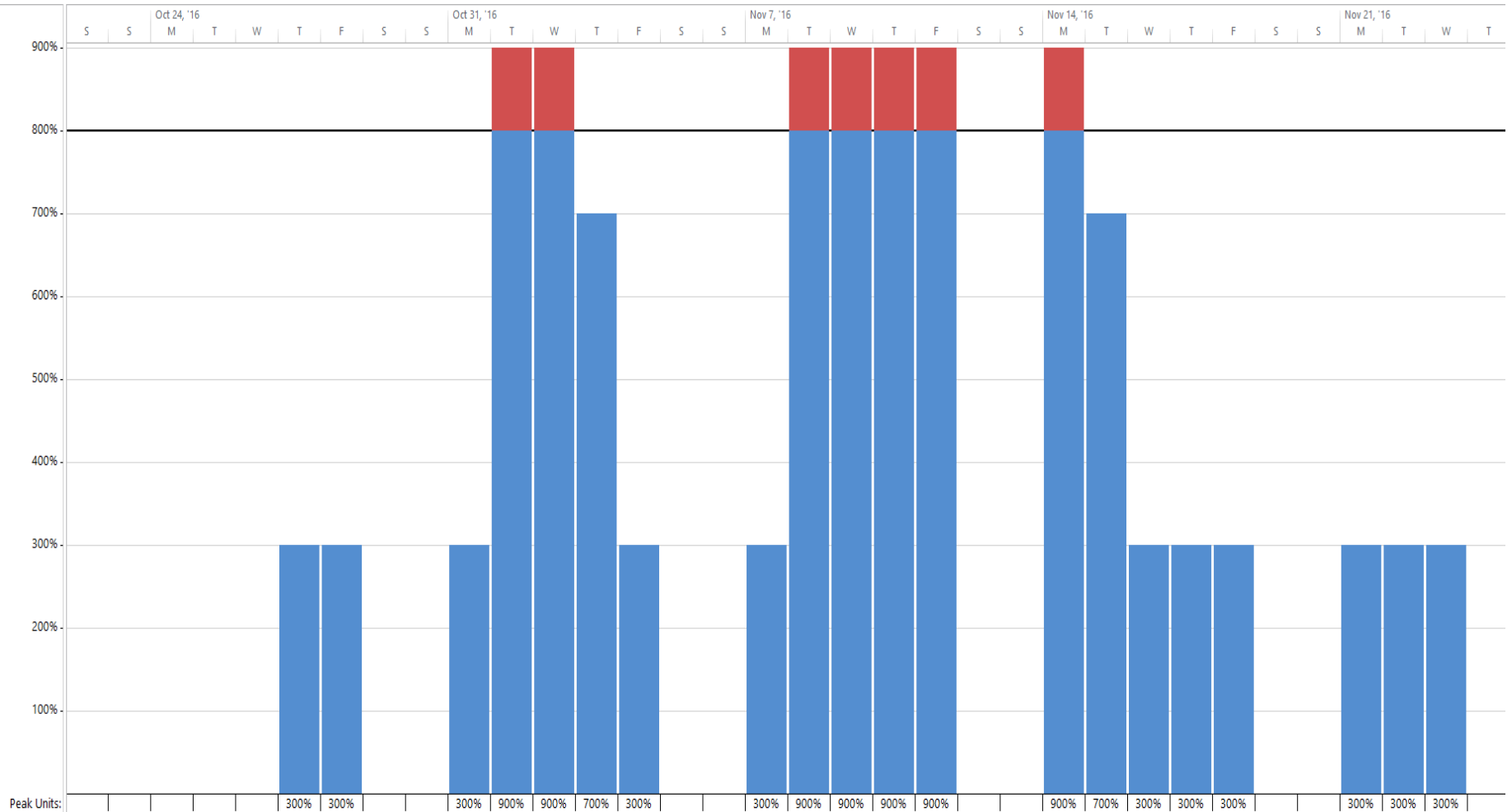
27

		Task Mode ▾	Task Name ▾	Duration ▾	Start ▾	Finish ▾	Predecessor ▾	Resource Names ▾	Total Slack ▾	Free Slack ▾
1			A	3 days	Thu 10/27/16	Mon 10/31/16		Labour[300%]	0 days	0 days
2			B	2 days	Tue 11/1/16	Wed 11/2/16	1	Labour[300%]	0 days	0 days
3			C	2 days	Tue 11/1/16	Wed 11/2/16	1	Labour[200%]	10 days	3 days
4			D	3 days	Thu 11/3/16	Mon 11/7/16	2	Labour[300%]	0 days	0 days
5			E	6 days	Tue 11/8/16	Tue 11/15/16	4	Labour[700%]	0 days	0 days
6			F	5 days	Tue 11/8/16	Mon 11/14/16	3,4	Labour[200%]	7 days	7 days
7			G	3 days	Tue 11/1/16	Thu 11/3/16	1	Labour[400%]	14 days	14 days
8			H	6 days	Wed 11/16/16	Wed 11/23/16	5	Labour[300%]	0 days	0 days

Resource sheet:

		Resource Name ▾	Type ▾	Material ▾	Initials ▾	Group ▾	Max. ▾	Std. Rate ▾	Ovt. ▾	Cost/Use ▾	Accrue ▾	Base ▾
1		Labour	Work		L		800%	\$0.00/hr	\$0.00/hr	\$0.00	Prorated	Standard

Resource graph (Before levelling)



R	3	3	3	9	9	7	3	3	9	9	9	9	9	7	3	3	3	3	3	
ΣR²	9	18	27	108	189	238	247	256	337	418	499	580	661	710	719	728	737	746	755	764

(Manual)

Levelling Options

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Resource Leveling [Close]

Leveling calculations

Automatic Manual

Look for overallocations on a **Day by Day** basis

Clear leveling values before leveling

Leveling range for 'Demo-4-Leveling'

Level entire project

Level From: **Thu 10/27/16** To: **Wed 11/23/16**

Resolving overallocations

Leveling order: **Priority, Standard**

Level only within available slack

Leveling can adjust individual assignments on a task

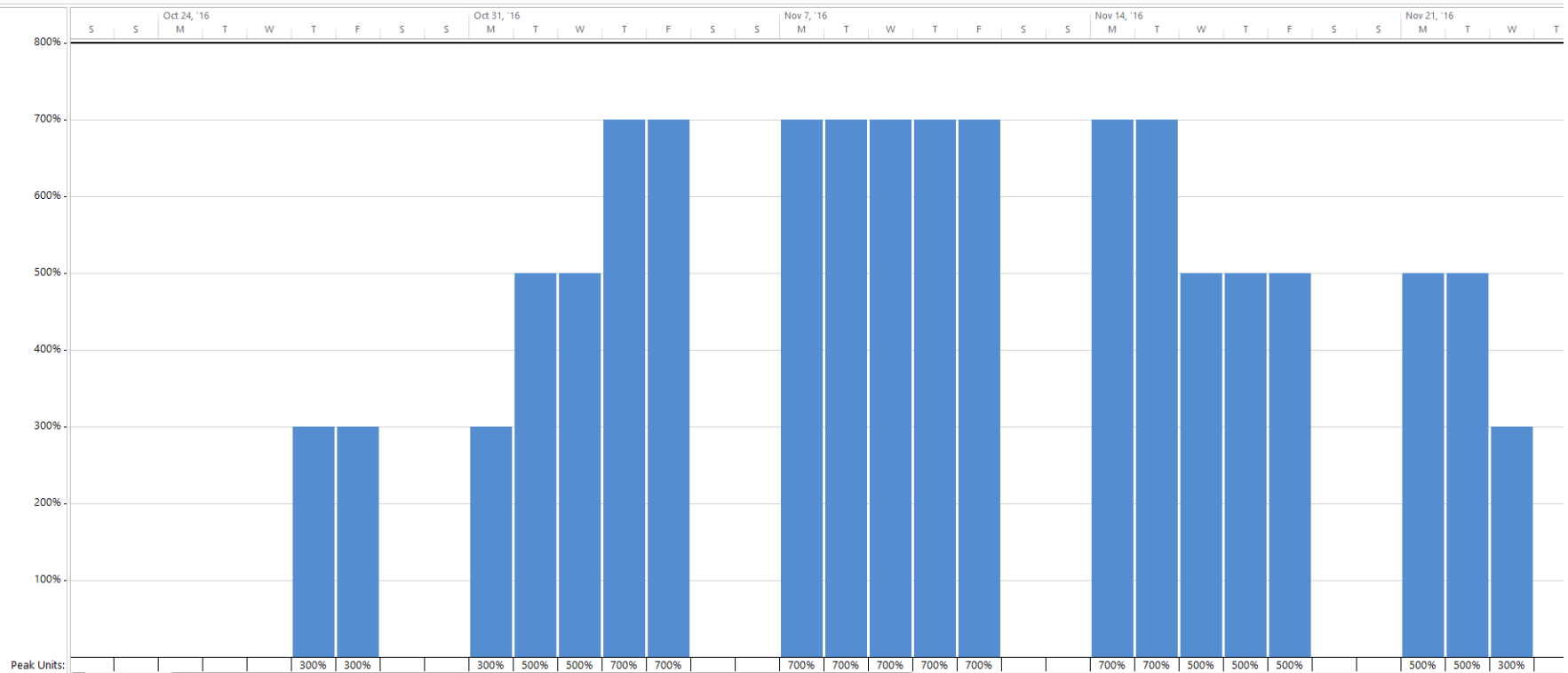
Leveling can create splits in remaining work

Level resources with the proposed booking type

Level manually scheduled tasks

Buttons: Help, Clear Leveling..., Level All, **OK**, Cancel

Resource graph (After Levelling)



R	3	3	3	5	5	7	7	7	7	7	7	7	7	7	5	5	5	5	5	3
ΣR^2	9	18	27	52	77	126	175	224	273	322	371	420	469	518	543	568	593	618	643	652

(Manual)

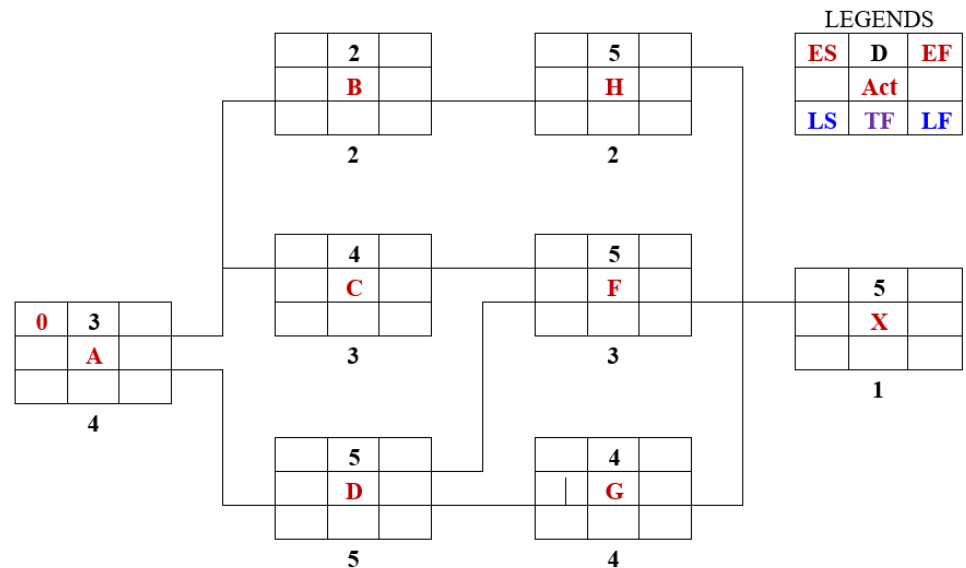
Demo Problem-5 (Resource Allocation)

31

A small engineering project is planned as shown below in the Activity-on-Node (AON) diagram. The number of resources required for each activity are shown under each activity box.

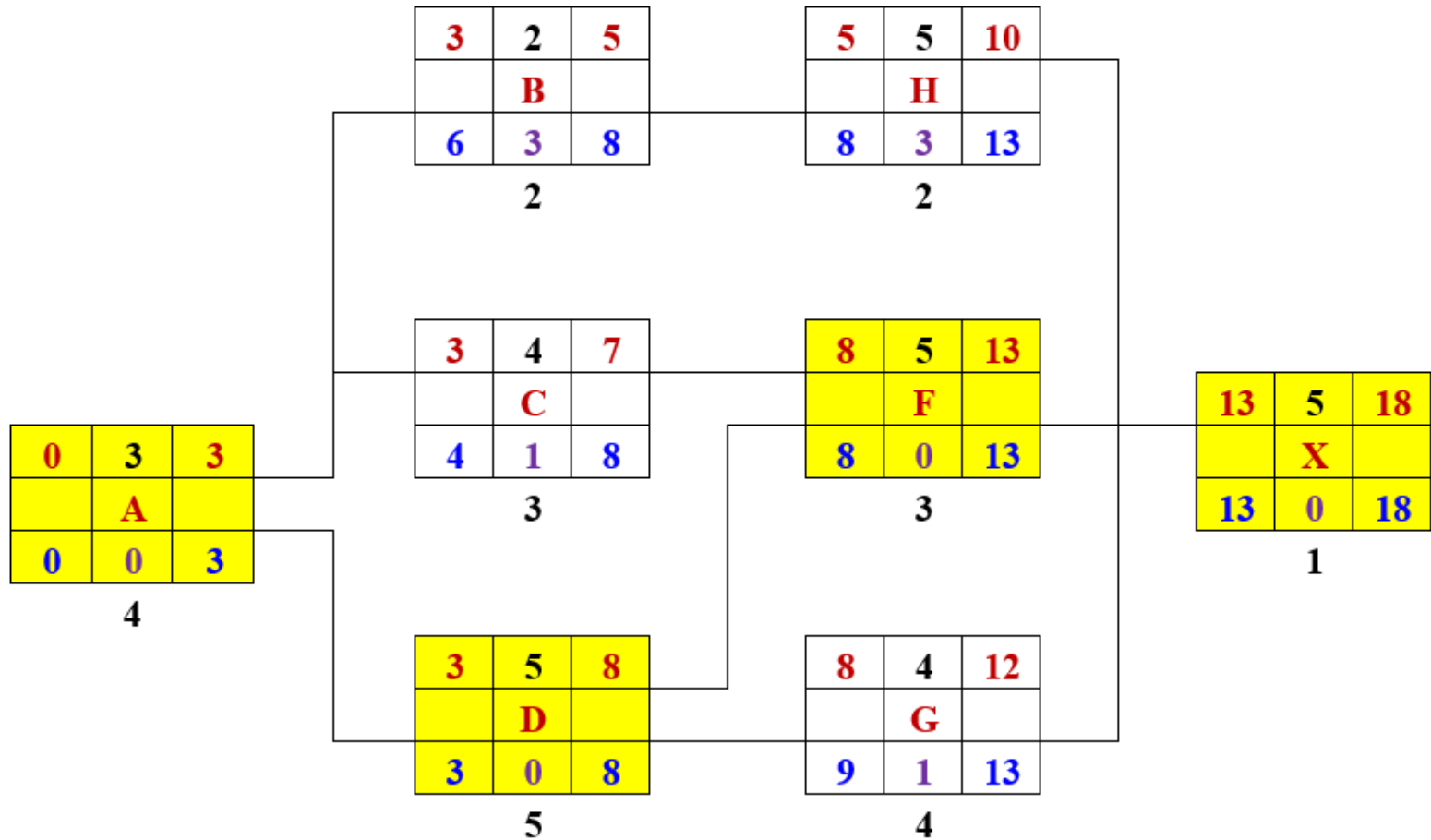
(a) Allocate the resources to the activities if the maximum available resource for any day are **six** only.

(b) Estimate the planned cost of each activity and entire project if each resource cost \$100.0/day.



Manual Solution

32



Resource allocation

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T (Days)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26					
EAS	A			B	B				B	G	G	G	G	G	G	G	G	G				X									
				C	C				C		H		F																		
				D					G																						
OSS				D					C		H		F					G				X									
				C					B		G		G																		
				B					G																						
A																															
4	4	4																													
				D																											
			5	5	5	5	5																								
									C																						
								3	3	3	3																				
									B																						
								2	2																						
											H																				
										2	2	2	2	2																	
													F																		
													3	3	3	3	3														
																		G													
																		4	4	4	4										
																						X									
																						1	1	1	1	1					
R	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	3	3	4	4	4	4	1	1	1	1	1					
ΣR	4	8	12	17	22	27	32	37	42	47	52	57	62	67	72	75	78	82	86	90	94	95	96	97	98	99					

Planned Cost of the project = $99 \times 100 = \$9,900$
















Planned Cost of Activities and Project

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Activity	Duration (days)	Resources	Planned Cost
A	3	4	$4 \times (100 \times 3) = \1200
B	2	2	$2 \times (100 \times 2) = \400
C	4	3	$3 \times (100 \times 4) = \1200
D	5	5	$5 \times (100 \times 5) = \2500
H	5	2	$2 \times (100 \times 5) = \1000
F	5	3	$3 \times (100 \times 5) = \1500
G	4	4	$4 \times (100 \times 4) = \1600
X	5	1	$1 \times (100 \times 5) = \500
Project planned cost =			\$ 9,900

Solution of Microsoft Project

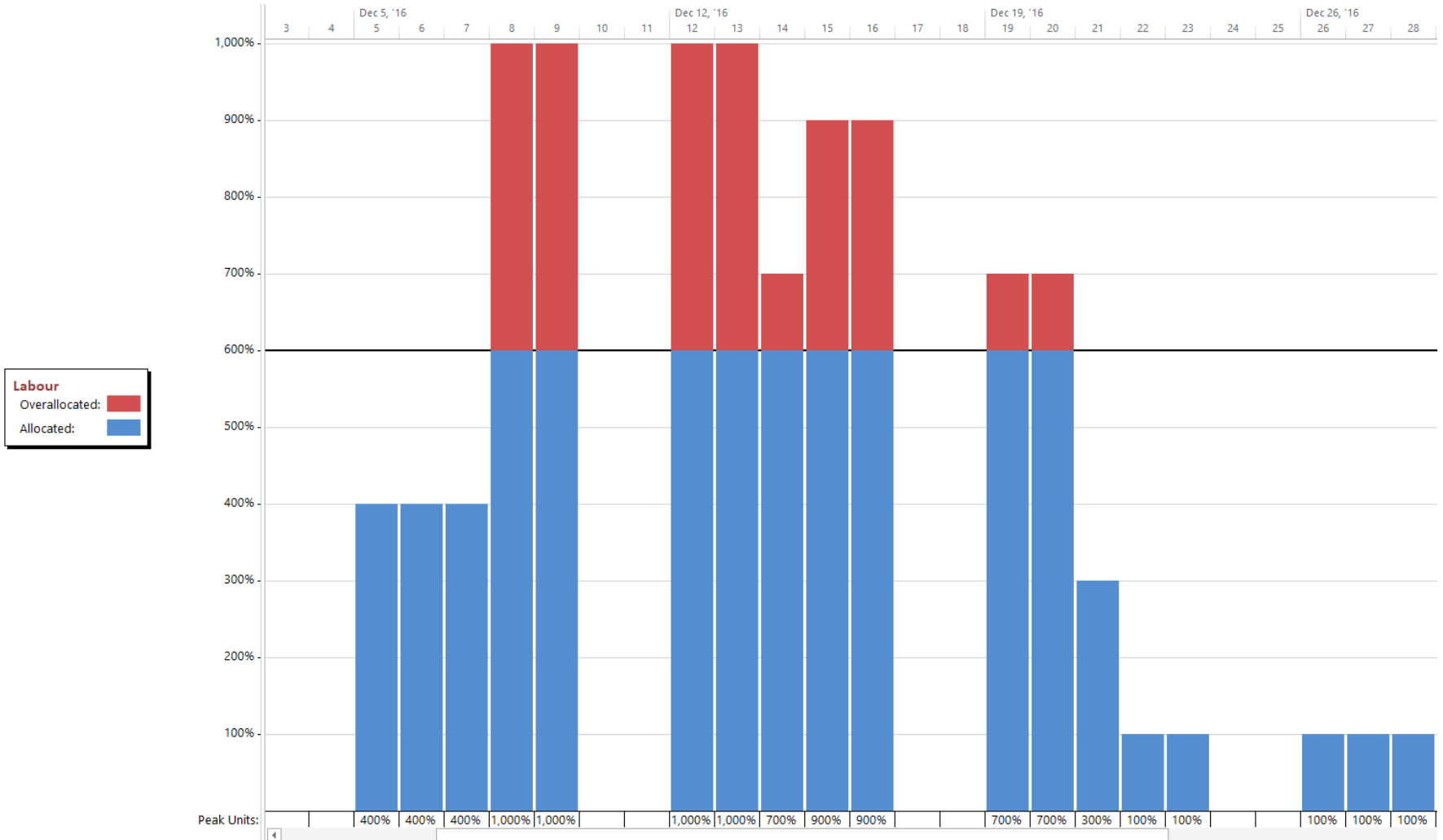
35

		Task Mode ▾	Task Name ▾	Duration ▾	Start ▾	Finish ▾	Predecessors ▾	Resource Names ▾	Free Slack ▾	Total Slack ▾
1			A	3 days	Mon 12/5/16	Wed 12/7/16		Labour[400%]	0 days	0 days
2			B	2 days	Thu 12/8/16	Fri 12/9/16	1	Labour[200%]	0 days	3 days
3			C	4 days	Thu 12/8/16	Tue 12/13/16	1	Labour[300%]	1 day	1 day
4			D	5 days	Thu 12/8/16	Wed 12/14/16	1	Labour[500%]	0 days	0 days
5			F	5 days	Thu 12/15/16	Wed 12/21/16	4,3	Labour[300%]	0 days	0 days
6			G	4 days	Thu 12/15/16	Tue 12/20/16	4	Labour[400%]	1 day	1 day
7			H	5 days	Mon 12/12/16	Fri 12/16/16	2	Labour[200%]	3 days	3 days
8			X	5 days	Thu 12/22/16	Wed 12/28/16	5,6,7	Labour	0 days	0 days

Resource sheet:

		Resource Name ▾	Type ▾	Material ▾	Initials ▾	Group ▾	Max. ▾	Std. Rate ▾	Ovt. ▾	Cost/Use ▾	Accrue ▾	Base ▾
1		Labour	Work		L		600%	\$100.00/day	\$0.00/hr	\$0.00	Prorated	Standard

Resource graph (Before Resource Allocation)



Levelling Options

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Resource Leveling

Leveling calculations

Automatic Manual

Look for overallocations on a basis

Clear leveling values before leveling

Leveling range for 'Demo-'

Level entire project

Level From: To:

Resolving overallocations

Leveling order:

Level only within available slack

Leveling can adjust individual assignments on a task

Leveling can create splits in remaining work

Level resources with the proposed booking type

Level manually scheduled tasks

Help Clear Leveling... Level All OK Cancel

Resource graph (After Resource Allocation)



R	4	4	4	5	5	5	5	5	5	5	5	5	5	5	3	3	4	4	4	4	1	1	1	1	1	
ΣR	4	8	12	17	22	27	32	37	42	47	52	57	62	67	72	75	78	82	86	90	94	95	96	97	98	99

(Manual)

Planned Costs

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COST STATUS

Cost status for top level tasks.

Name	Actual Cost	Remaining Cost	Baseline Cost	Cost	Cost Variance
A	\$0.00	\$1,200.00	\$1,200.00	\$1,200.00	\$0.00
B	\$0.00	\$400.00	\$400.00	\$400.00	\$0.00
C	\$0.00	\$1,200.00	\$1,200.00	\$1,200.00	\$0.00
D	\$0.00	\$2,500.00	\$2,500.00	\$2,500.00	\$0.00
F	\$0.00	\$1,500.00	\$1,500.00	\$1,500.00	\$0.00
G	\$0.00	\$1,600.00	\$1,600.00	\$1,600.00	\$0.00
H	\$0.00	\$1,000.00	\$1,000.00	\$1,000.00	\$0.00
X	\$0.00	\$500.00	\$500.00	\$500.00	\$0.00

COST OVERVIEW

MON 12/5/16 - MON 1/9/17

COST

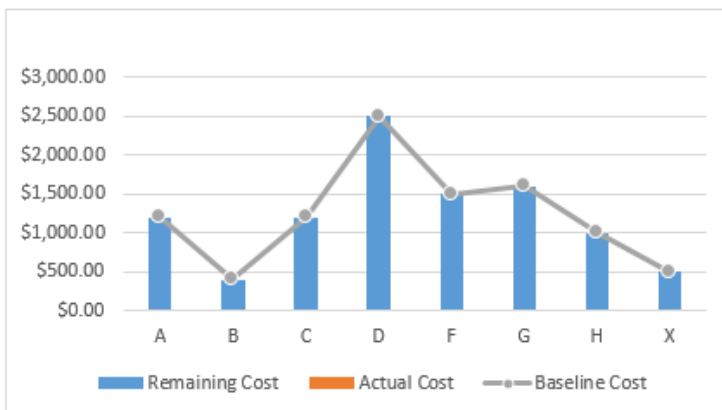
\$9,900.00

REMAINING COST

\$9,900.00

% COMPLETE

0%



Manual Planned Cost of the project =
 $99 \times 100 = \$9,900$

Microsoft Project Assignment

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GE 404- Engineering Management

Project Management using Microsoft Project

I. Objective

This assignment familiarizes you with the project management software Microsoft Project. You will manage a multi-phase multi-task project as described below. You will learn how to create graphic output about your project, and learn how to read information produced by Microsoft Project. Below are detailed requirements to accomplish this assignment.

II. Implementation Procedure

- Download a trial version of Microsoft project software that is compatible with your computer.
- In your computer, find **Microsoft Project** in your programs list and open the software.
- Enter the **Project Information** below:
- Project title is “**Your Major**” Project
 - Project manager is “**Your Name**”
 - Project beginning date is **January 6, 2020**.
 - Project working days are **Sunday -Thursday** with **Friday & Saturday** as nonworking days.
 - Project working hours are from **8:00 AM – 12:00 PM**; and from **1:00 PM-5:00 PM**
- Enter the following 3-phase System Analysis project (**Table 1**) into your worksheet.
- Use your nine-digit **student ID** to assign tasks durations (one digit for each task), e.g. if your ID is 412345678; the duration of task 1.1 is 4 days and for 1.2 is 1 day, and so on.

Table 1. Task List

Phase	Tasks	Duration (days)	Predecessors
1. Initiation	1.1 Defining Team Organization		None
	1.2 Establish initial contact		1.1
	1.3 Define problem/opportunity		1.1; 1.2
	1.4 Problem ID Statement*	0	1.3
2. Planning	2.1 Describe project scope		1.4
	2.2 Conduct feasibility analysis		2.1
	2.3 Define tasks and schedule		2.1
	2.4 Select baseline project plan*	0	2.2; 2.3
3. Analysis	3.1 Data needs analysis		2.4
	3.2 Resource identification		3.1
	3.3 Define major processes		3.1
	3.4 Deliver preliminary models*	0	3.2,3.3

* Indicates that the task is a “Milestone”

- The above multi-phase multi-task project will be conducted by a four-person team.

Name	Initials	Max units	Std Rate	Ovt rate	Cost/Use
Your Name	YN	100%	\$18/hr	\$27.0/hr	\$0
Jamal Nasser	JN	100%	15.0/hr	20.0/hr	\$75
Fahad Sultan	FS	100%	12.0/hr	18.0/hr	\$50
Ali Khaled	AK	100%	10.0/hr	15.0/hr	0

- Enter the following resource assignment. At this moment, only tasks in the initiation Phase are assigned. Do not worry about tasks in the next two phases.

Task name	Assignment
1.1 Defining Team Organization	YN (100%), JN (100%)
1.2 Establish initial contact	YN (100%), JN (50%), FS (50%)
1.3 Define Problem/Opportunity	JN(100%), AK (50%)
1.4 Problem ID Statement	YN (100%), AK (50%)

- Perform resource leveling and resource allocation (if needed) for your project.

III. Deliverables

- After you have successfully entered the above data, save your project under the name **StudentID-GE404**.
- Collect information about your project using **Microsoft Project** and **Microsoft Word**. Collect the following information and components:
 - Name your Word document **StudentID - GE404**.
 - Click **Project | Project Information | Statistics** to find out the **Project Finish date**, **Total Duration**, **Total Work hours**, and **Total Costs**. (Print screen)
- Turn in your deliverable in the following manner:
 - Use a cover page that has your (Name, Student ID, Section #).
 - Then include this cover page to your Word document that contains all required results from your project:
 - Project Statistics (screenshot)**
 - A Gantt Critical Path (screenshot)**
 - Associated Gantt information**
 - A task sequence of all critical tasks in the critical path.**
 - Network diagram**
 - Resource graph**
 - Cost overview**
- Upload both files** (MS Word and MS Project) to LMS (Blackboard)

Note: If you do not turn in your work in the above manner (and order), you may lose up to **10%** of your assignment grade.

Thank You

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Questions Please

