CRASHING

The Real World of Projects

Duration not optimal for total cost

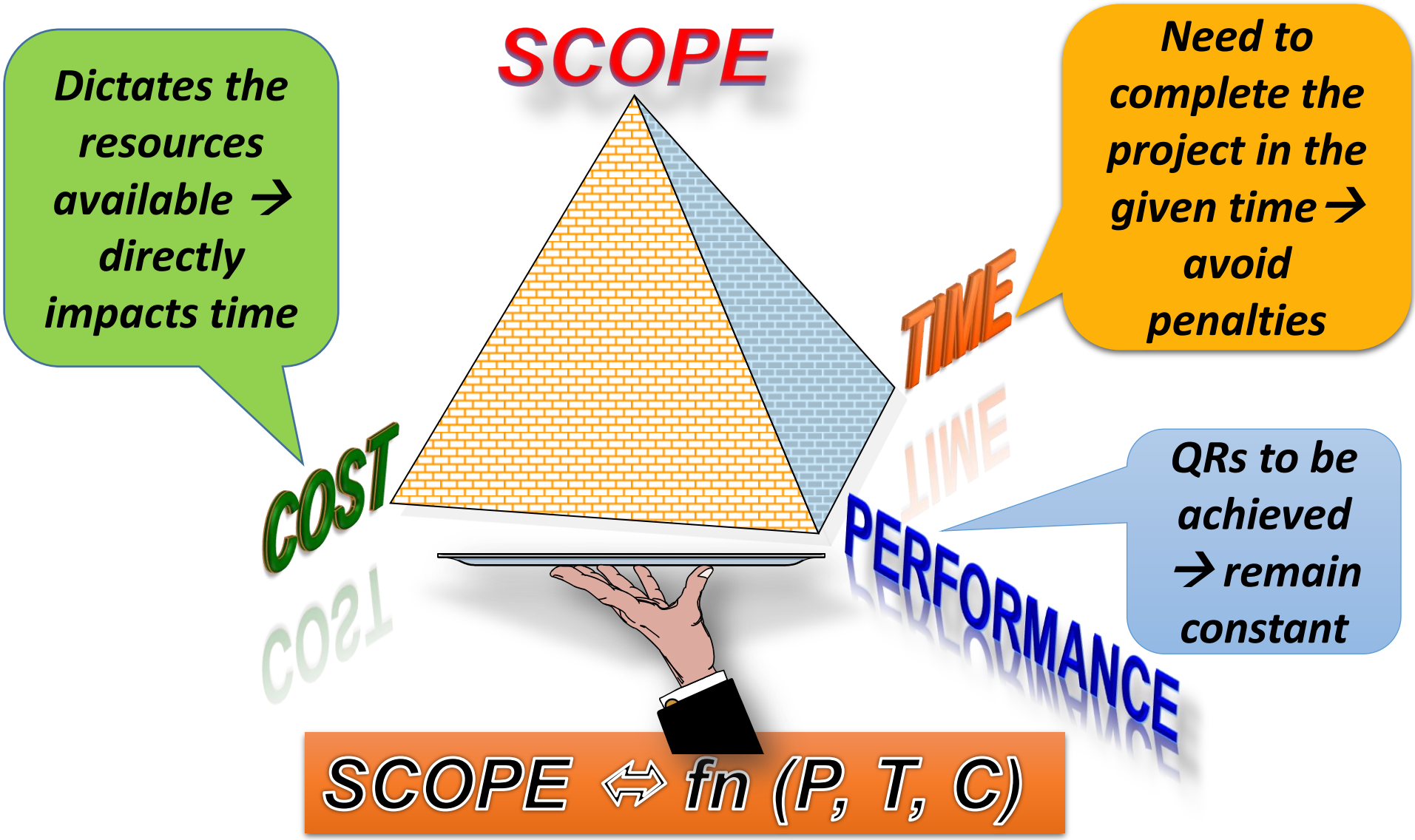
Duration not acceptable to mgmt due to urgency

Slippages during execution

Reqmt of meeting a freshly set deadline

Complete project in time - HOW ??

Impact of Triple Constraints



For Best Outcome in a Project

Optimum Resource Utilisation

Goals & Objectives, Quality, Customer Satisfaction

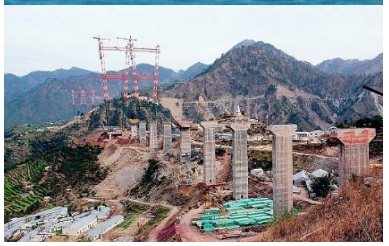
EFFICIENCY is doing THINGS RIGHT

EFFECTIVENESS is doing the RIGHT THINGS

HOW TO SAVE TIME?

Project Crashing

- *Time Compression*
- *Time – Cost Trade off*
- *POM - QM Software*



Time Compression

- **Fast Tracking**
  - **Parallel Activities**
  - **Relationship discretionary**
  - **Enhanced Risk**
  - **Constant Cost**

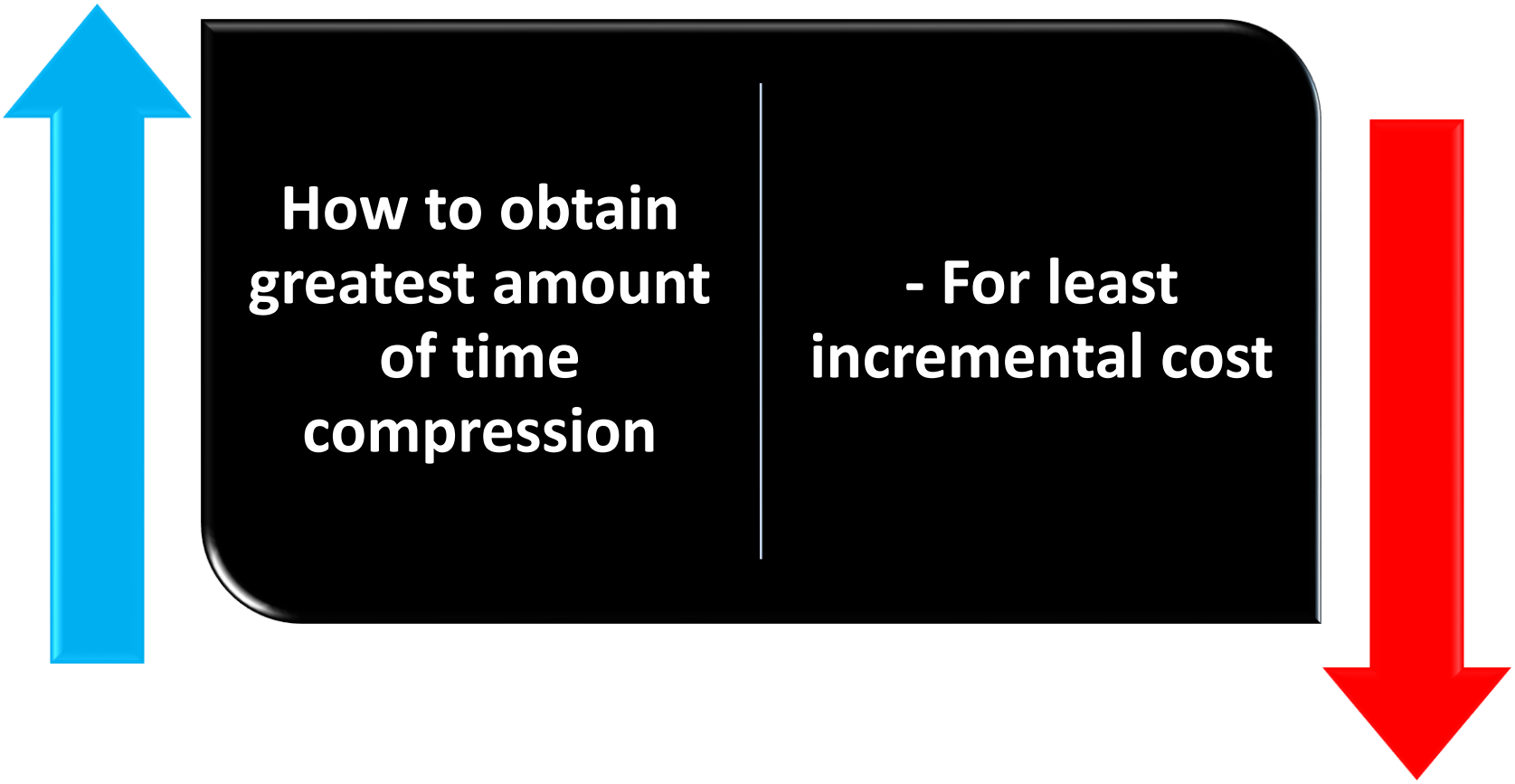
- **Project Crashing**
  - **Sequential**
  - **Enhanced Cost**
  - **Optimal Cost Optimal Duration**

Crashing Project Schedule

Project Time Compression by adding resources with incremental increase in cost

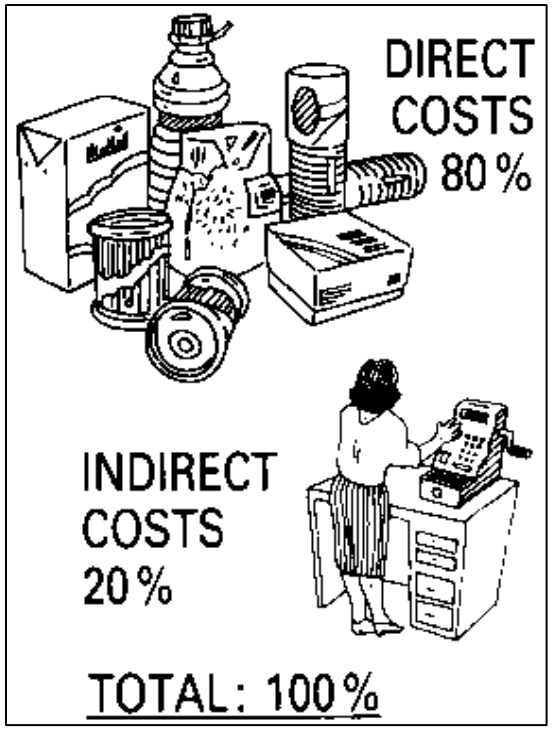
Time – Cost Trade-Offs

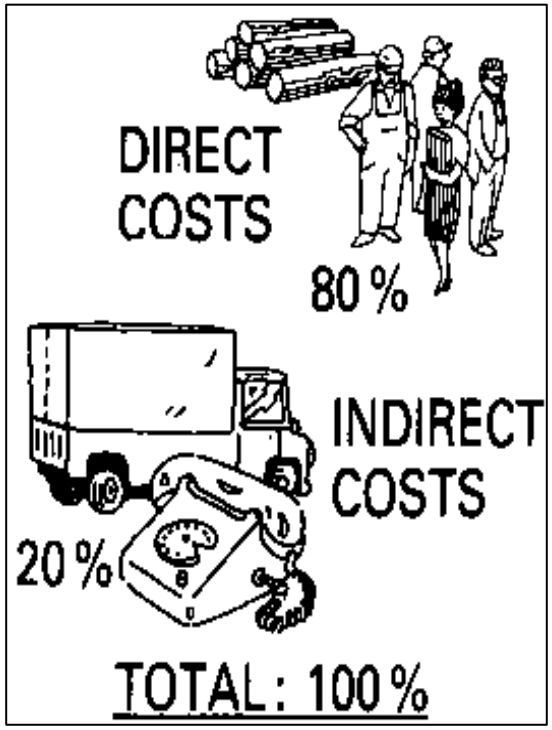
Cost and Time trade off carried out to determine :-

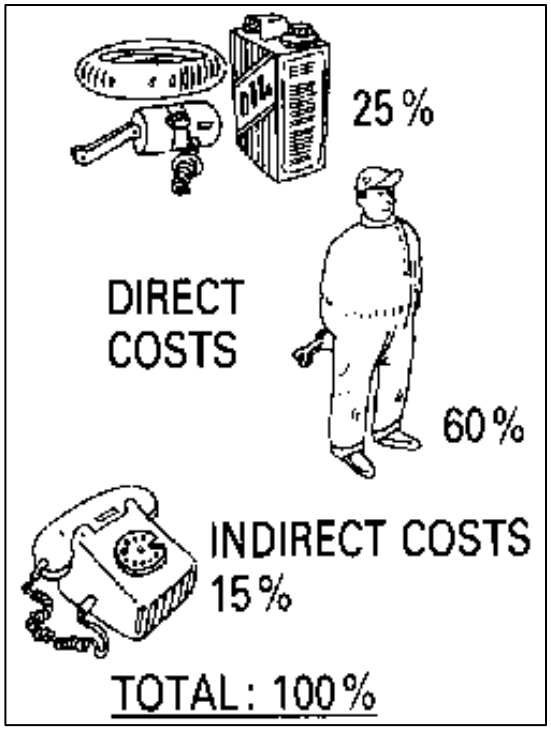


Project Costs

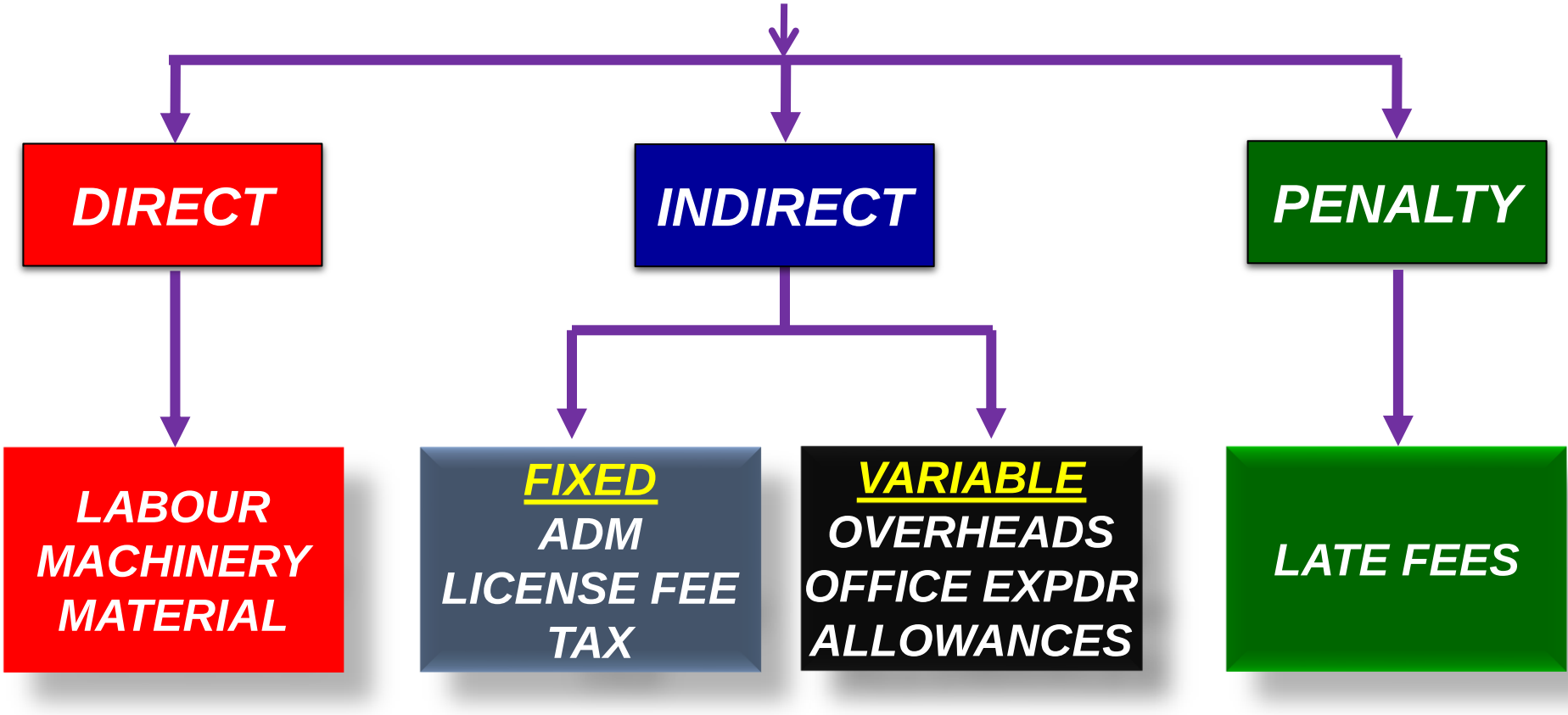
Total Project Costs =
Direct Costs + Indirect Costs + Penalty Costs





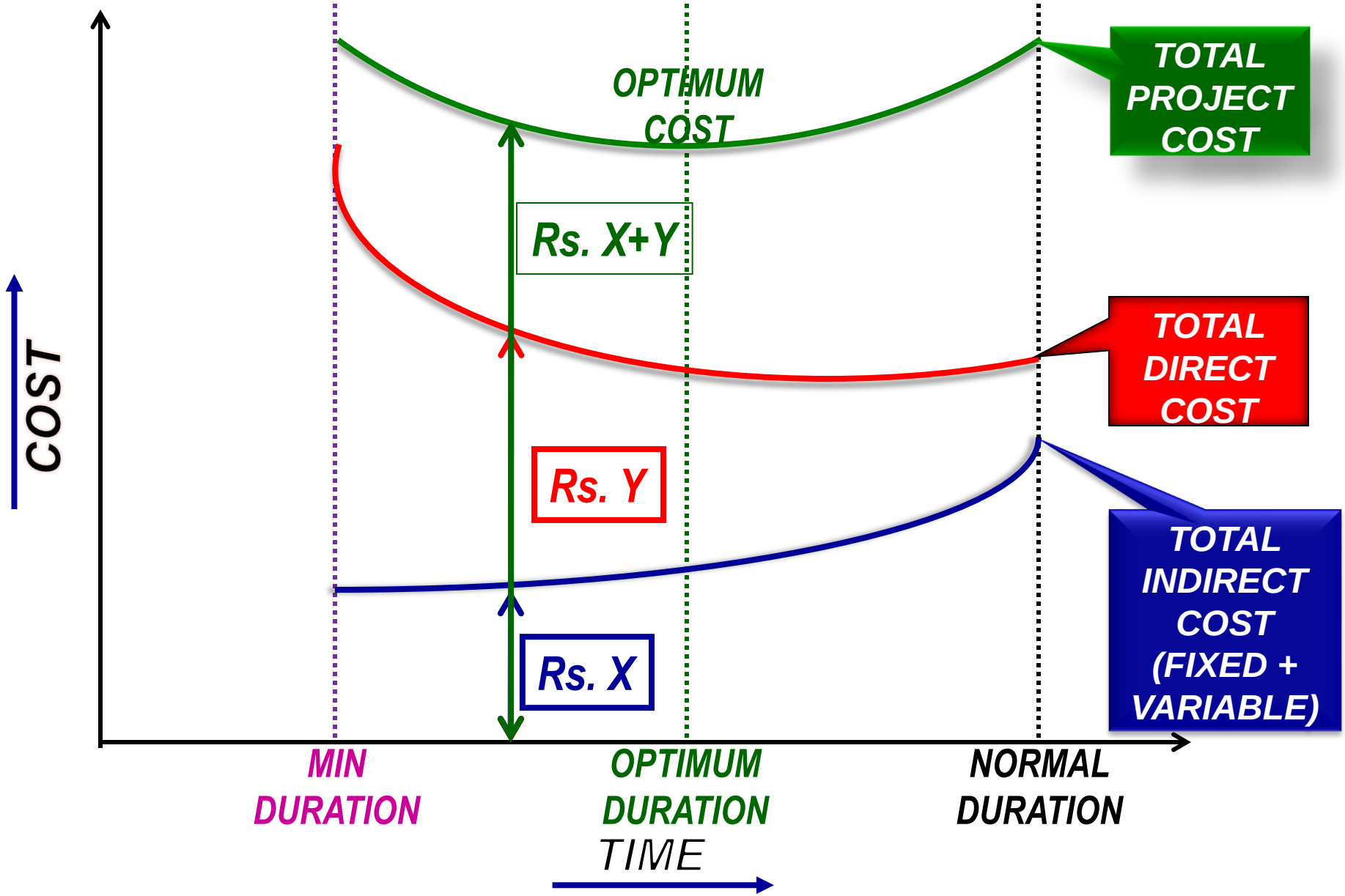


Project Costs



Cost is usually a binding constraint

Time – Cost Relationship



Crashing

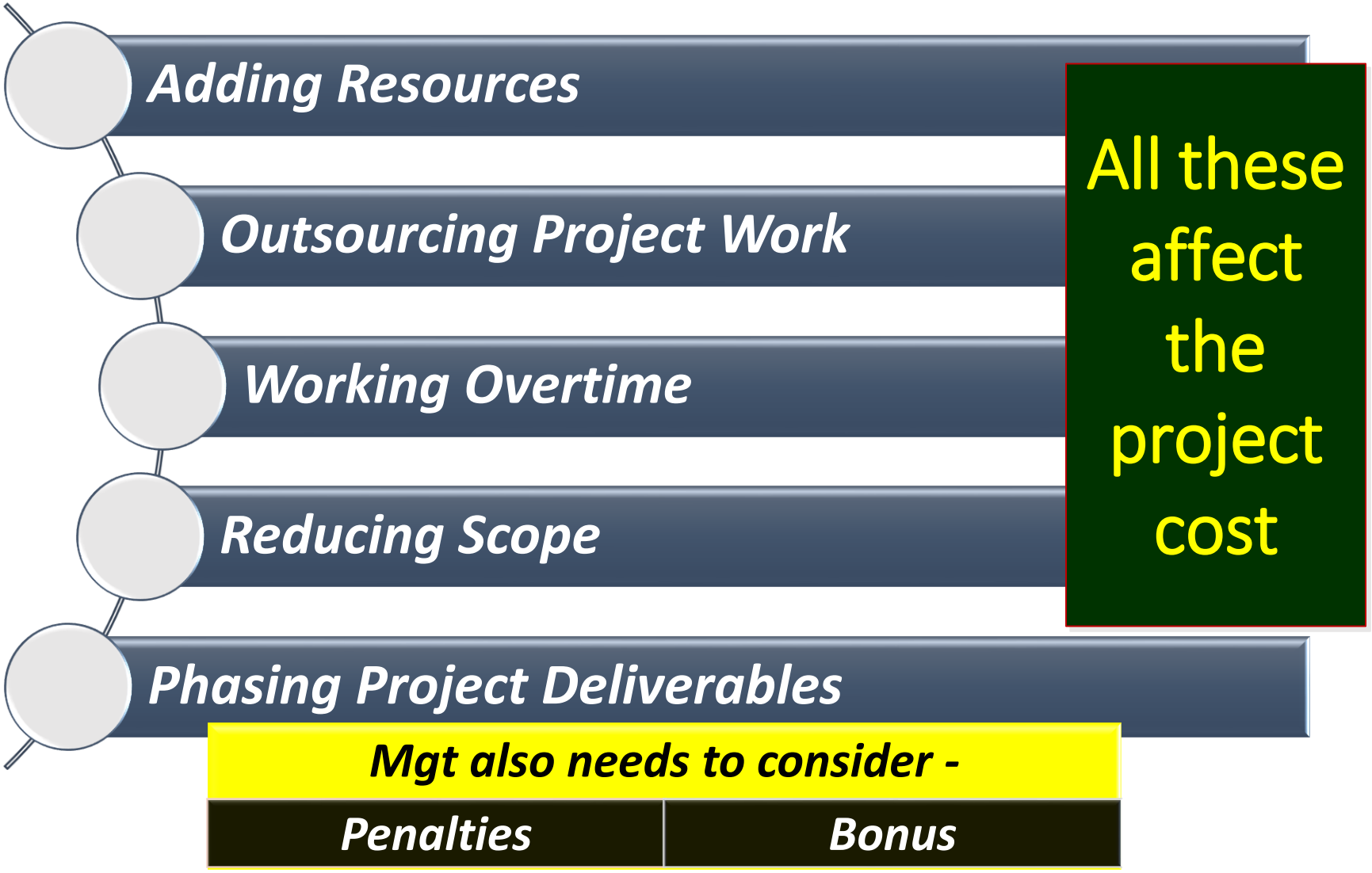
Finishing the project early by reducing time viz expediting one or more activities.

This reduction in the normal activity time is referred to as Crashing.

Some tasks can be shortened by devoting more resources – associated direct costs will increase.

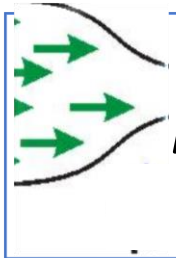
Reduction in project duration - based on analysis of TIME–COST trade-off.

Options for Crashing Project Activities



Which Activities are the Best Candidates for Crashing?

Lie on the critical path



Bottleneck activities

Occur relatively early in the schedule

Relatively long durations

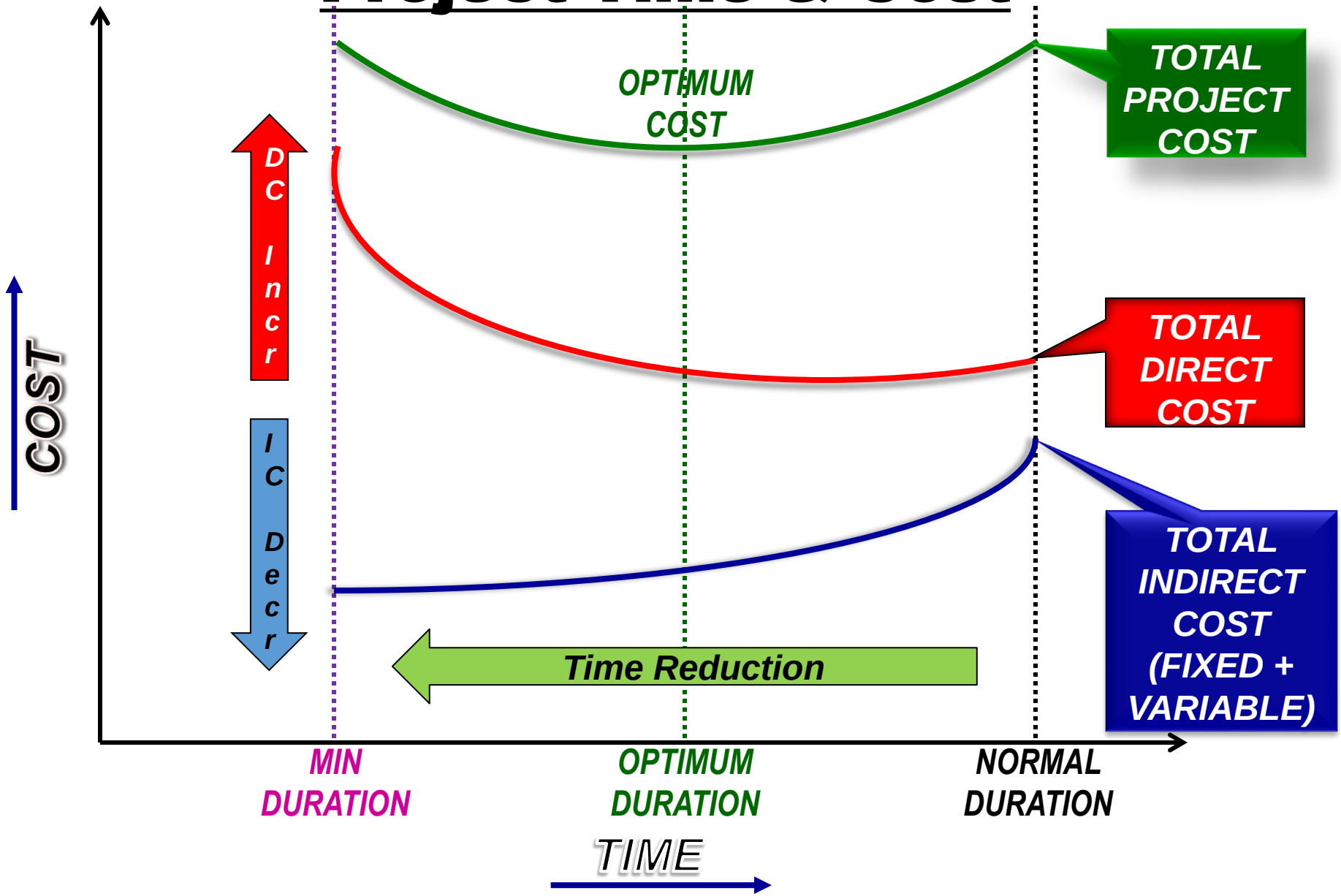
Relatively lesser costs to crash

Not likely to cause quality problems

Time-Cost Tradeoff
How ??

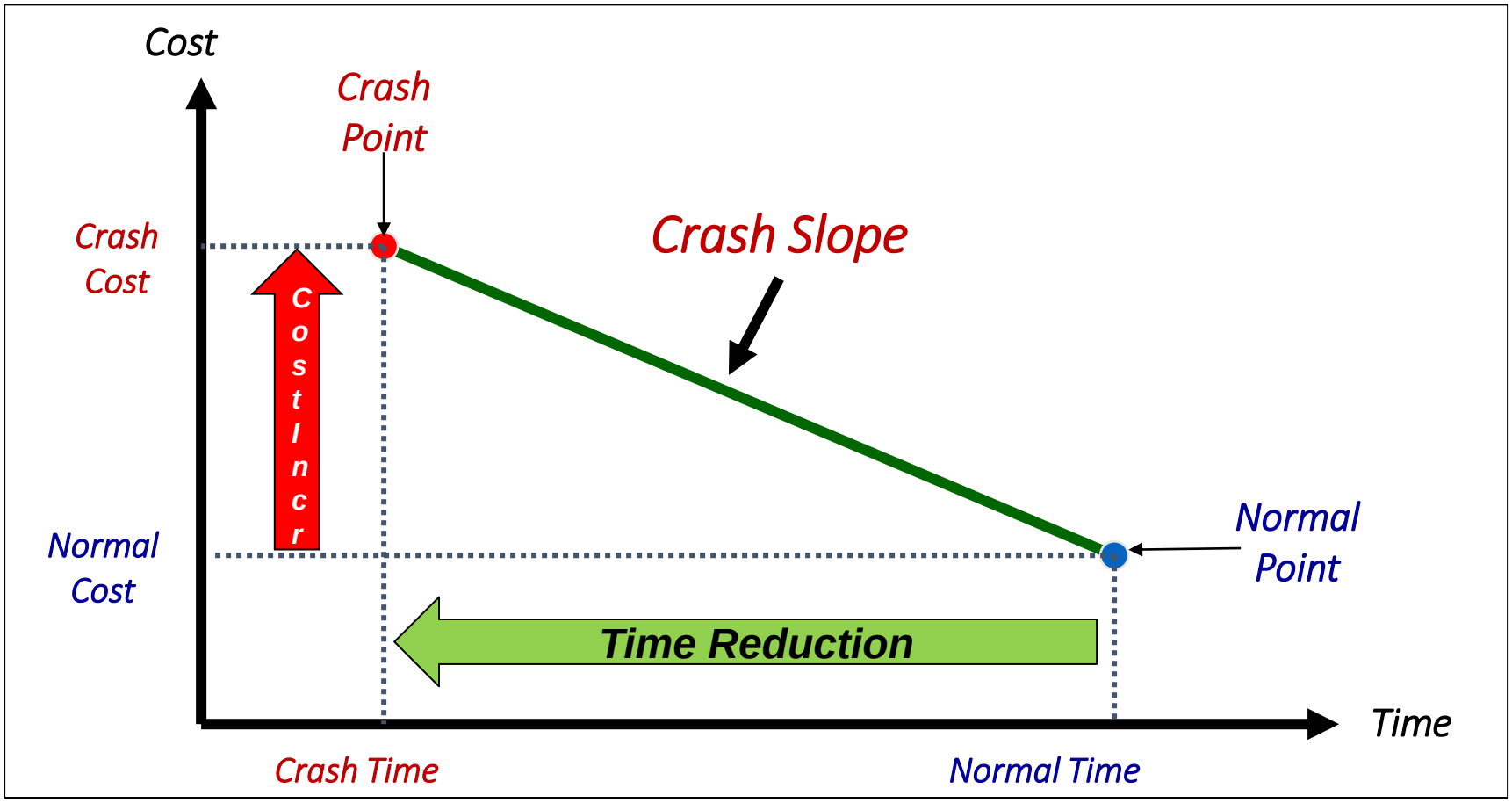
1. Set each activity duration to its normal time.
2. Determine the critical path(s) and project duration based on the normal activity times.
3. Calculate total direct costs and indirect costs for the normal schedule.
4. Reduce project duration by one time unit on selected activity(s).
5. Calculate the project's direct and indirect costs for each possible duration.
6. Take mgt decision on extent of crashing the project (TIME-COST trade off).

Relation of Crashing Slope with Project Time & Cost



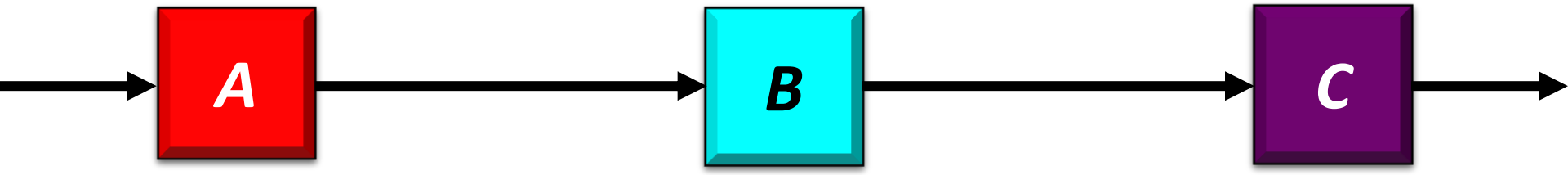
Crash Slope

In theory, the normal or expected duration of a task can be reduced by assigning additional resources to the task



$$\text{Crash Slope} = \frac{\text{Crash Cost} - \text{Normal Cost}}{\text{Normal Duration} - \text{Crash Duration}}$$

Crashing Cost



8

8/5

4

4/2

6

6/5

ND/CD
in months

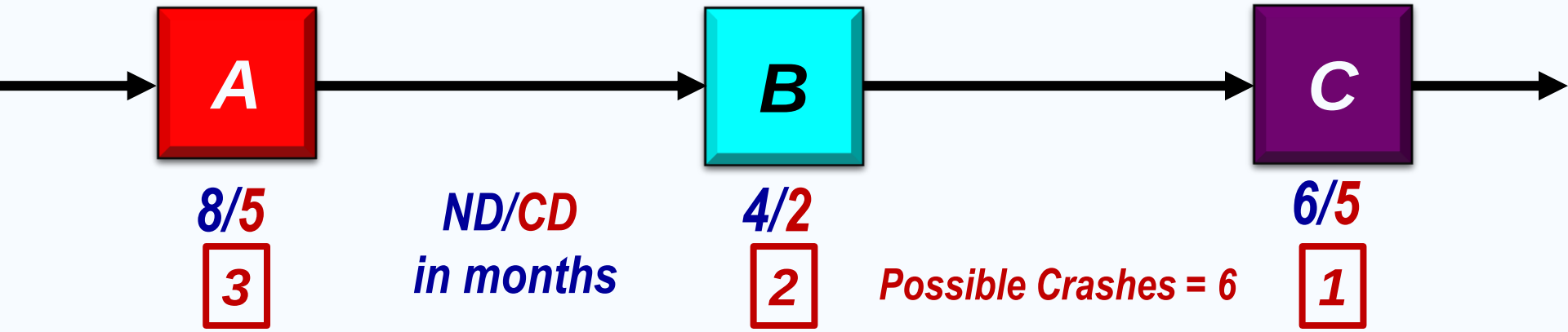
3

2

1

Possible Crashes = 6

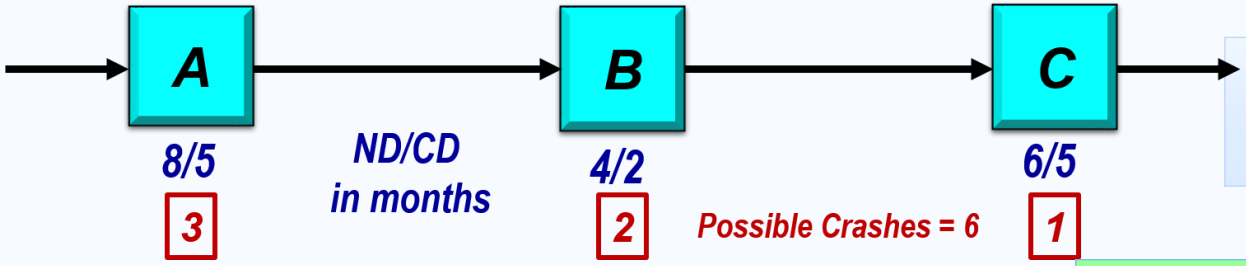
Crashing Cost



ACTIVITY	NORMAL COST	CRASHED COST	NORMAL DURATION	CRASHED DURATION	SLOPE
A	5000	6500	8 m	5 m	500
B	4000	4500	4 m	2 m	250
C	3000	3500	6 m	5 m	500

$$Crash\ Slope = \frac{Crash\ Cost - Normal\ Cost}{Normal\ Duration - Crash\ Duration}$$

Crash Slope is the per duration unit Crashing Cost



Indirect Cost = Rs 300 /- Month

ACTIVITY	NORMAL COST	CRASHED COST	NORMAL DURATION	CRASHED DURATION	SL
A	5000	6500	8 m	5 m	5
B	4000	4500	4 m	2 m	2
C	3000	3500	6 m	5 m	50

Duration for Least Cost

Least Duration

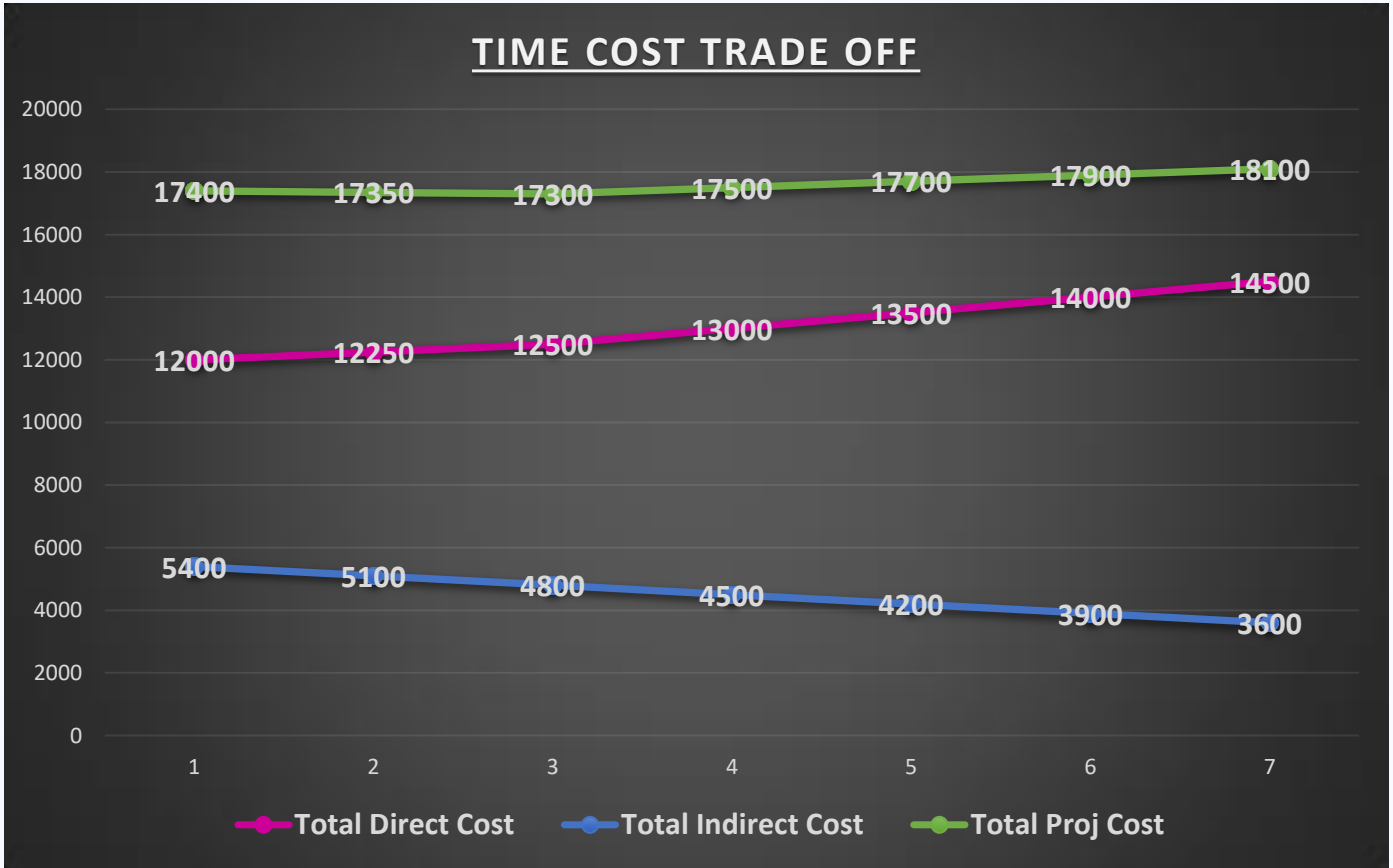
Crash Duration	0	1(B)	1(B)	1(A)	1(A)	1(A)	1(C)
Proje							12
Crash							500
Cumulative Incr in Direct Cost	-	250	500	1000	1500	2000	2500
Total Direct Cost	12000	12250	12500	13000	13500	14000	500
Total Indirect Cost	5400	5100	4800	4500	4200	3900	600
Total Proj Cost	17400	17350	17300	17500	17700	17900	18100

Take the Mgt Decision

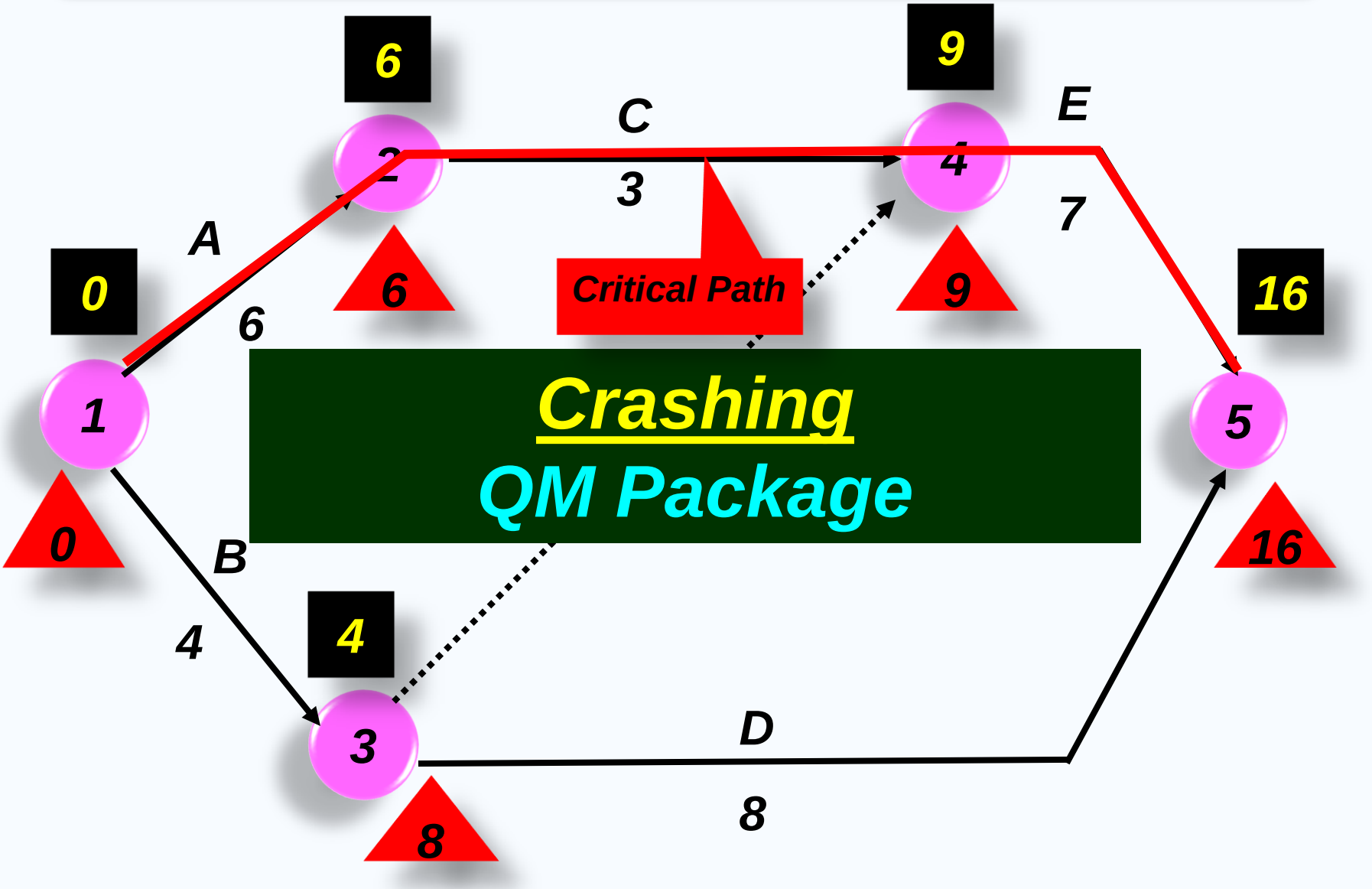
Least Cost

Cost for Least Duration

Crash Duration	0	1(B)	1(B)	1(A)	1(A)	1(A)	1(C)
Project Duration (m)	18	17	16	15	14	13	12
Crash Slope	0	250	250	500	500	500	500
Increase in DC (cumulative)	0	250	500	1000	1500	2000	2500
Total Direct Cost	12000	12250	12500	13000	13500	14000	14500
Total Indirect Cost	5400	5100	4800	4500	4200	3900	3600
Total Proj Cost	17400	17350	17300	17500	17700	17900	18100



EX : FASTWORK


6
9
C
E
2
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3
7
A
0
6
6
9
16
Critical Path
1
5
Crashing
QM Package
0
16
B
4
4
3
D
8
8

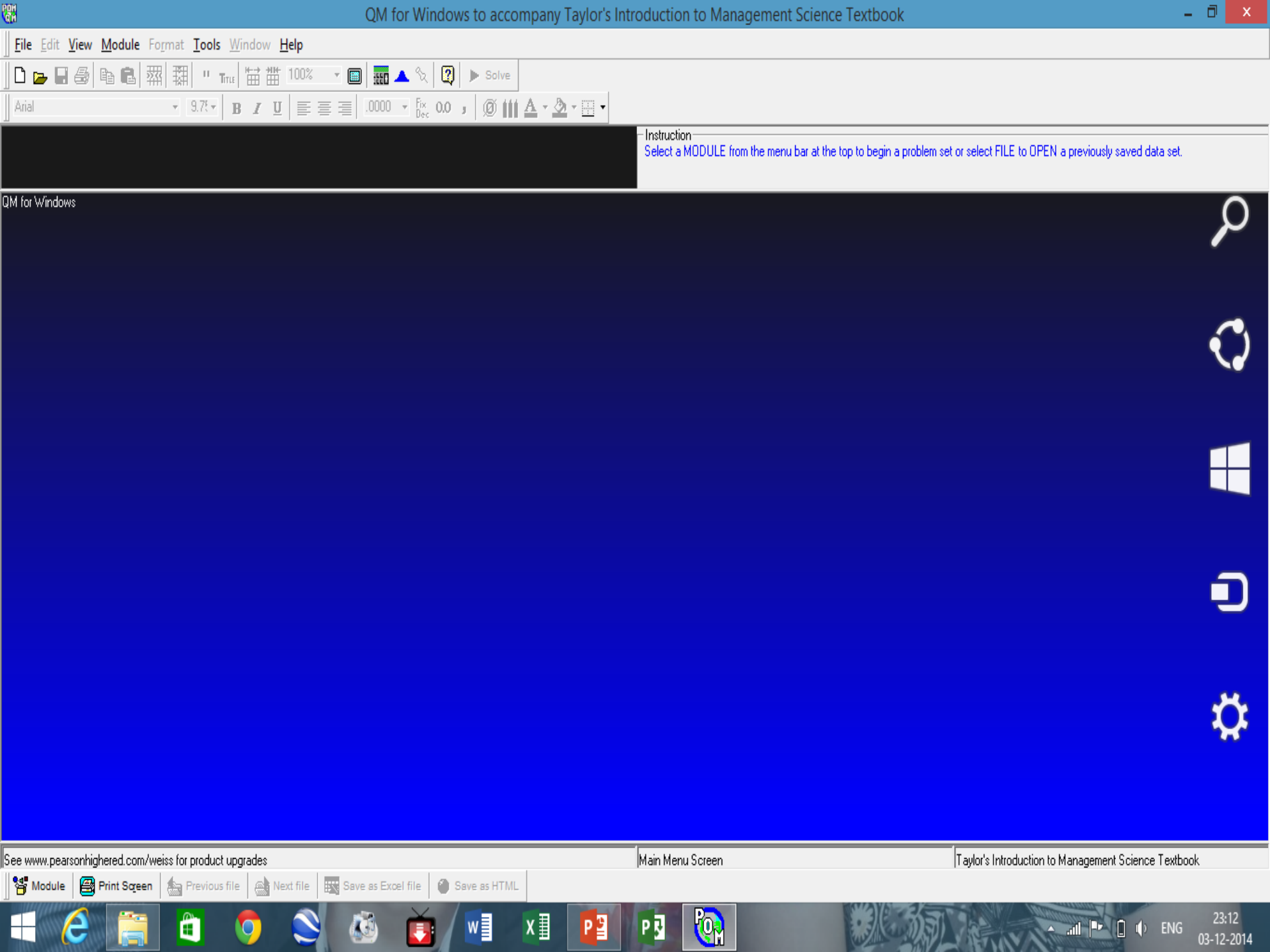
EX : FASTWORK

ACTIVITY	DURATION		COST	
	NORMAL	CRASHED	NORMAL COST (NC)	CRASHED COST (CC)
A	6	4	10000	18000
B	4	2	5000	11000
C	3	1	4000	6000
DUMMY	-	-	-	-
D	8	6	9000	15000
E	7	4	7000	8500
		TOTAL	35000	58500

Indirect Cost (IC)/day = Rs 600/-

EX : FASTWORK

ACTIVITY	DURATION		COST		
	NORMAL	CRASHED	NORMAL COST (NC)	CRASHED COST (CC)	CRASH SLOPE (CS)
A	6	4	10000	18000	4000
B	4	2	5000	11000	3000
C	3	1	4000	6000	1000
DUMMY	-	-	-	-	-
D	8	6	9000	15000	3000
E	7	4	7000	8500	500
		TOTAL	35000	58500	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File Edit View Module Format Tools Window Help
Solve
Instruction
Select a MODULE from the menu bar at the top to begin a problem set or select FILE to OPEN a previously saved data set.
QM for Windows
See www.pearsonhighered.com/weiss for product upgrades
Main Menu Screen
Taylor's Introduction to Management Science Textbook
Module
Print Screen
Previous file
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Save as Excel file
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ENG
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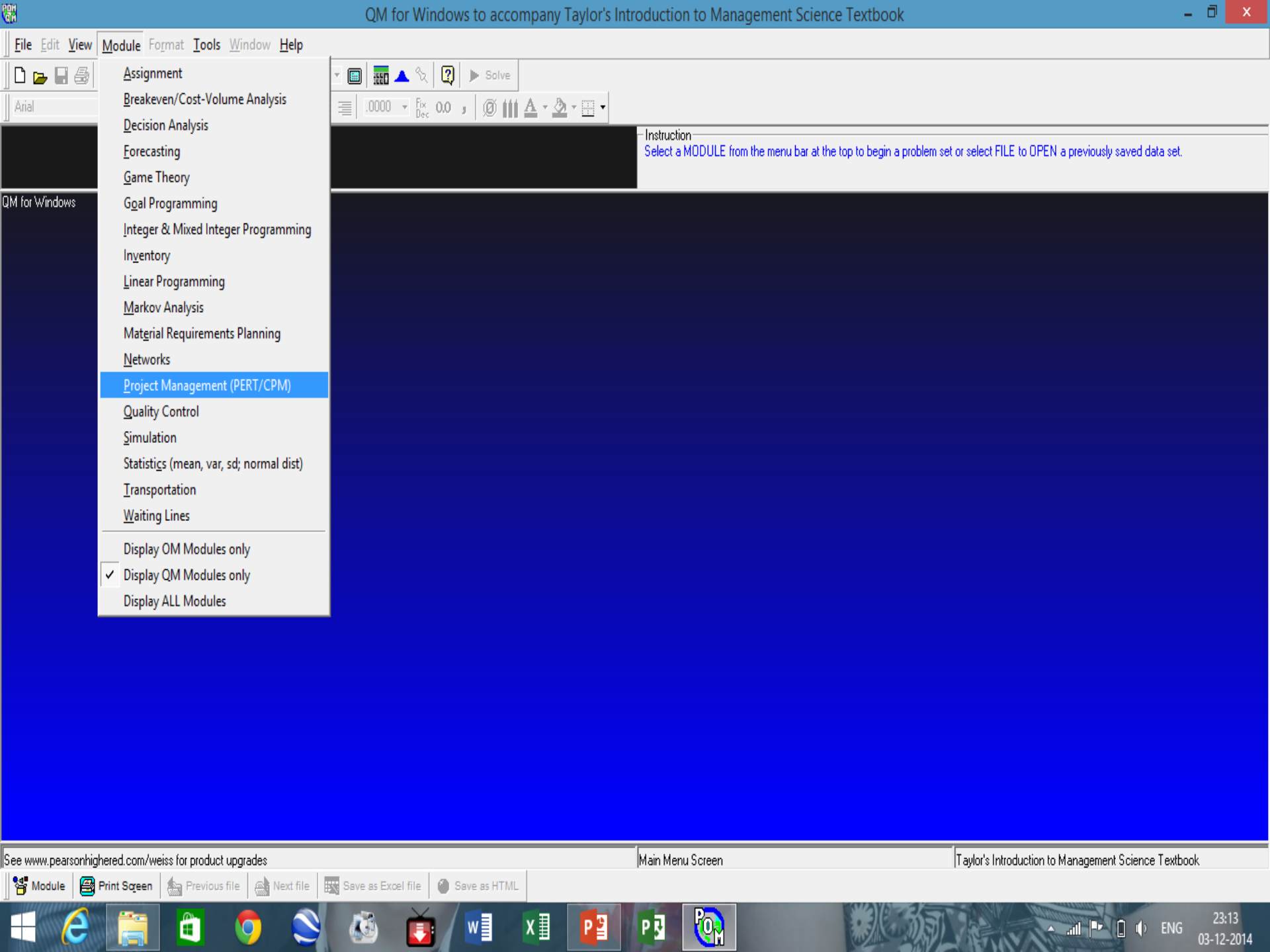
QM for Windows to accompany Taylor's Introduction to Management Science Textbook
File Edit View Module Format Tools Window Help
Assignment
Breakeven/Cost-Volume Analysis
Decision Analysis
Forecasting
Game Theory
Goal Programming
Integer & Mixed Integer Programming
Inventory
Linear Programming
Markov Analysis
Material Requirements Planning
Networks
Project Management (PERT/CPM)
Quality Control
Simulation
Statistics (mean, var, sd; normal dist)
Transportation
Waiting Lines
Display OM Modules only
Display QM Modules only
Display ALL Modules
Solve
Instruction
Select a MODULE from the menu bar at the top to begin a problem set or select FILE to OPEN a previously saved data set.
QM for Windows
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Main Menu Screen
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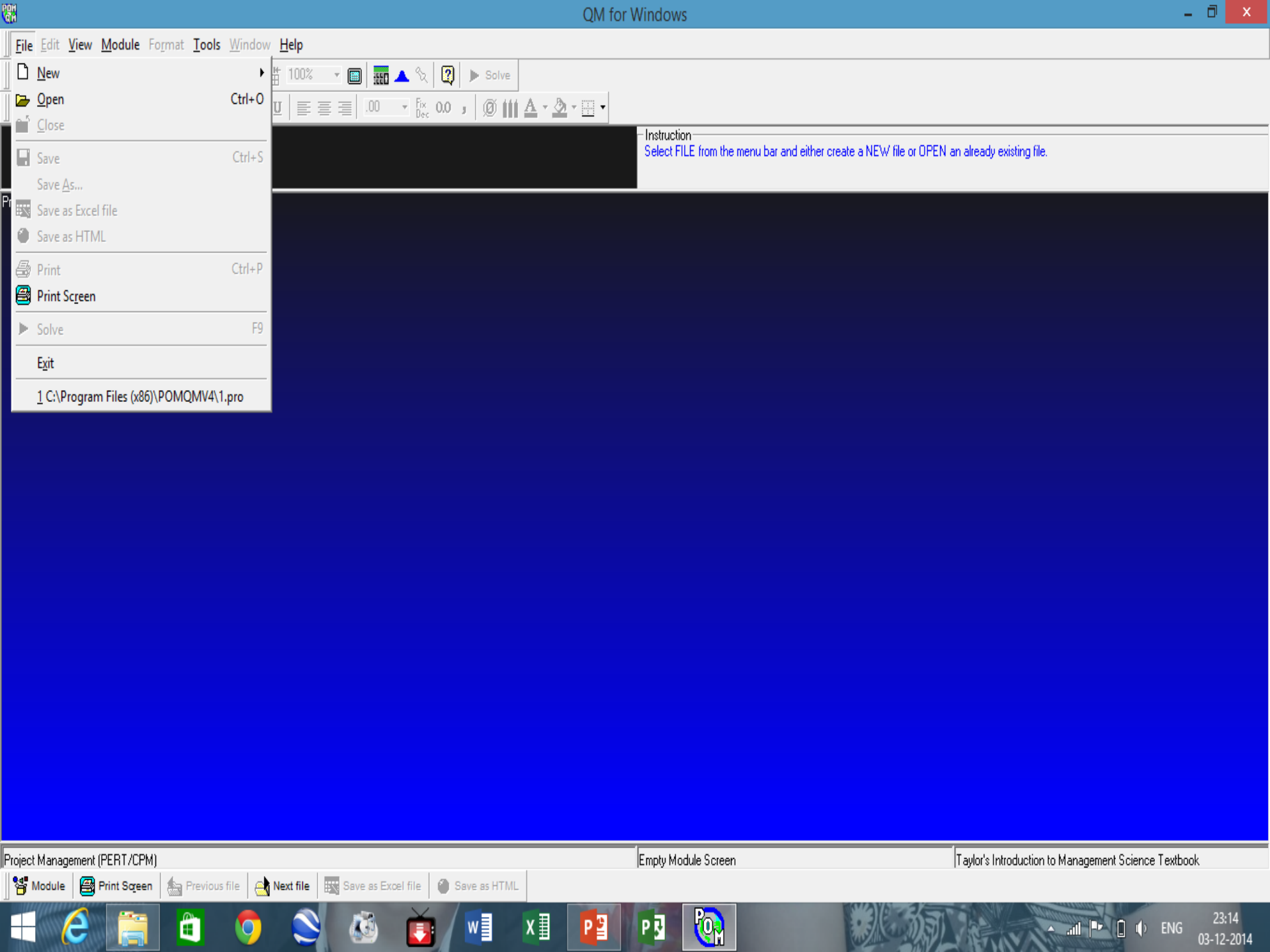
QM for Windows
File Edit View Module Format Tools Window Help
New
Open Ctrl+O
Close
Save Ctrl+S
Save As...
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Print Ctrl+P
Print Screen
Solve F9
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1 C:\Program Files (x86)\POMQMV4\1.pro
Solve
Instruction
Select FILE from the menu bar and either create a NEW file or OPEN an already existing file.
Project Management (PERT/CPM)
Empty Module Screen
Taylor's Introduction to Management Science Textbook
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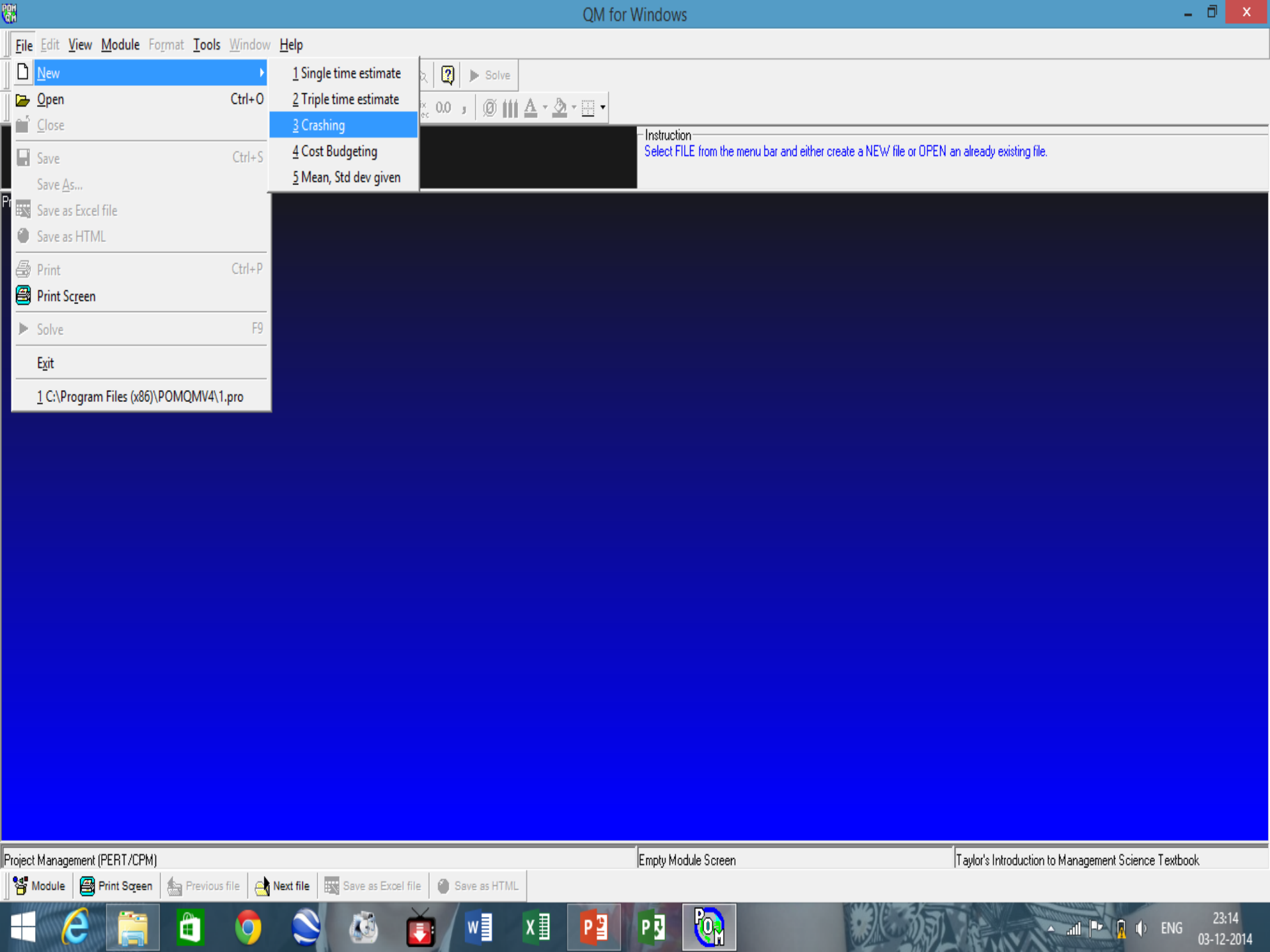
QM for Windows
File Edit View Module Format Tools Window Help
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Open Ctrl+O
Close
Save Ctrl+S
Save As...
Save as Excel file
Save as HTML
Print Ctrl+P
Print Screen
Solve F9
Exit
1 C:\Program Files (x86)\POMQMV4\1.pro
1 Single time estimate
2 Triple time estimate
3 Crashing
4 Cost Budgeting
5 Mean, Std dev given
Solve
Instruction
Select FILE from the menu bar and either create a NEW file or OPEN an already existing file.
Project Management (PERT/CPM)
Empty Module Screen
Taylor's Introduction to Management Science Textbook
Module
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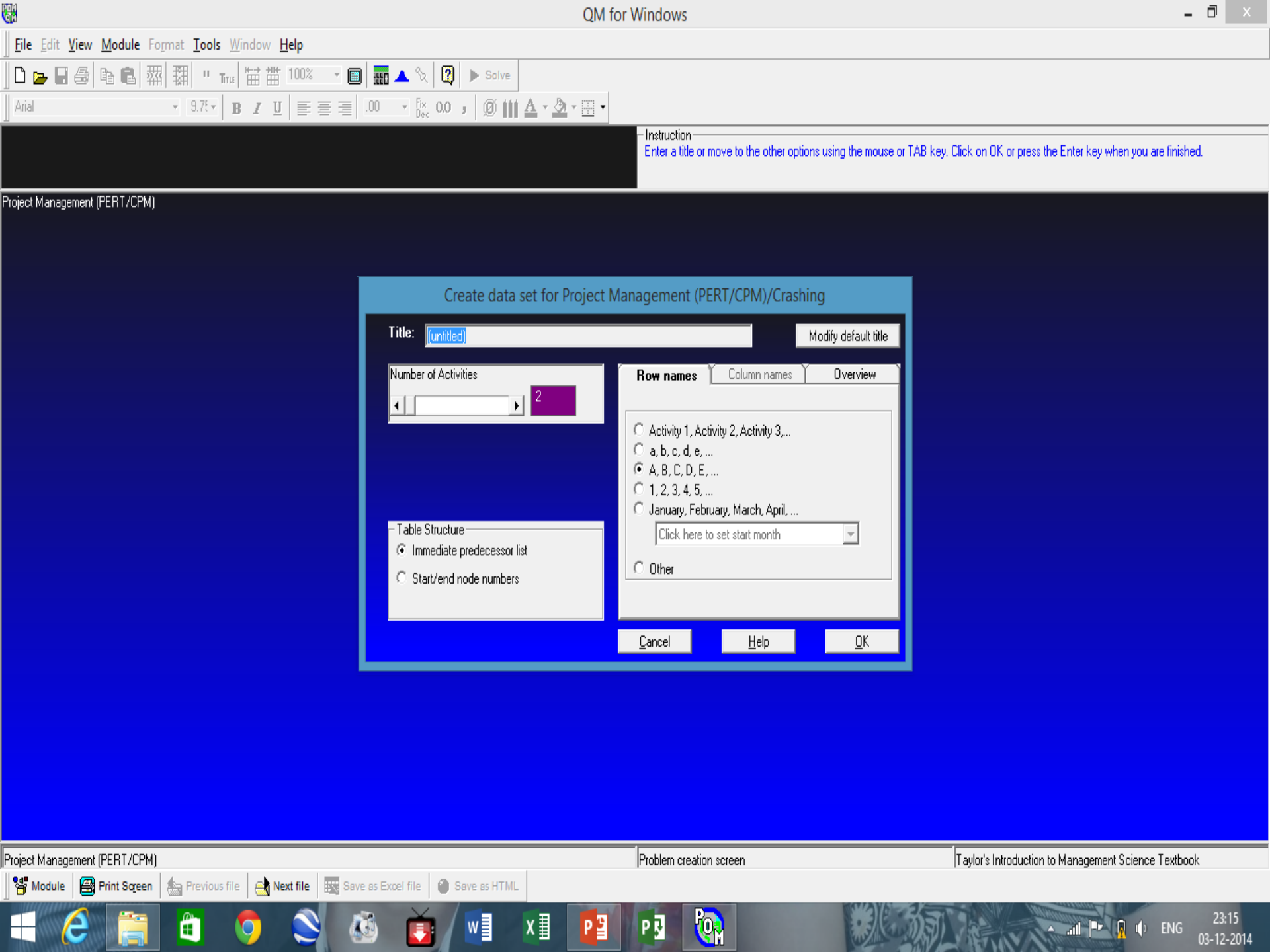
QM for Windows
File Edit View Module Format Tools Window Help
Solve
Instruction
Enter a title or move to the other options using the mouse or TAB key. Click on OK or press the Enter key when you are finished.
Project Management (PERT/CPM)
Create data set for Project Management (PERT/CPM)/Crashing
Title:
[untitled]
Modify default title
Number of Activities
2
Row names
Column names
Overview
Activity 1, Activity 2, Activity 3,...
a, b, c, d, e, ...
A, B, C, D, E, ...
1, 2, 3, 4, 5, ...
January, February, March, April, ...
Click here to set start month
Other
Table Structure
Immediate predecessor list
Start/end node numbers
Cancel
Help
OK
Project Management (PERT/CPM)
Problem creation screen
Taylor's Introduction to Management Science Textbook
Module
Print Screen
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Save as Excel file
Save as HTML
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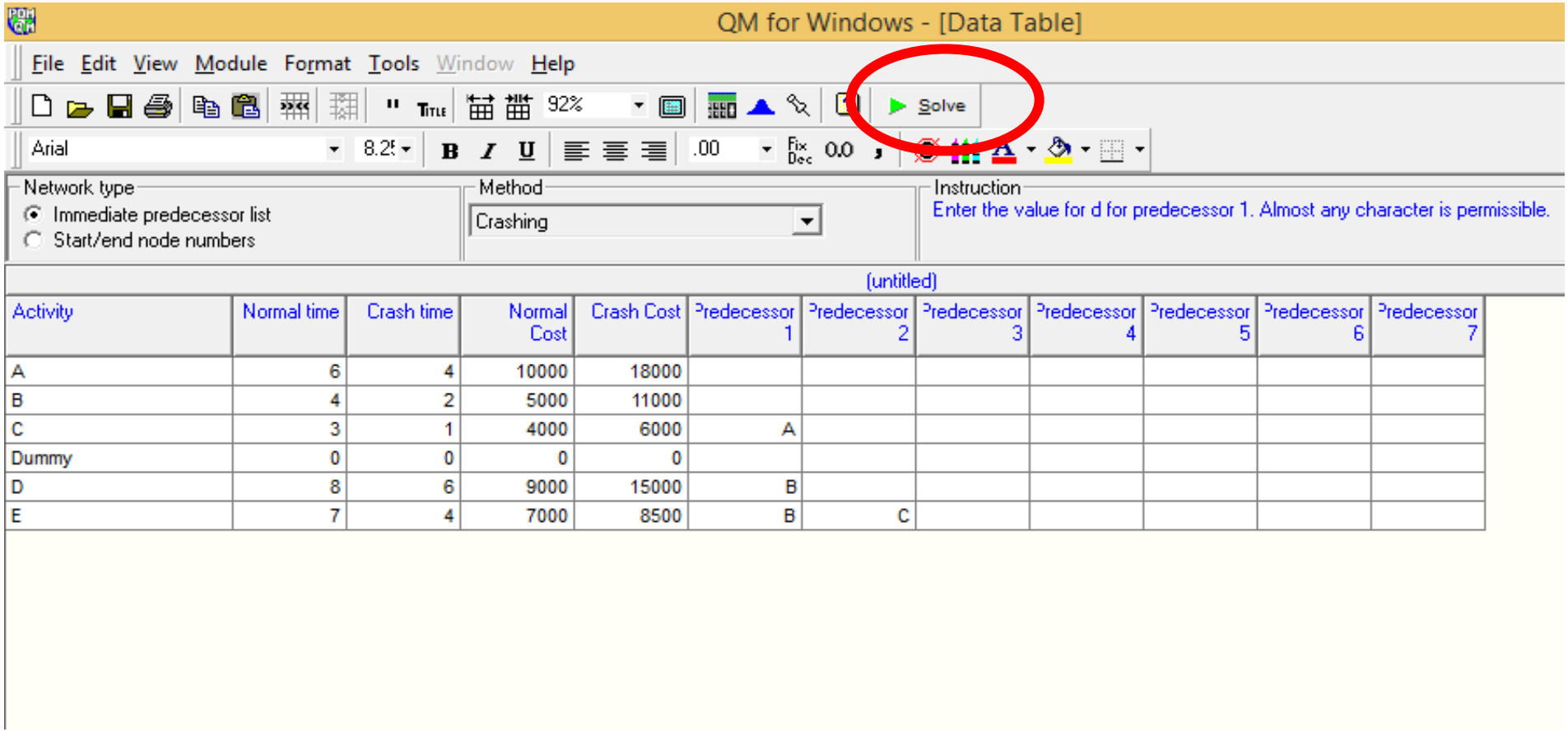
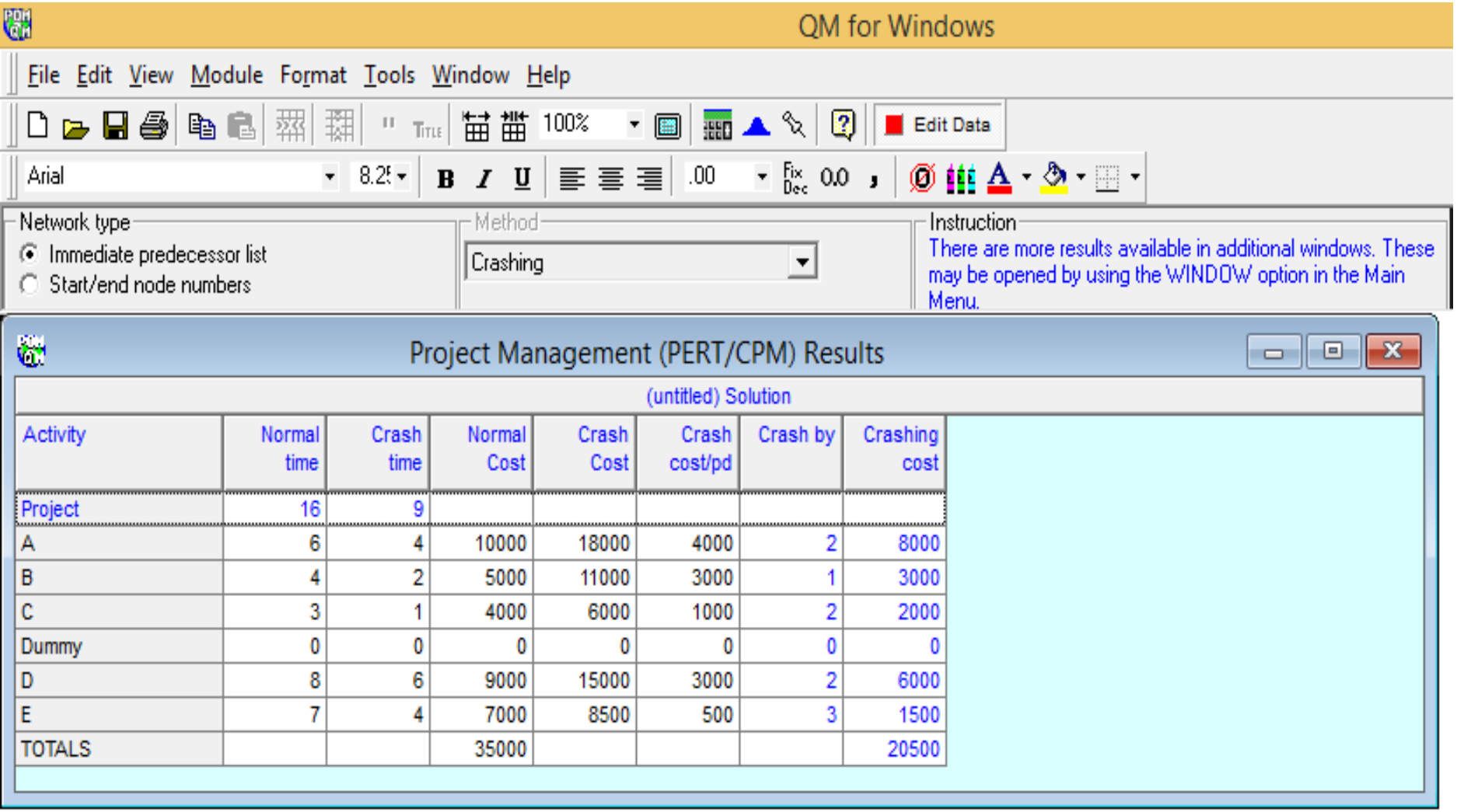
Crashing Data



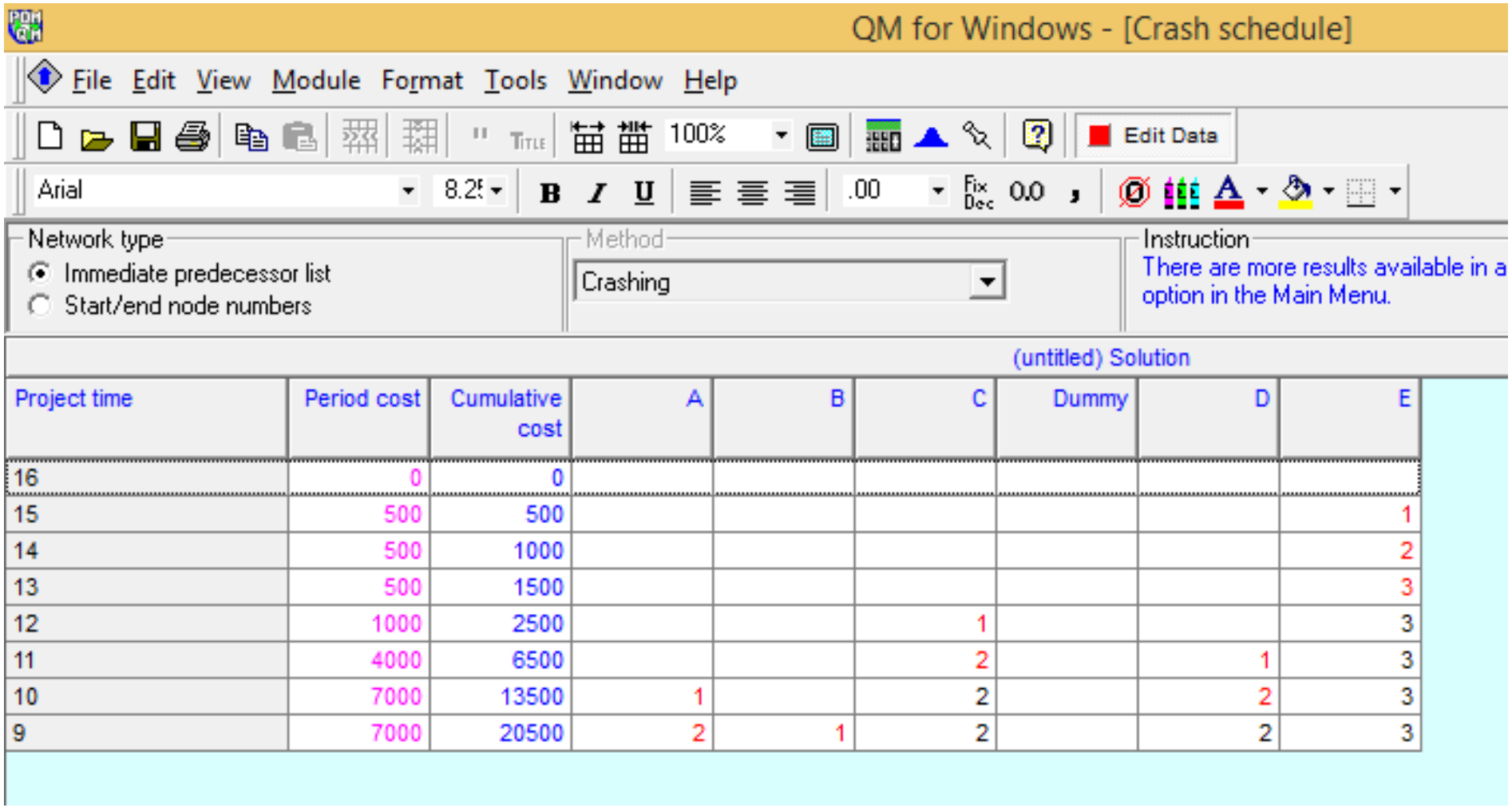
Activity	Normal time	Crash time	Normal Cost	Crash Cost	Predecessor 1	Predecessor 2	Predecessor 3	Predecessor 4	Predecessor 5	Predecessor 6	Predecessor 7
A	6	4	10000	18000							
B	4	2	5000	11000							
C	3	1	4000	6000	A						
Dummy	0	0	0	0							
D	8	6	9000	15000	B						
E	7	4	7000	8500	B	C					

Crashing Slope



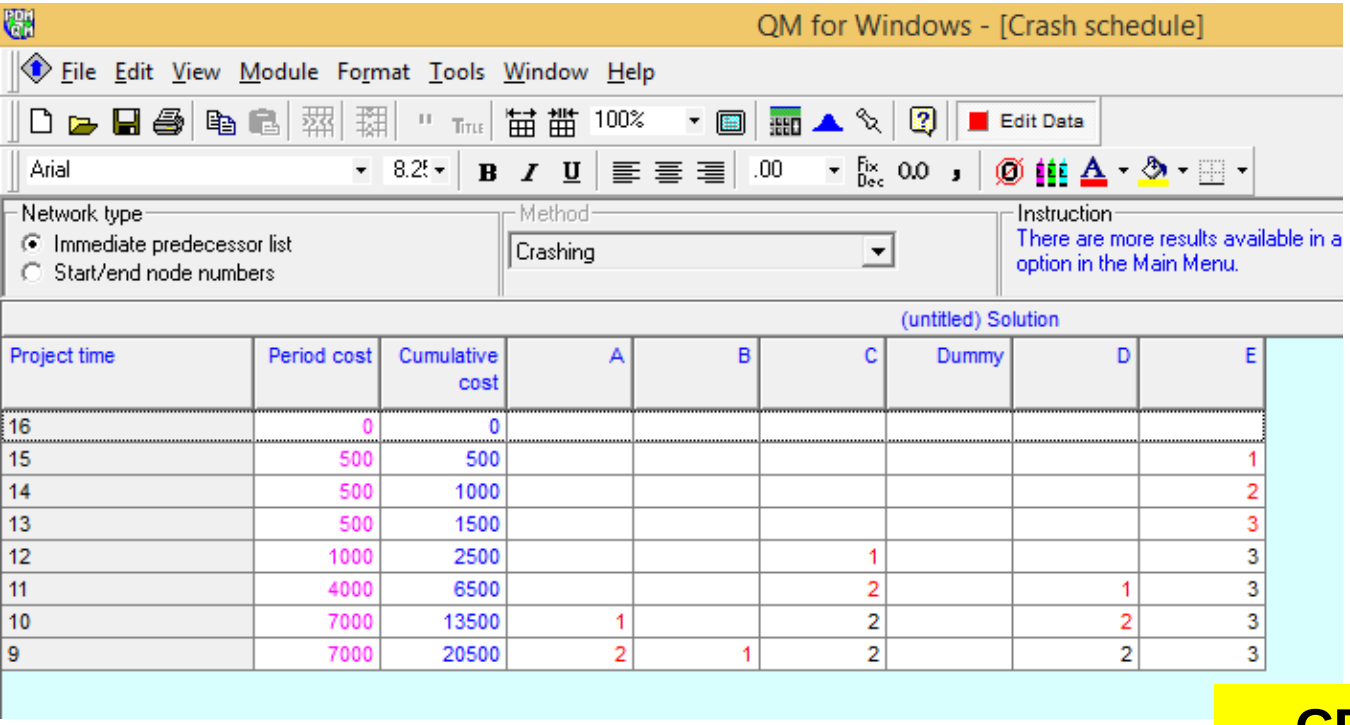
Activity	Normal time	Crash time	Normal Cost	Crash Cost	Crash cost/pd	Crash by	Crashing cost
Project	16	9					
A	6	4	10000	18000	4000	2	8000
B	4	2	5000	11000	3000	1	3000
C	3	1	4000	6000	1000	2	2000
Dummy	0	0	0	0	0	0	0
D	8	6	9000	15000	3000	2	6000
E	7	4	7000	8500	500	3	1500
TOTALS			35000				20500

Crash Schedule



Project time	Period cost	Cumulative cost	A	B	C	Dummy	D	E
16	0	0						
15	500	500						1
14	500	1000						2
13	500	1500						3
12	1000	2500			1			3
11	4000	6500			2		1	3
10	7000	13500	1		2		2	3
9	7000	20500	2	1	2		2	3

Crash Schedule



Project time	Period cost	Cumulative cost	A	B	C	Dummy	D	E
16	0	0						
15	500	500						1
14	500	1000						2
13	500	1500						3
12	1000	2500			1			3
11	4000	6500			2		1	3
10	7000	13500	1		2		2	3
9	7000	20500	2	1	2		2	3

CRASH SCHEDULE

- Activity E by 3 days
- Activity C by 01 day
- Activity C& D by 1 day
- Activity A & D by 1 day
- Activity A & B by 1 day

Crash Card for Ex Fast Work

Activity	Normal time	Crash time	Normal Cost	Crash Cost	Crash cost/pd	D0	D1	D2	D3	D4	D5	D6	D7
Project	16	9											
A	6	4	10000	18000	4000								
B	4	2	5000	11000	3000								
C	3	1	4000	6000	1000								
D	8	6	9000	15000	3000								
E	7	4	7000	8500	500								
TOTALS			35000										
							E	E	E	C			A,B
Crash Duration						0	1	1	1	1	1		1
Project Duration						16	15	14	13	12	11	10	9
	(Direct Cost + Indirect Cost)					44000	44500						

Duration for Least Cost

Now take the Mgt Decision of Time v/s Cost Trade Off

Least Duration

Potential Problems with Crashing

Reduced flexibility and less margin for error → increased risk of failure to complete project on time

Raises potential for poor quality

Increases potential for staff burnout, stress, and turnover (Death March projects)

Raises activity-based costs

May negatively affect other projects

May create unrealistic expectations for future projects

Thank You