BHARATIYA VIDYA BHAVANS
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Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai

Experiment 7

Group Members:

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Project Title: Resort Property Management System

Aim: To perform resource optimization techniques

Resource optimization:

Resource optimization is a tool technique used in the Develop Schedule process of Schedule Management knowledge area.

Resource optimization is a schedule network analysis technique applied to a schedule that has already been analyzed by the Critical Path Method (CPM).

Resource optimization is needed when resources have been overallocated, such as when a resource has been assigned to two or more activities during the same time period. It may also be needed when certain resources (eg. equipment or machinery) are available in limited quantities, while the CPM schedule demands more than the available quantities.

In short, resource optimization is employed when there is a resource conflict (ie. when the schedule requires more than the available resources) or when there is a need to keep the resource usage at a constant level.

Two examples of resource optimization techniques are:

- Resource leveling and
- Resource smoothing

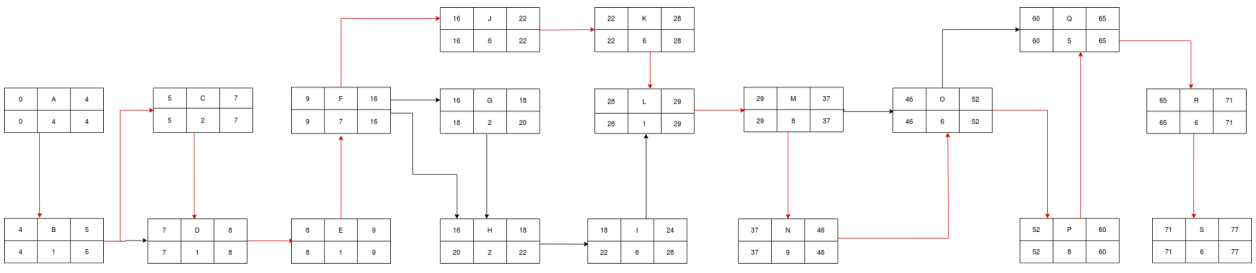
Resource Leveling

- Main constraint is resource availability. You extend the project duration as required.
- Project End date may change.
- Overall Project can be delayed. Consequently, costs may be increased.
- Can be done to activities on the critical path.
- Changes are allowed to critical path.
- Used when resources are over-allocated.
- Resource Constrained Scheduling (RCS)

Resource Smoothing

- Main constraint is time. Project Duration is fixed.
- Project End date will not change.
- Overall project will not be delayed, but Activities may only be delayed with in their free or total float.
- Cannot be done to activities on the critical path.
- changes are not allowed to critical path.
- Used when resources are unevenly allocated.
- Time Constrained Scheduling (TCS)

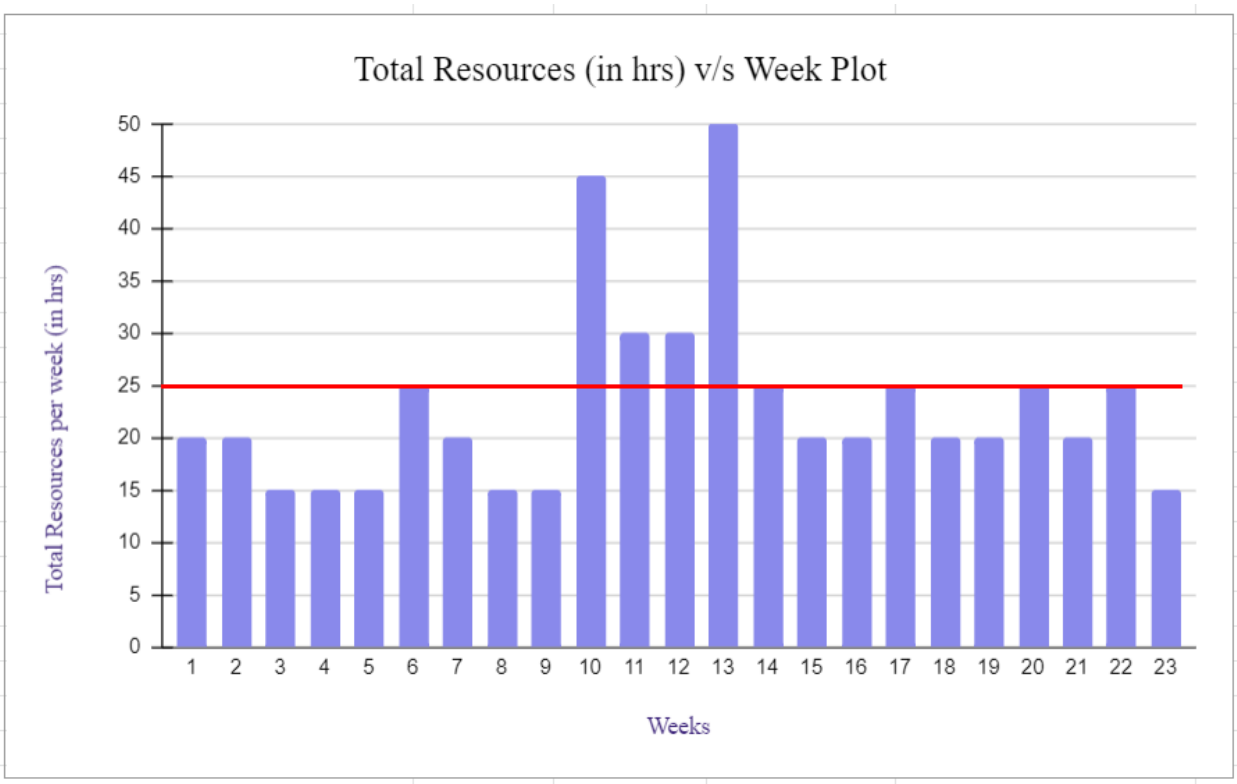
Network Diagram :



Resource Allocation

Activity Name	Node Name	Predecessors	Duration Weeks	Resourcess (Time) / Week	Critical Path	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Requirement Analysis	A	-	2	20	Yes	20	20																					
Defining Problem Statement	B	A	1	15	Yes			15																				
Defining Objectives and Features	C	B	2	15	Yes				15	15																		
Proposal Documentation	D	B,C	1	25	Yes						25																	
Project Proposal Approval	E	D	1	20	Yes							20																
Designing UI	F	E	2	15	Yes								15	15														
Database connectivity and setup	G	F	1	25	No										25													
Login-Signup Implementation	H	F, G	2	10	No											10	10											
Implementation of User System	I	H	1	25	No													25										
Implementation of Property System	J	F	3	20	Yes										20	20	20											
Implementation of Booking System	K	J	1	25	Yes													25										
Phase II Documentation and Presentation	L	I, K	1	25	Yes														25									
Implementation of Payment System	M	L	2	20	Yes															20	20							
Implementation of Inventory Management	N	M	1	25	Yes																	25						
Testing	O	M, N	2	20	Yes																		20	20				
Deployment	P	O	1	20	Yes																				25			
Phase III Documentation	Q	O, P	1	20	Yes																					20		
Final Project Report Preparation	R	Q	1	25	Yes																						25	
Final Presentation	S	R	1	15	Yes																							15
Total Resources						20	20	15	15	15	25	20	15	15	45	30	30	50	25	20	20	25	20	20	25	20	25	15
Resource Restriction (Threshold)			25																									
Critical Path			A-B-C-D-E-F-J-K-L-M-N-O-P-Q-R-S																									

Bar chart format to understand the resource usage over time periods



Threshold : 25 resources per week

As per graph, week 10, 12, 12, 13 has resource conflict

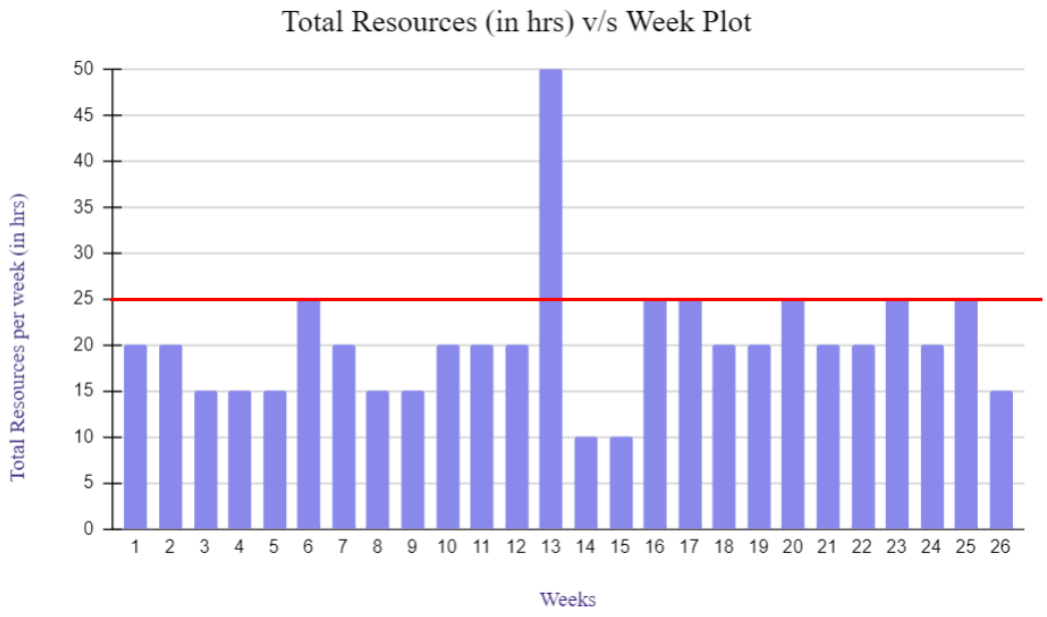
Resource Leveling:

Resource leveling looks at removing all resource conflicts without worrying too much about extending the project duration.

There is resource conflict on week 10, 11, 12 and 13.

Let us look at the first conflict, which happens between activities G and J. To avoid the conflict, we need to delay either activity G or activity J. Since activity J is on the critical path, we delay activity G. Accordingly, successor activities are also shifted.

Activity Name	Node Name	Predecessors	Duration Weeks	Resourcess (Time) / Week	Critical Path	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	27	28
Requirement Analysis	A	-	2	20	Yes	20	20																										
Defining Problem Statement	B	A	1	15	Yes			15																									
Defining Objectives and Feature	C	B	2	15	Yes				15	15																							
Proposal Documentation	D	B,C	1	25	Yes						25																						
Project Proposal Approval	E	D	1	20	Yes							20																					
Designing UI	F	E	2	15	Yes								15	15																			
Database connectivity and setup	G	F	1	25	No													25															
Login-Signup Implementation	H	F, G	2	10	No														10	10													
Implementation of User System	I	H	1	25	No																25												
Implementation of Property Syst	J	F	3	20	Yes										20	20	20																
Implementation of Booking Syst	K	J	1	25	Yes													25															
Phase II Documentation and Pres	L	I, K	1	25	Yes																	25											
Implementation of Payment Syst	M	L	2	20	Yes																		20	20									
Implementation of Inventory Ma	N	M	1	25	Yes																				25								
Testing	O	M, N	2	20	Yes																					20	20						
Deployment	P	O	1	20	Yes																							25					
Phase III Documentation	Q	O, P	1	20	Yes																								20				
Final Project Report Preparation	R	Q	1	25	Yes																									25			
Final Presentation	S	R	1	15	Yes																										15		
Total Resources						20	20	15	15	15	25	20	15	15	20	20	20	50	10	10	25	25	20	20	25	20	20	25	20	25	15	0	
Resource Restriction (Threshold)			25			Shifting activity G days after J ends as F in not on Critical Path, consequently shifting other acivities dependen																												

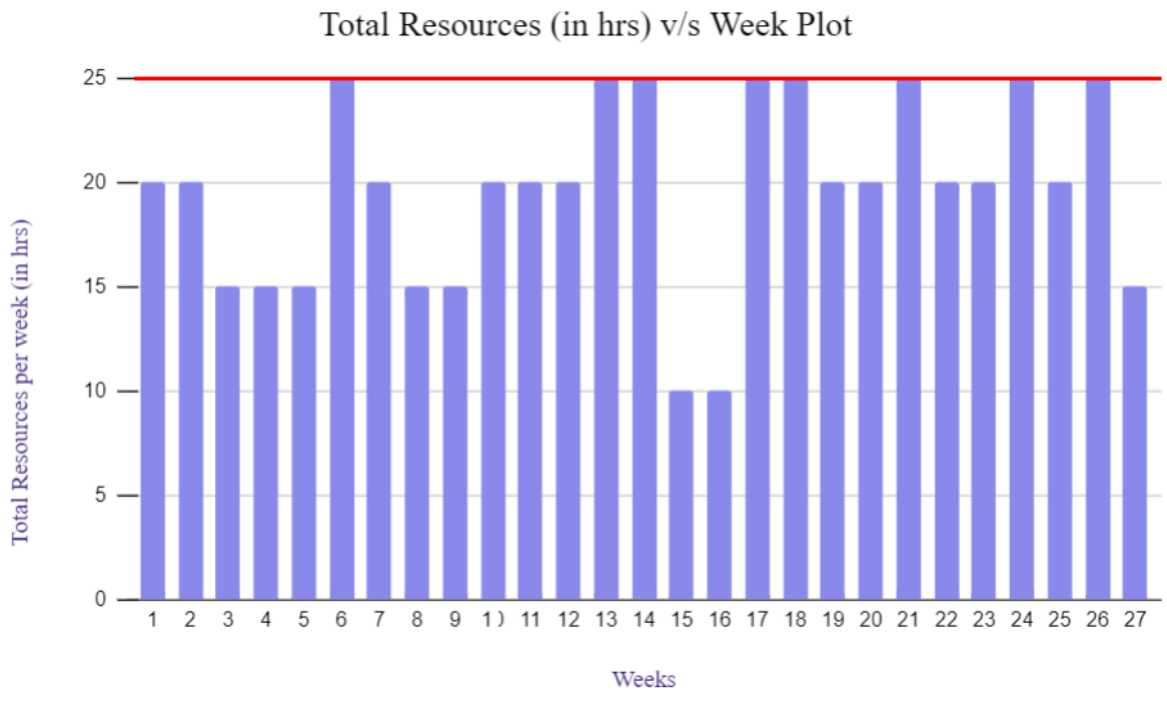


Now, there is conflict at week 13, which happens between activities G and K. To avoid the conflict, we need to delay activity G, since activity K is on the critical path. Accordingly, successor activities are also shifted.

Gantt Chart after resource leveling is performed

Activity Name	Node Name	Predecessors	Duration Weeks	Resourcess (Time) / Week	Critical Path	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	27	28
Requirement Analysis	A	-	2	20	Yes	20	20																										
Defining Problem Statement	B	A	1	15	Yes			15																									
Defining Objectives and Feature	C	B	2	15	Yes				15	15																							
Proposal Documentation	D	B,C	1	25	Yes						25																						
Project Proposal Approval	E	D	1	20	Yes							20																					
Designing UI	F	E	2	15	Yes								15	15																			
Database connectivity and setup	G	F	1	25	No													25															
Login-Signup Implementation	H	F, G	2	10	No														10	10													
Implementation of User System	I	H	1	25	No																25												
Implementation of Property Syst	J	F	3	20	Yes										20	20	20																
Implementation of Booking Syst	K	J	1	25	Yes													25															
Phase II Documentation and Pres	L	I, K	1	25	Yes																	25											
Implementation of Payment Syst	M	L	2	20	Yes																		20	20									
Implementation of Inventory Ma	N	M	1	25	Yes																				25								
Testing	O	M, N	2	20	Yes																					20	20						
Deployment	P	O	1	20	Yes																							25					
Phase III Documentation	Q	O, P	1	20	Yes																								20				
Final Project Report Preparation	R	Q	1	25	Yes																									25			
Final Presentation	S	R	1	15	Yes																										15		
Total Resources						20	20	15	15	15	25	20	15	15	20	20	20	25	25	10	10	25	25	20	20	25	20	20	25	20	25	15	
Resource Restriction (Threshold)				25		Shifting activity K days after J ends, both are on Critical Path, consequently shifting other acivities dependent																											

Bar Graph after resource leveling is performed



All resource conflicts are removed. Now, the maximum resources required is only 25 numbers every week. However, in the process, the project gets delayed by 4 weeks. The total duration of the project is 27 weeks now.

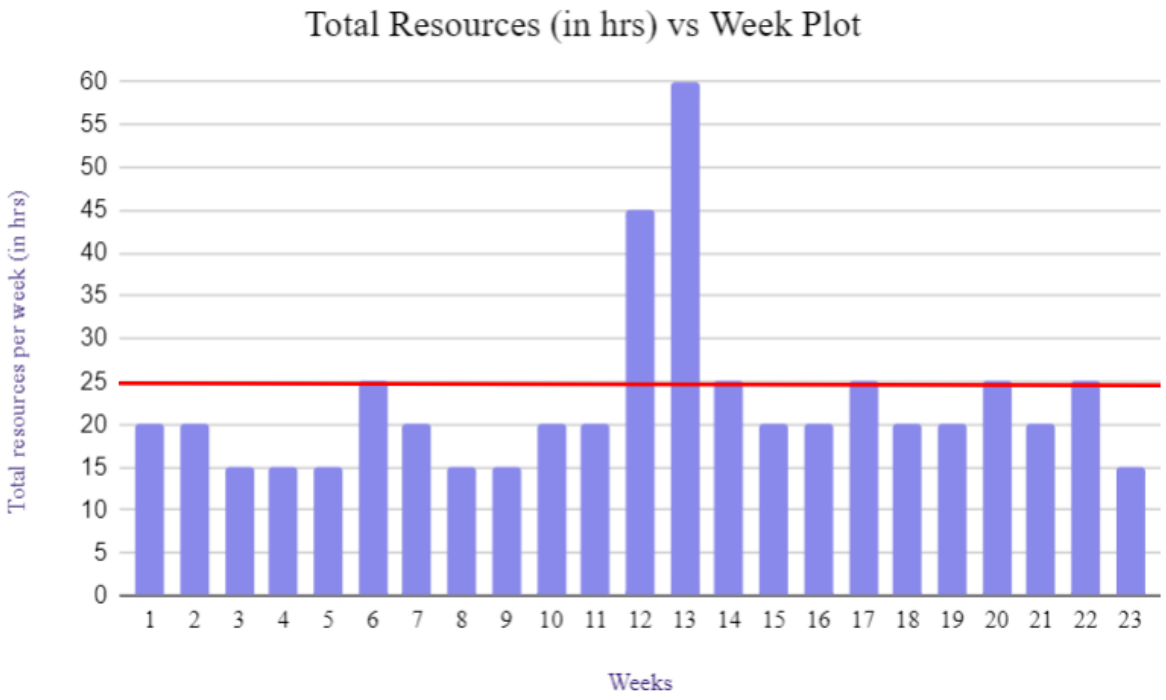
Resource smoothing:

Resource smoothing looks at removing as much resource conflicts as possible without delaying the total project duration.

Gantt Chart after resource smoothing is performed

Activity Name	Node Name	Duration Weeks	Resourcess (Time) / Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Requirement Analysis	A	2	20	20	20																					
Defining Problem Statement	B	1	15			15																				
Defining Objectives and Features	C	2	15				15	15																		
Proposal Documentation	D	1	25						25																	
Project Proposal Approval	E	1	20							20																
Designing UI	F	2	15								15	15														
Database connectivity and setup	G	1	25												25											
Login-Signup Implementation	H	2	10													10	10									
Implementation of User System	I	1	25													25										
Implementation of Property System	J	3	20										20	20	20											
Implementation of Booking System	K	1	25													25										
Phase II Documentation and Presentation	L	1	15														15									
Implementation of Payment System	M	2	20															20	20							
Implementation of Inventory Management	N	1	25																	25						
Testing	O	2	20																		20	20				
Deployment	P	1	20																				25			
Phase III Documentation	Q	1	20																					20		
Final Project Report Preparation	R	1	25																						25	
Final Presentation	S	1	15																							15
Total Resources				20	20	15	15	15	25	20	15	15	20	20	45	60	25	20	20	25	20	20	25	20	25	15
Resource Restriction (Threshold)			25																							
Critical Path			A-B-C-D-E-F-J-K-L-M-N-O-P-Q-R-S																							

Bar Graph after resource smoothing is performed



All the resource conflicts cannot be removed. Resource smoothing managed to remove 2 weeks of conflict. However, if the organization wants to stick to the original schedule, then additional resources are required on weeks 12 and 13.

Conclusion:

Resource leveling is a resource-limited scheduling technique, while resource smoothing is a time-limited scheduling technique. In this experiment we performed resource leveling and smoothing on our project topic Resort Property Management.

References:

- https://www.apm.org.uk/resources/find-a-resource/difference-between-resource-smoothing-and-resource-levelling/
- https://www.pmdrill.com/resource-leveling-smoothing-explained/