Shoubra faculty of Engineering

2nd year Communication

2020/2021

Projects Management (PM)

إدارة المشروعات

Lecture 8

Time Management (Part3):

- **Critical Path Method (CPM)**
- **PERT**

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6) Developing the Schedule (cont'd)

Critical Path Method (CPM) or critical path analysis

- CPM is a network diag. technique used to predict total duration of project.

- You are not finished with the project until you have finished all the tasks.

- **A critical path** for a project is the series of activities that determine the earliest time by which the project can be completed.

- المسار الحرج للمشروع هو سلسلة الأنشطة التي تحدد أقرب وقت يمكن فيه إكمال المشروع

- It is the longest path through the network diagram and has the least amount of slack or float.

إنه أطول مسار عبر مخطط الشبكة ويحتوي على أقل قدر من التراخي أو التعويم.

- **Slack or float** is the amount of time an activity may be delayed without delaying a succeeding activity or the project finish date.

- فترة السماح أو التعويم هي مقدار الوقت الذي قد يتأخر فيه نشاط ما دون تأخير نشاط تالٍ أو تاريخ انتهاء المشروع

Using Critical Path to shorten project schedule

- The project manager can shorten the duration of critical-path activities by allocating ***more resources*** to those activities.

Some Critical Path aspects

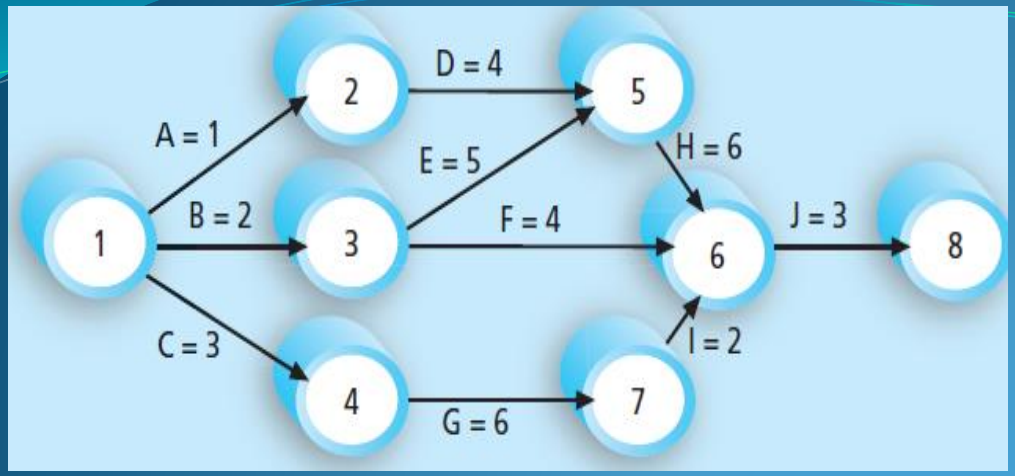
- Can there be more than one critical path for a project?

✓ Yes

- Can the critical path ever change?

✓ Yes

Calculating Critical Path



1) Determine All possible paths

A → D → H → J — path1

B → E → H → J — path2

B → F → J — path3

C → G → I → J — path4

1) All possible paths	2) Path length
Path1: A-D-H-J	1+4+6+3= 14 days
Path2: B-E-H-J	2+5+6+3= 16 days
Path3: B-F-J	2+4+3= 9 days
Path4: C-G-I-J	3+6+2+3= 14 days

3) Critical Path is: B-E-H-J, its length 16 days.

B, E, H, J, are critical activities, can't be delayed

Shortest time to complete the project is 16 days

Exercise (1):

What is the critical path for the shown data of project Y, and what is its length?

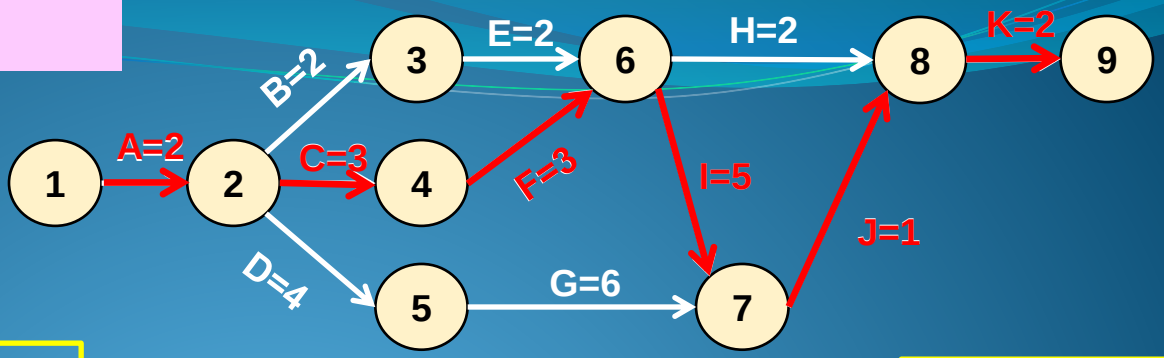
What is the shortest time to complete this project?

Activity	Initial Node	Final Node	Estimated Duration
A	1	2	2
B	2	3	2
C	2	4	3
D	2	5	4
E	3	6	2
F	4	6	3
G	5	7	6
H	6	8	2
I	6	7	5
J	7	8	1
K	8	9	2

Exercise (1): Solution

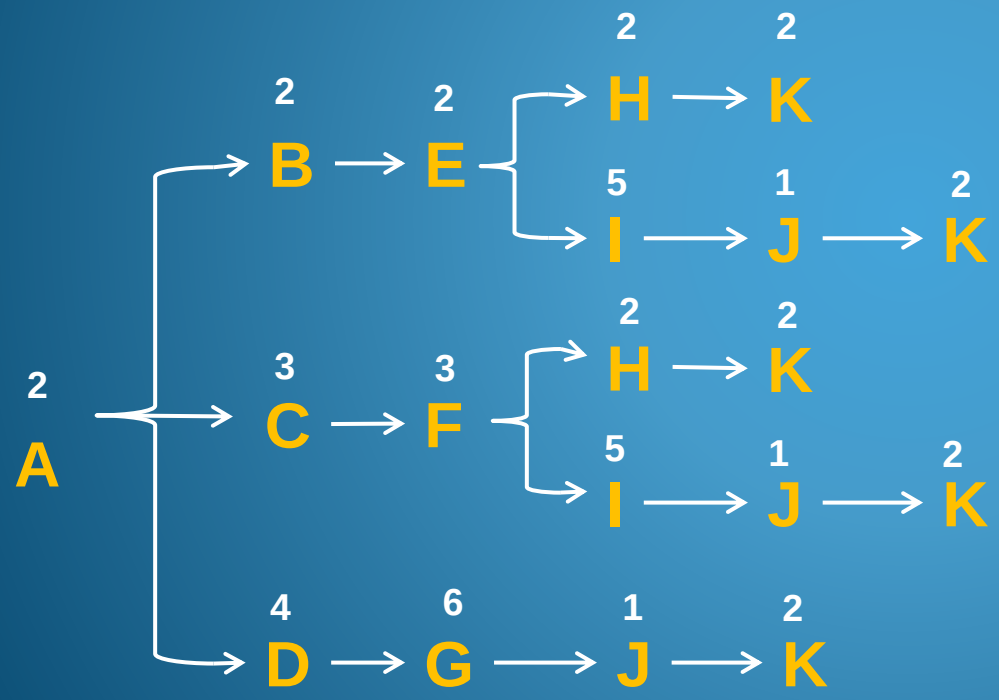
AOA network diagram

Critical path



1) Determine All possible paths

2) Lengths



Path1: **A-B-E-H-K**	Length=10
Path2: **A-B-E-I-J-K**	Length=14
Path3: **A-C-F-H-K**	Length=12
Path4: **A-C-F-I-J-K**	Length=16
Path5: **A-D-G-J-K**	Length=15

3) Critical path is: A-C-F-I-J-K its length 16 days

Shortest time to complete the project is 16 days

A, C, F, I, J, and K are critical activities,

Exercise

What is the critical path for the shown data of project Z, and what is its length?

What is the shortest time to complete this project?

Activity	Initial Node	Final Node	Estimated Duration
A	1	2	10
B	1	3	12
C	1	4	8
D	2	3	4
E	2	5	8
F	3	4	6
G	4	5	4
H	4	6	8
I	5	6	6
J	5	8	12
K	6	7	8
L	7	8	10

6) Developing the Schedule (cont'd)

Program Evaluation and Review Technique (PERT)

- ***PERT*** is a network analysis technique used to estimate project duration when there is a high degree of uncertainty about the activity duration.

PERT هي تقنية لتحليل الشبكة تُستخدم لتقدير مدة المشروع عندما تكون هناك درجة عالية من عدم اليقين بشأن مدة النشاط.

- PERT applies the CPM to a ***weighted average duration estimate*** based on ***optimistic*** متفائل, ***most likely*** غالبا, and ***pessimistic*** متشائم ***estimates***.

$$\text{PERT weighted average} = \frac{\text{optimistic time} + 4 * \text{most likely time} + \text{pessimistic time}}{6}$$

Ex: for an activity, optimistic time=8 workdays, pessimistic=24, most likely=10

$$\text{PERT weighted average} = \frac{8 \text{ workdays} + 4 * 10 \text{ workdays} + 24 \text{ workdays}}{6}$$
$$= 12 \text{ workdays}$$

- Project team would use 12 workdays when doing critical path analysis.

Program Evaluation and Review Technique (PERT)

Example:

Use PERT technique:

a) Draw the AOA diagram

b) Find the critical path

c) Calculate the shortest possible time to complete the project.

Activity name	Initial Node	Final Node	Duration		
			T_o (optimistic)	T_m (most likely)	T_p (pessimistic)
A	1	2	4	6	8
B	1	3	2	3	10
C	1	4	6	8	16
D	2	3	1	2	3
E	4	3	6	7	8
F	4	5	6	7	14
G	3	6	3	5	7
H	3	7	4	11	12
I	5	7	2	4	6
J	6	7	2	9	10

Solution

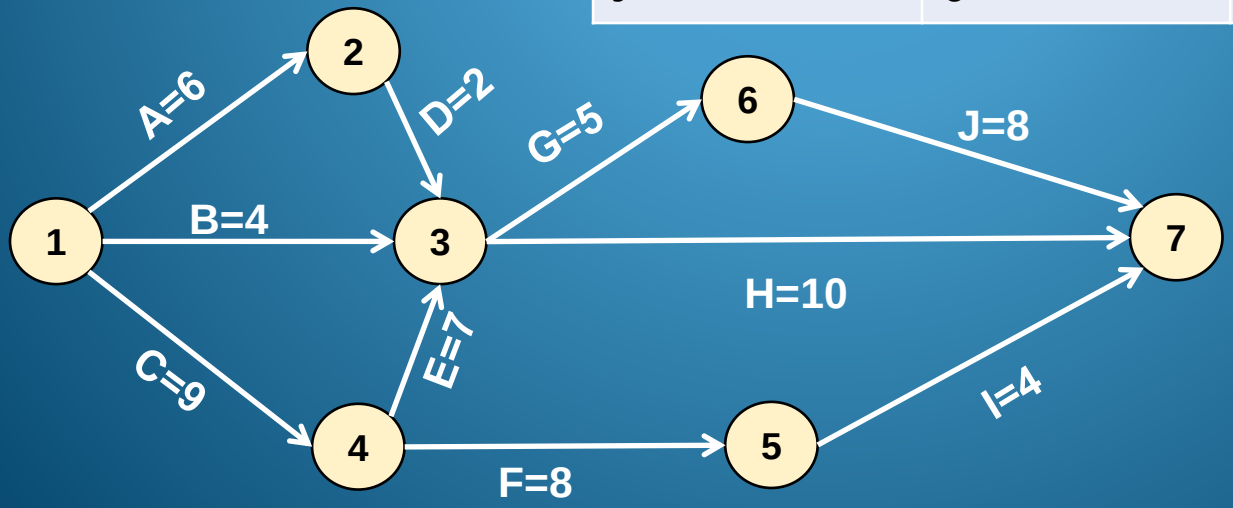
$$\textbf{PERT estimated duration} = \frac{T_o + (4 * T_m) + T_p}{6}$$

Activity name	Duration			Estimated duration using PERT
	T_o (optimistic)	T_m (most likely)	T_p (pessimistic)	
A	4	6	8	$\frac{4+(4*6)+8}{6} = 6$
B	2	3	10	**4**
C	6	8	16	**9**
D	1	2	3	**2**
E	6	7	8	**7**
F	6	7	14	**8**
G	3	5	7	**5**
H	4	11	12	**10**
I	2	4	6	**4**
J	2	9	10	**8**

Solution

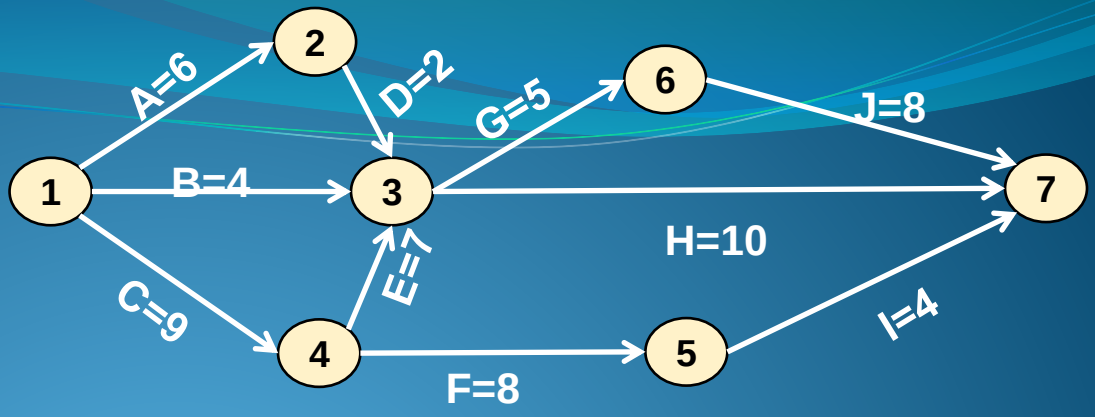
Activity name	Initial Node	Final Node	PERT duration
A	1	2	**6**
B	1	3	**4**
C	1	4	**9**
D	2	3	**2**
E	4	3	**7**
F	4	5	**8**
G	3	6	**5**
H	3	7	**10**
I	5	7	**4**
J	6	7	**8**

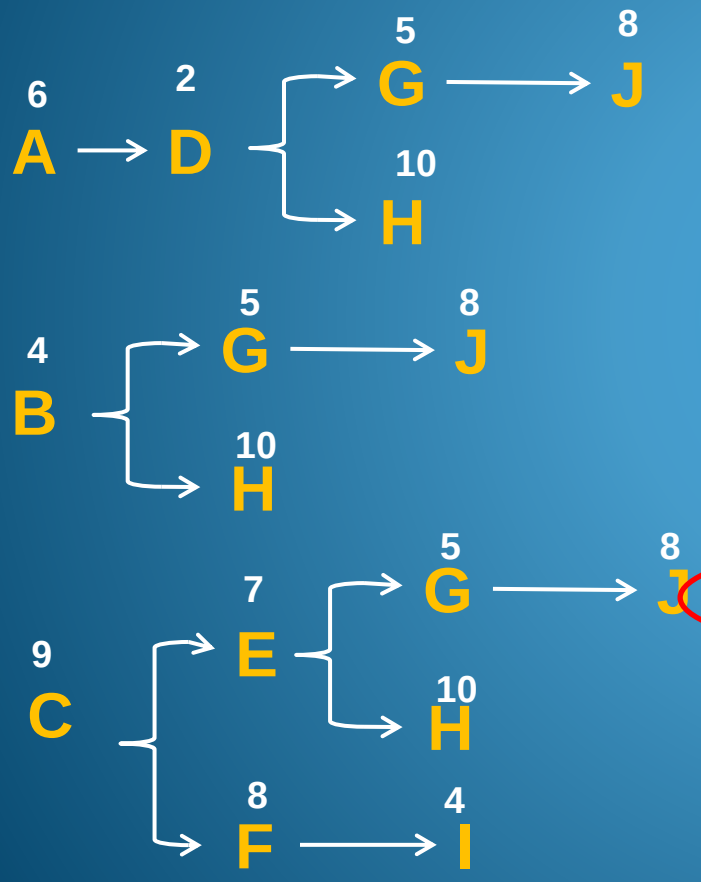
a) AOA diagram



Solution

b) Critical path





Path 1: **A-D-G-J**	Length=21
Path 2: **A-D-H**	Length=18
Path 3: **B-G-J**	Length=17
Path 4: **B-H**	Length=14
Path 5: **C-E-G-J**	Length=29
Path 6: **C-E-H**	Length=26
Path 7: **C-F-I**	Length=21

Critical path is: C-E-G-J
its length 29 days

Shortest time to complete the project is 29 days

Thanks for Attention