Learning Objectives: In this homework you will experience Critical Chain Scheduling and Control Method, and Earned Value Analysis Method calculations and evaluation.

Assignments

1. *Consider a project to install a new office system with activities specified as follows:*

   Table 1: Installing a New Office System

Activity	Description	Staff	Duration (weeks)	Predecessors
A	Prepare offices	2	12	-
B	Procure equipment	2	8	-
C	Design tests	1	5	-
D	Install equipment	4	10	A and B
E	Test system	3	10	C and D
F	Train users	1	5	A and B

   (a) Draw simple AoN network and do the CPM calculations. Identify the critical path and critical duration Then, prepare a simple bar chart with appropriate time scale.
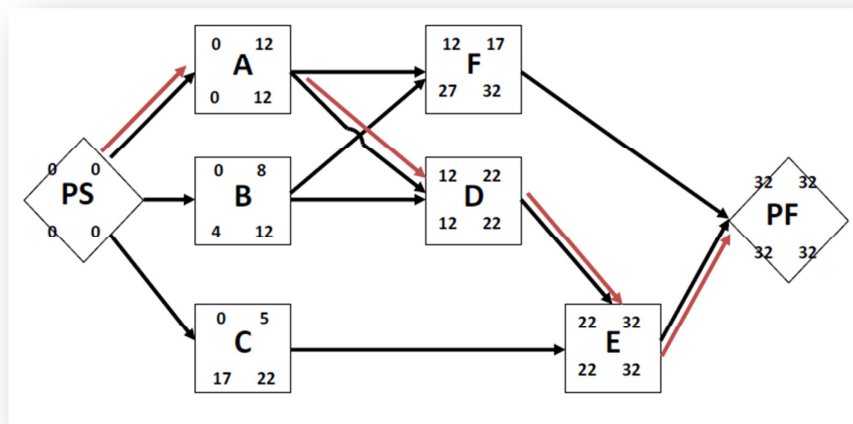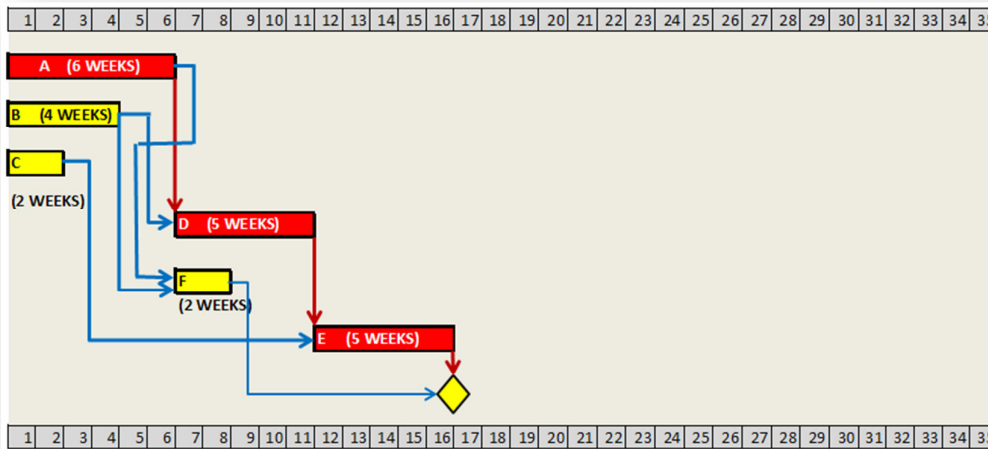
ACTIVITY	IPA	DURATION	STAFF	ES	EF	LS	LF	TS
A	-	12	2	0	12	0	12	
B	-	8	2	0	8	4	12	4
C	-	5	1	0	5	17	22	17
D	A, B	10	4	12	22	12	22	
E	C, D	10	3	22	32	22	32	
F	A, B	5	1	12	17	27	32	15

PS-A-D-E-PF is the critical path and total Project time is 32 weeks.
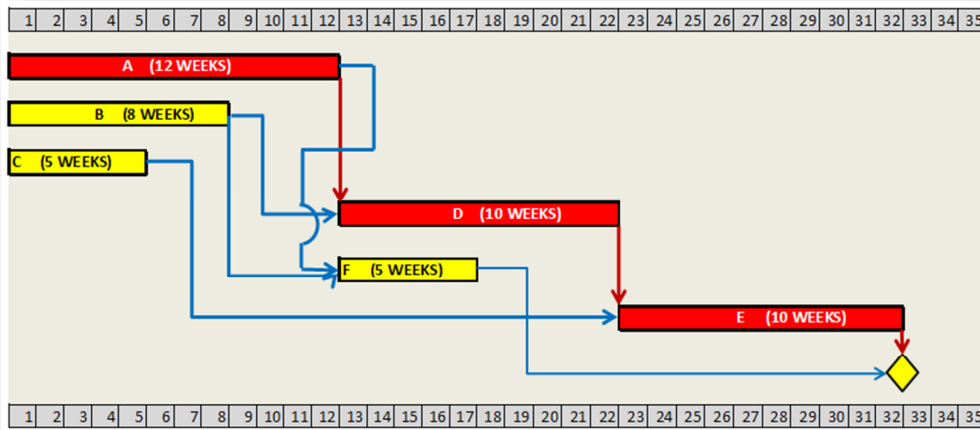
(b) Again prepare a bar chart by removing safety times and reducing task durations by 50%. What is Project duration in that case?

Duration: Task A + Task D + Task E = 6 + 5 + 5 = **16 Weeks**

(c) Reconstruct Schedule by using late finish dates and remove resource constraints (if exist any). Identify the critical chain. Again specify Project duration.
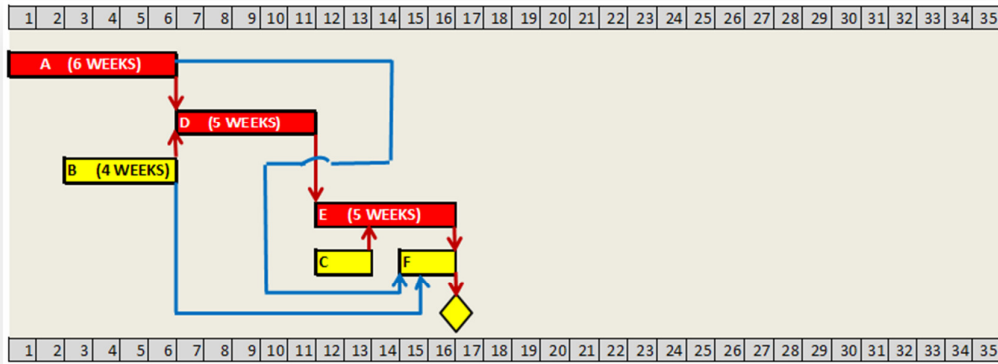
Duration: *Task A + Task D + Task E = 6 + 5 + 5 =* **16 Weeks**

(d) *Add Project buffer of 50% of Project duration and add feeder buffer to non critical chain. Reconstruct the chart and specify final critical chain duration.*
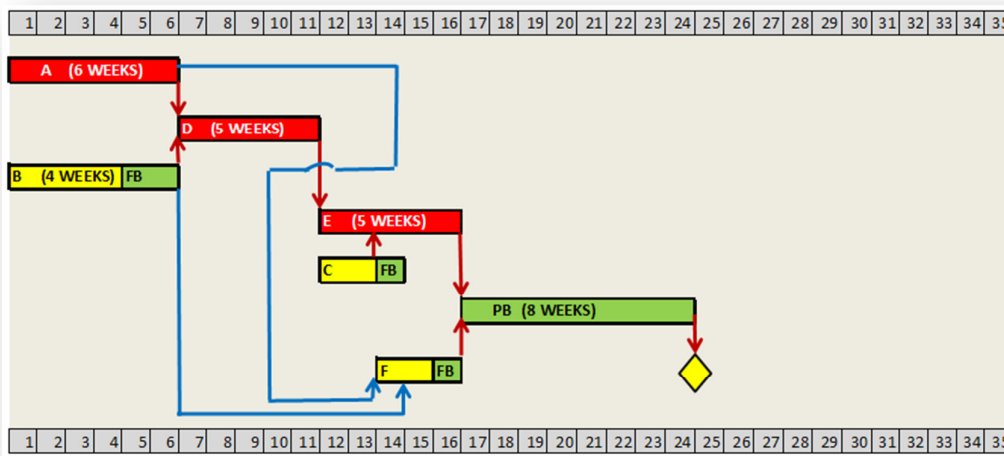
Project Buffer (PF) = 50 % of Project Duration = 0,5 * 16 weeks = 8 weeks

Add Feeder Buffer (FB) for non critical tasks on chain. (Again 50% of task duration)
FB for Task B = 0,5 * 4 weeks = 2 weeks
FB for Task C = 0,5 * 2,5 weeks = 1 week (Rounded)
FB for Task F = 0,5 * 2,5 weeks = 1 week (Rounded)

Duration: *Task A + Task D + Task E + PB = 6 + 5 + 5 + 8 =* **24 Weeks**

(e) *Compare critical path duration and critical chain duration. What is the rate of reduction as %.*

According to the results found above, project duration by CPM traditional approach is 32 weeks and the project duration for the same amount of work by using CCPM is 24 weeks.
Using CCPM, Project Duration can be reduced by; [(32-24) / 32] * 100 = **25 %.**

2. *An artist agreed to prepare portraits of 100 celebrities in 200 days at a price of $500 per portrait. Fifty days later, artist finished 21 portraits with an actual total cost of $11,400. What is the status of the Project? Specify your answer by making all possible EVA (Earned Value Analysis) calculations.*

Total Planned Budget (TB) = 100 portraits * $500 = $50,000

Daily Planned Production = 100 portraits / 200 days = 0,5 portrait/day (or 2 days per portrait)

Daily Planned Budget = $50,000 / 200 days = $250 = 0,5 portrait/day * $500 = $250

Percent complete = (21 / 100) * 100 = 21%

After 50 days, the artist's plan calls for 0.5 units/day * 50 days = 25 portraits to be finished, with a total cost of 25 * $500 = **$12,500**. We call this amount **the Budgeted Cost for Work Scheduled (BCWS) or Planned Value (PV)**. In other words, if everything (schedule and cost) worked according to plan, in 50 days the contractor would have finished 25 units and earned $12,500.

The contract price was $500 and the artist actually finished 21 portraits, so she/he earned 21 * $500 = **$10,500** from the owner. This is called the **Budgeted Cost for Work Performed (BCWP) or Earned Value (EV)**.

However, the artist's actual cost was **$11,400**. This is called A**ctual Cost for Work Performed (ACWP) or Actual Cost (AC)**.

Cost Variance (CV) = BCWP - ACWP or EV - AC = $10,500 - $11,400 = - $900

Schedule Varience (SV) = BCWP – BCWS or EV - PV = $10,500 - $12,500 = - $2,000

Schedule Varience in days (SV, days) = SV ($) / Daily Planned Budget = $2,000 / $250 = 8 days

Cost Performance Index (CPI) = BCWP / ACWP or EV / AC = $10,500 / $11,400 = 0,92

Schedule Performance Index (SPI) = BCWP / BCWS or EV / PV = 10,500 / 12,500 = 0,84

Forecasted Cost Varience (FCV) = CV / % Complete = 900 / 0,21 = $4,286

Forecasted Schedule Varience (FSV) = SV(days) / % Complete = 8 / 0,21 = 38,1 days

Summary	
TOTAL BUDGET ($)	50,000
% COMPLETE	21
ACWP ($)	11,400
BCWP ($)	10,500
BCWS ($)	12,500
CV ($)	-900
SV ($)	-2,000
SV (DAYS)	8
CPI	0,92
SPI	0,84
FCV ($)	4,286
FSV (DAYS)	38,1

From simple observation, we can say the following:

- The project is 21% complete.
- The project is behind schedule by 8 days (planned to finish 25 units in 50 days but finished 21).
- The project is over budget by $900 (earned $10,500 but spent $11,400).
- If work continues at the same pace and pattern, the contractor will finish this project 38 days behind schedule with a budget deficit of $4,286.
- If the critical ratio is between 0.9 and 1.2, we consider the deviation to be acceptable. So, CPI is 0,92 and just acceptable; however, SPI is 0,84 which means that needs attention and possible corrective action.

THANK YOU!