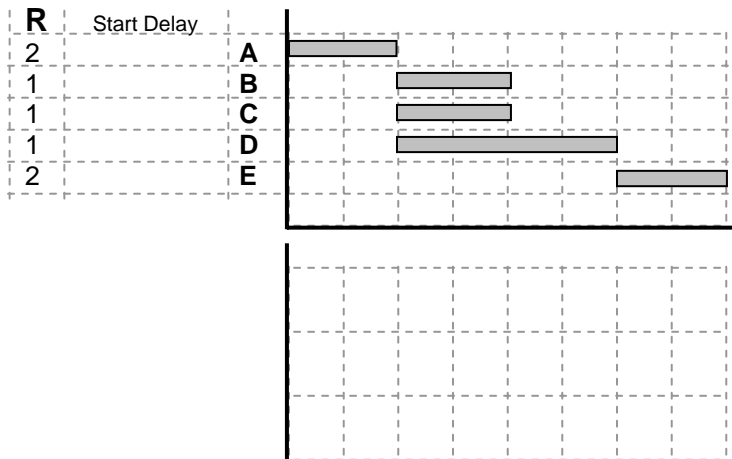


# RESOURCE LEVELING VS RESOURCE ALLOCATION

## Resource Leveling:

- How to smooth resource demands?
- No problem with time or resources.
- Strategy?
- Method of moments?
- Method of double moments?
- Multi-Resources?
- Desired (best) profiles?

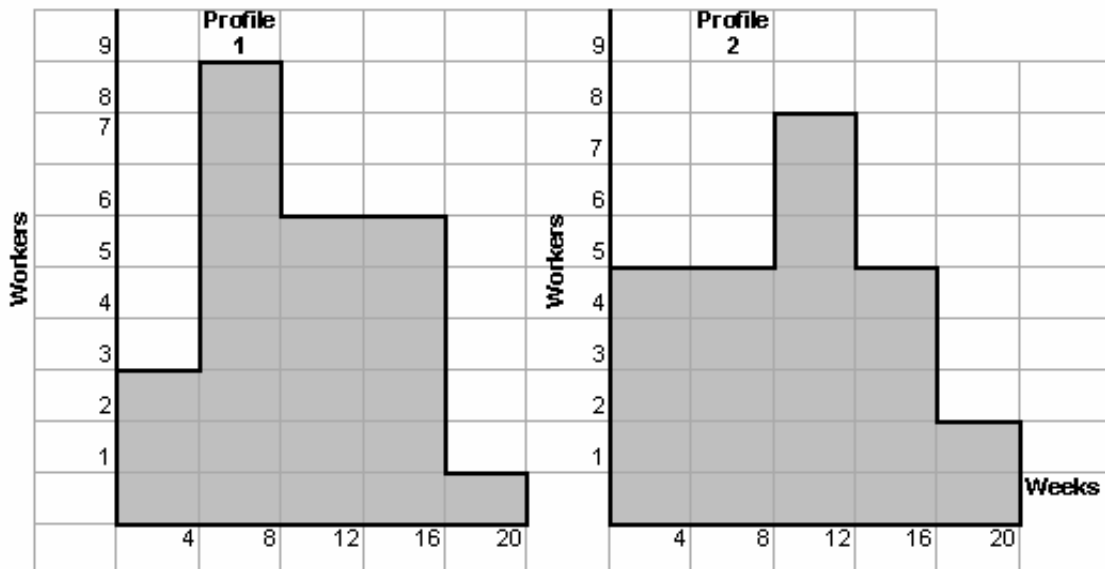


Resource Profile:

Strategy: \_\_\_\_\_

## Example:

Two schedule alternatives have associated resource profiles as shown below, which alternative would you choose and why? Also calculate the total **worker-weeks** needed for both cases:



**Mx =**

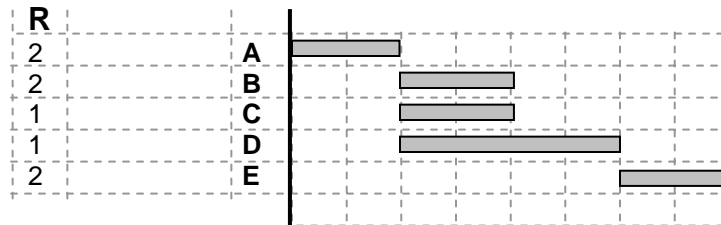
**My =**

## Resource Allocation:

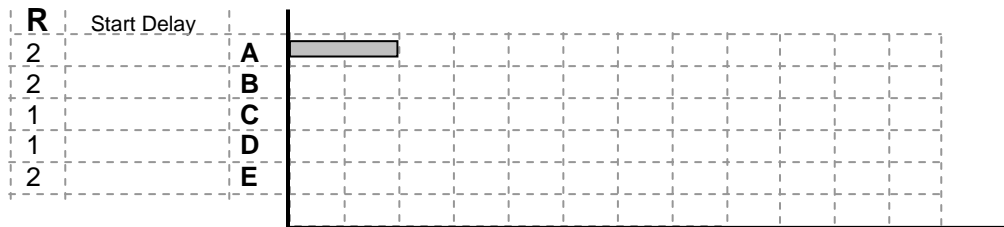
- Allocate limited resources to top-priority activities.
- Strategy?
- Heuristic rules
- Inconsistency among existing software
- Excel Implementation
- EasyPlan Optimization

**Floats?**

**Resource limit = 2 / day**

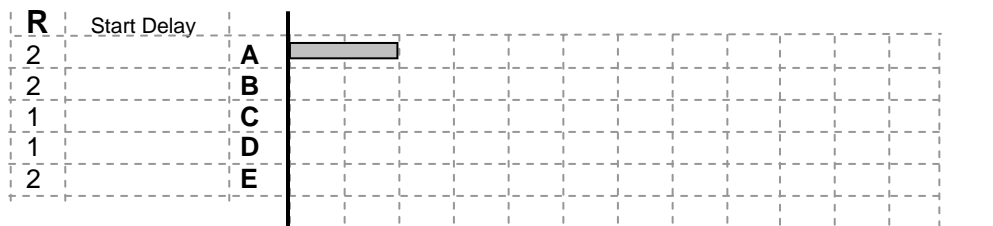


## Solution



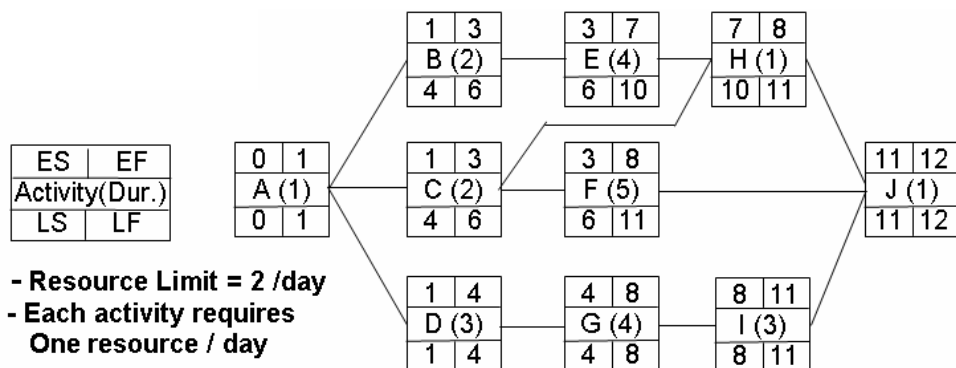
Strategy: \_\_\_\_\_

## Another Solution



## Priority Rules:

### Resource Allocation Example:



Time	Eligible Activities	Resources (limit = 2)	Duration	Rule (ELS)	Decision	Finish Time

## Microsoft Project Solution?

### Case of Multi-Resources? Case of Multi-Resources Multi-Skills?

## MEETING DEADLINE

- Activity time-cost relationship? Linear vs Discrete  
(**Cheap & Slow** versus **Fast & Expensive**)
- Cost Slope?
- Project time-cost relationship?
- Strategy to meet deadline?

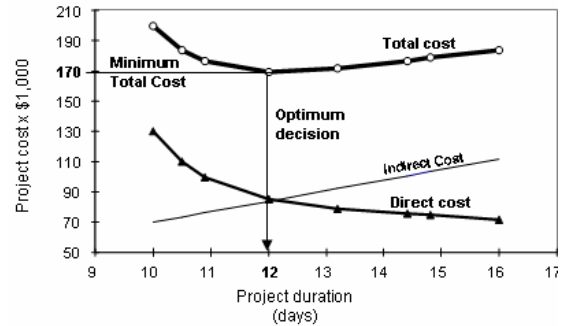
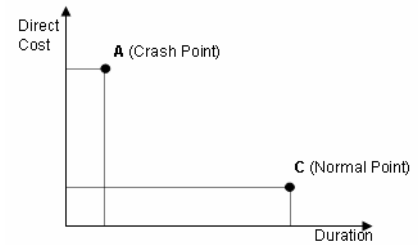
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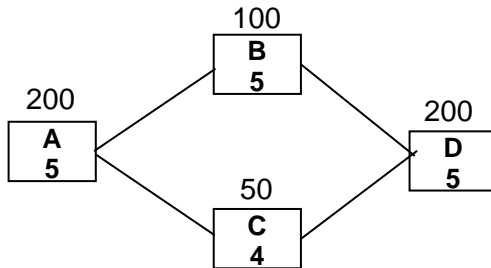
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**Example 1:** Durations and cost slopes are shown. We need to meet a 12-day deadline.




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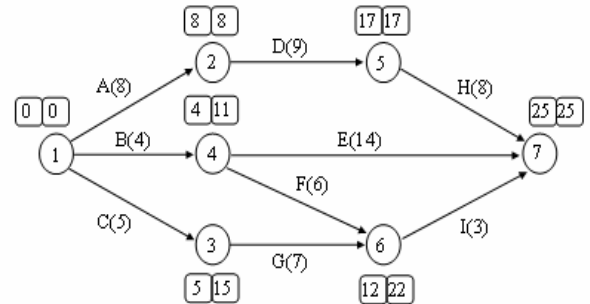


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**Example 2:** Normal and crash data for the tasks are shown.  
What is the optimum project duration?  
How can the project be finished in 20 days?



Activity	Normal Duration	Normal Cost	Crash Duration	Crash Cost	Critical	Crash Cost/Day
A	8	16,000	6	19,000		
B	4		No crashing			
C	5					
D	9	18,000	7	19,000		
E	14		No crashing			
F	6					
G	7		No crashing			
H	8	16,000	6	18,000		
I	3		No crashing			

Notes: - Total "Normal" cost of all other tasks = \$70,000  
- Daily indirect cost is \$1,000/day.

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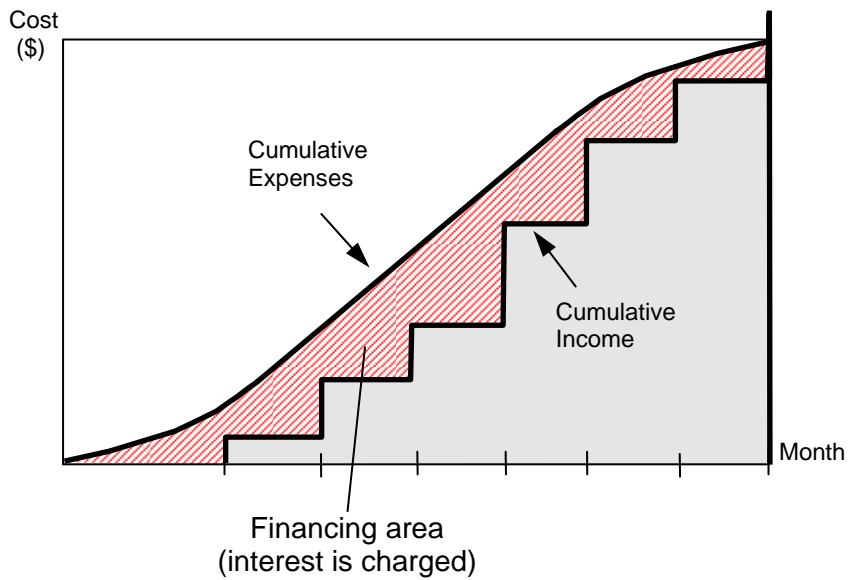


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# CASH FLOW ANALYSIS

## Factors Affecting Interest Payment:

Credit from suppliers  
Reporting Periods (payment frequency)  
Interest rate  
Subcontracting  
Mobilization payment  
Better scheduling  
Hold back percentage  
Bid Unbalancing



## Terms Used Every Period:

- Cost = (Direct + Indirect) estimates
- Expenses  $\leq$  Cost (if suppliers can give you a credit)
- Budget = Cost + Markup \* Cost = Cost (1 + Markup)
- Income = Owner payment = Budget - Holdback

## If Everything goes well:

- Expenses  $\leq$  Cost
- Income = Budget
- Profit = Cost \* Markup

### Example: Overdraft Calculations

### Data:

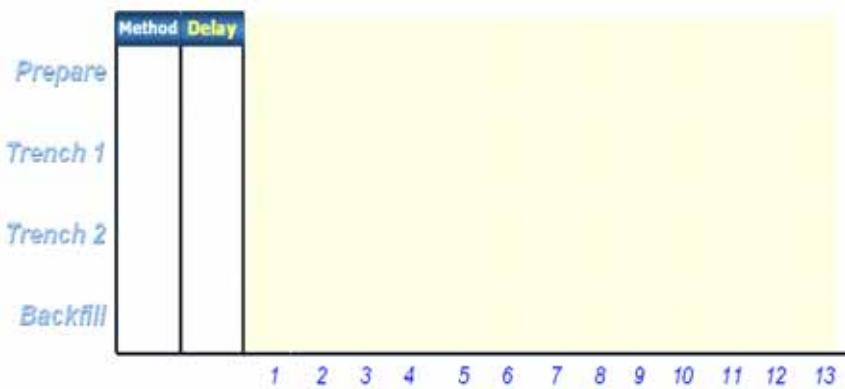
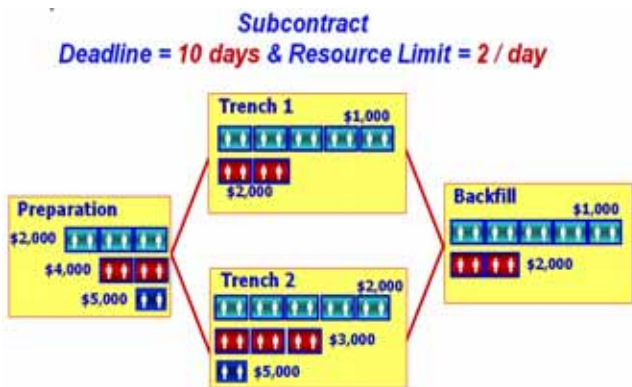
- Direct costs (evenly distributed) on the bar chart;
- Indirect costs = \$5000 per month;
- Contractor's markup = 5%;
- Reporting period = monthly;
- Owner retainage = 10% (no retainage after work is 50% complete);
- Payments made 30 days after invoice made; and
- Interest rate is 1% monthly.

## OVERDRAFT CALCULATIONS

	Month 1	Month 2	Month 3	Month 4
Direct cost	\$25,000	\$65,000	\$75,000	\$15,000
Indirect cost	5,000	5,000	5,000	5,000
<b>Subtotal</b>	<b>30,000</b>	<b>70,000</b>	<b>80,000</b>	<b>20,000</b>
Markup	1,500	3,500	4,000	1,000
<b>Total billed</b>	<b>31,500</b>	<b>73,500</b>	<b>84,000</b>	<b>21,000</b>
Retainage withheld	3,150	7,350	0	0
<b>Payment received</b>		<b>\$28,350</b>	<b>\$66,150</b>	<b>\$84,000</b>
Total cost to date	30,000	100,000	180,000	200,000
Total amount billed to date	31,500	105,000	189,000	210,000
Total paid to date		28,350	94,500	178,500
Overdraft end of month	30,000	100,300	152,953	108,333
Interest on overdraft balance a	300	1,003	1,530	1,083
<b>Total amount financed</b>	<b>\$30,300</b>	<b>\$101,303</b>	<b>\$154,483</b>	<b>\$109,416</b>
				<b>\$25,670</b>

... 3. A simple illustration only. Most lenders would calculate interest charges more precisely on the amount/time involved employing daily interest factors.

## MANAGING BOTH: DEADLINE & RESOURCES



If Markup = 10%, Retention = 5% and Indirect Cost = \$100 /day, Draw the Cash Flow Chart. What is the effect of bid unbalancing?

[illegible]