Pen Drive, G-Drive, VOD,
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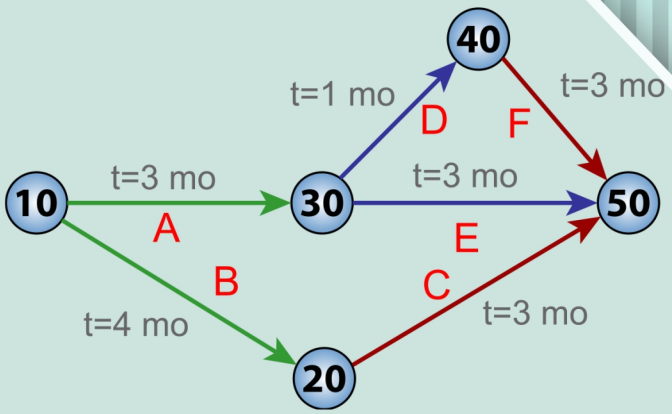
CPM - PERT

By Mukesh Sir



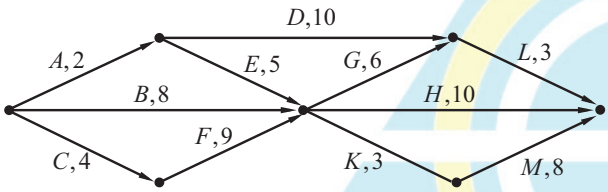
Video Lecture Information

Sr.	Lecture Name	Duration
1	Introduction to CPM-PERT	**0:37:23**
2	CPM - Critical Path Method	**1:07:11**
3	Workbook Q.1 - Q.2	**0:17:16**
4	Workbook Q.3 - Q.6	**0:23:54**
5	CPM - Floats	**0:29:09**
6	Workbook Q.7 - Q.8	**0:14:36**
7	PERT - Program Evaluation & Review Technique	**0:23:37**
8	Workbook Q.9 - Q.11	**0:10:27**
9	PERT - Probability	**0:21:24**
10	Effect of Delay & Earliness (Crash)	**0:52:36**
11	Workbook Q.12 - Q.13	**0:07:02**
12	Crashing of Project Network	**0:54:54**
13	Workbook Q.14	**0:11:19**

1 CPM & PERT

M MCQ & NAT Questions

Q.1 A project consists of activities A to M shown in the net in the following figure with the duration of the activities marked in days



The project can be completed

[GATE 2003, IIT Madras]

(A) Between 18, 19 days

(B) Between 20, 22 days

(C) Between 24, 26 days

(D) Between 60, 70 days

Q.2 The project activities, precedence relationships and durations are described in the table. The critical path of the project is

[GATE 2010, IIT Guwahati]

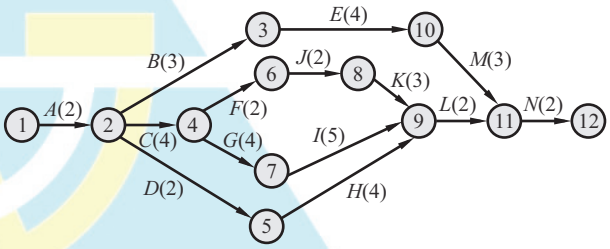
Activity	Precedence	Duration (in days)
P	–	3
Q	–	4
R	P	5
S	Q	5
T	R, S	7
U	R, S	5
V	T	2
W	U	10

(A) P-R-T-V (B) Q-S-T-V

(C) P-R-U-W (D) Q-S-U-W

Q.3 A project consists of 14 activities, A to N. The duration of these activities (in days) are shown in brackets on the network diagram. The latest finish time (in days) for node 10 is _____ .

[GATE 2016, IISc Bangalore]



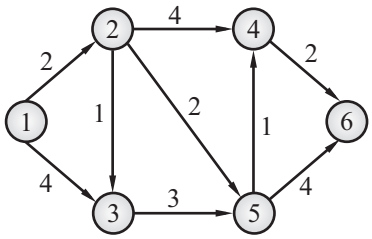
Q.4 A project starts with activity A and ends with activity F. The precedence relation and durations of the activities are as per the following table :

Activity	Immediate predecessor	Duration (days)
A	-	4
B	A	3
C	A	7
D	B	14
E	C	4
F	D, E	9

The minimum project completion time (in days) is _____.

[GATE 2017, IIT Roorkee]

Q.5 The arc lengths of a directed graph of a project are as shown in the figure. The shortest path length from node 1 to node 6 is _____. **[GATE 2018, IIT Guwahati]**



Q.6 The activities of a project, their duration and the precedence relationship are given in the table. For example in a precedence relationship "$X < Y, Z$" means that X is a predecessor of activities Y and Z. The time to complete the activities along the critical path is _____ weeks.

[GATE 2019, IIT Madras]

Activities	Duration (Week)	Precedence
A	5	$A < B.C.D$
B	7	$B < E.F.G$
C	10	$C < I$
D	6	$D < G$
E	3	$E < H$
F	9	$F < I$
G	7	$G < I$
H	4	$H < I$
I	2	_____

(A) 25 (B) 21

(C) 17 (D) 23

Q.7 The precedence relations and duration (in days) of activities of a project network are given in the table. The total float (in days) of activity e and f, respectively are

[GATE 2014, IIT Kharagpur]

Job	Predecessors	Duration (days)
a	–	2
b	–	4
c	a	2
d	b	3
e	c	2
f	c	4
g	d, e	5

(A) 0 and 4 (B) 1 and 4

(C) 2 and 3 (D) 3 and 1

Q.8 A project consists of six activities. The immediate predecessor of each activity and the estimated duration is also provided in the table below,

Activity	Precedence	Activity time (in weeks)
P	-	5
Q	-	1
R	Q	2
S	P, R	4
T	P	6
U	S, T	3

If all activities other than S take the estimated amount of time, the maximum duration (in weeks) of the activity S without delaying the completion of the project is _____. **[GATE 2019, IIT Madras]**

Common Data for Questions 9 & 10

Consider a PERT network for a project involving six tasks (a to f)

Task	Predecessor	Expected task time (in days)	Variance of the task time (in days^2)
a	–	30	25
b	a	40	64
c	a	60	81
d	b	25	9
e	b, c	45	36
f	d, e	20	9

Q.9 The expected completion time of the project is **[GATE 2006, IIT Kharagpur]**

(A) 238 days (B) 224 days

(C) 171 days (D) 155 days

Q.10 The standard deviation of the critical path of the project is

[GATE 2006, IIT Kharagpur]

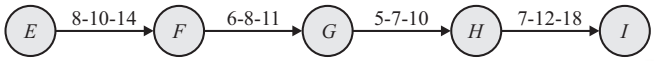
(A) $\sqrt{151}$ days

(B) $\sqrt{155}$ days

(C) $\sqrt{200}$ days

(D) $\sqrt{238}$ days

Q.11 The Optimistic Time (O), Most likely Time (M) and Pessimistic Time (P) (in days) of the activities in the critical path are given below in the format O-M-P.



The expected completion time (in days) of the project is _____

[GATE 2016, IISc Bangalore]

Common Data for Questions 12 & 13

For a particular project, eight activities are to be carried out. Their relationships with other activities and expected durations are mentioned in the table below,

Activity	Predecessor	Duration (days)
a	–	3
b	*a*	4
c	*a*	5
d	*a*	4
e	*b*	2
f	*d*	9
g	*c, e*	6
h	*f, g*	2

Q.12 The critical path for the project is

[GATE 2012, IIT Delhi]

(A) *a-b-e-g-h* (B) *a-c-g-h*

(C) *a-d-f-h* (D) *a-b-c-f-h*

Q.13 If duration of activity '*f*' is changed to 10 days then the

[GATE 2012, IIT Delhi]

(A) Critical path remains the same and the total duration to complete the project changes to 19 days.

(B) Critical path and the total duration to complete the project remains the same.

(C) Critical path changes but the total duration to complete the project remains the same.

(D) Critical path changes and the total duration to complete the project changes to 17 days.

Q.14 A project has six activities (*A* to *F*) with respective activity durations 7, 5, 6, 6, 8, 4 days. The network has three path *A-B*, *C-D* and *E-F*. All the activities can be crashed with the same crash cost per day. The number of activities that need to be crashed to reduce the project duration by 1 day is **[GATE 2005, IIT Bombay]**

(A) 1 (B) 2

(C) 3 (D) 6

P Practice Questions

Q.1 In the construction of networks, dummy activities are introduced in order to

(A) Compute the slack on all events.

(B) Transfer resources, if necessary, during monitoring.

(C) Clearly designate a precedence relationship.

(D) Simplify the crashing plan.

Q.2 In PERT, the distribution of activity times is assumed to be

(A) Normal (B) Gamma

(C) Beta (D) Exponential

Q.3 A dummy activity is used in PERT network to describe

(A) Precedence relationship

(B) Necessary time delay

(C) Resource restriction

(D) Resource idleness

Q.4 A project consists of three parallel paths with durations and variances of (10, 4), (12, 4) and (12, 9) respectively. According to the standard PERT assumptions, the distribution of the project duration is

(A) Beta with mean 10 and standard deviation 2.

(B) Beta with mean 12 and standard deviation 2.

(C) Beta with mean 10 and standard deviation 3.

(D) Beta with mean 12 and standard deviation 3.

Q.5 In PERT analysis a critical activity has **[1 Mark]**

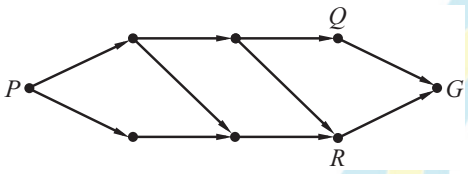
(A) Maximum float

(B) Zero float

(C) Maximum cost

(D) Minimum cost

Q.6 For the network below, the objective is to find the length of the shortest path from node P to node G. Let d_{ij} be the length of directed arc from node i to node j.



Let S_G be the length of the shortest path from P to node G. Which of the following equations can be used to find S_G?

(A) $S_G = \text{Min}\{S_Q, S_R\}$

(B) $S_G = \text{Min}\{S_Q - d_{QG}, S_R - d_{RG}\}$

(C) $S_G = \text{Min}\{S_Q + d_{QG}, S_R + d_{RG}\}$

(D) $S_G = \text{Min}\{d_{QG}, d_{RG}\}$

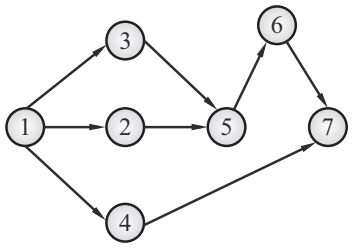
Q.7 The expected time (t_e) of a PERT activity in terms of optimistic time (t_0), pessimistic time (t_p) and most likely time (t_l) is given by

(A) $t_e = \dfrac{t_0 + 4t_l + t_p}{6}$ (B) $t_e = \dfrac{t_0 + 4t_p + t_l}{6}$

(C) $t_e = \dfrac{t_0 + 4t_l + t_p}{3}$ (D) $t_e = \dfrac{t_0 + 4t_p + t_l}{3}$

Common Data for Questions 8 & 9

Consider the following PERT network :



The optimistic time, most likely time and pessimistic time of all the activities are given in the table below,

Activity	Optimistic time (days)	Most likely time (days)	Pessimistic time (days)
1 – 2	1	2	3
1 – 3	5	6	7
1 – 4	3	5	7
2 – 5	5	7	9
3 – 5	2	4	6
5 – 6	4	5	6
4 – 7	4	6	8
6 – 7	2	3	4

Q.8 The critical path duration of the network (in days) is

(A) 11 (B) 14

(C) 17 (D) 18

Q.9 The standard deviation of the critical path is

(A) 0.33 (B) 0.55

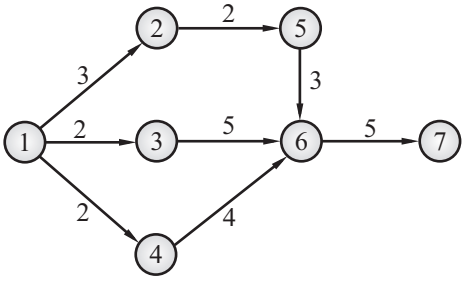
(C) 0.88 (D) 1.66

Q.10 A project has four activities P, Q, R and S as shown below,

Activity	Normal duration (days)	Predecessor	Cost slope (Rs./day)
P	3	–	500
Q	7	P	100
R	4	P	400
S	5	R	200

The normal cost of the project is Rs. 10,000/- and the overhead costs Rs. 200/- per day. If the project duration has to be crashed down to 9 days, the total cost (in Rupees) of the project is _____.

Q.11 Consider the given project network, where numbers along various activities represent normal time. The free float on activity 4-6 and the project duration, respectively are



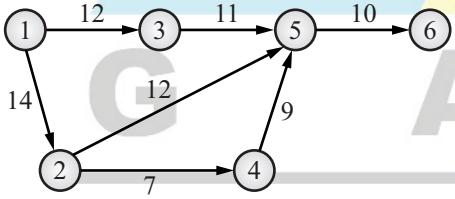
(A) 2 and 13 (B) 0 and 13
(C) – 2 and 13 (D) 2 and 12

Q.12 Following data refers to the activities of a project, where node 1 refers to the start and node 5 refers to the end of the project.

Activity	Duration (days)
1-2	2
2-3	1
4-3	3
1-4	3
2-5	3
3-5	2
4-5	4

The critical path (CP) in the network is
(A) 1-2-3-5 (B) 1-4-3-5
(C) 1-2-3-4-5 (D) 1-4-5

Q.13 A project consists of 7 activities. The network along with the time durations (in days) for various activities is shown in figure

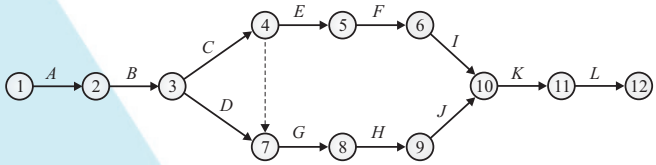


The minimum time (in days) for completion of the project is _____.

Q.14 In PERT chart, the activity time distribution is
(A) Normal (B) Binomial
(C) Poisson (D) Beta

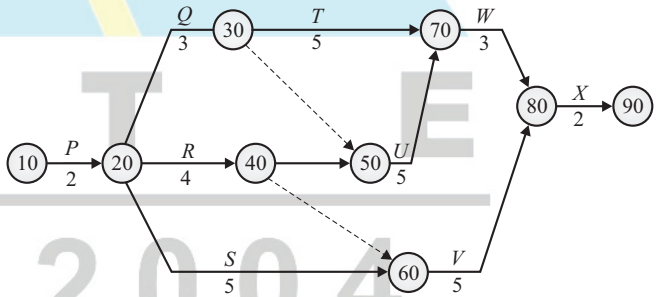
Q.15 A construction project consists of twelve activities. The estimated duration (in days) required to complete each of the activities along with the corresponding network diagram is shown below.

Activity		Duration (days)	Activity		Duration (days)
A	Inauguration	1	*G*	Flooring	25
B	Foundation work	7	*H*	Electrification	7
C	Structural construction-1	30	*I*	Plumbing	7
D	Structural construction-2	30	*J*	Wood work	7
E	Brick masonry work	25	*K*	Coloring	3
F	Plastering	7	*L*	Handing over function	1



Total floats (in days) for the activities 5-7 and 11-12 for the project are, respectively,
[GATE 2016, IISc Bangalore]
(A) 25 and 1 (B) 1 and 1
(C) 0 and 0 (D) 81 and 0

Q.16 The activity-on-arrow network of activities for a construction project is shown in the figure. The durations (expressed in days) of the activities are mentioned below the arrows.



The critical duration for this construction project is **[GATE 2016, IISc Bangalore]**
(A) 13 days (B) 14 days
(C) 15 days (D) 16 days

Q.17 The activity details of a project are given below :

Activity	Depends on	Duration (in days)
P	--	6
Q	P	15

R	Q.T	12
S	R	16
T	P	10
U	Q,T	14
V	U	16

The estimated minimum time (in days) for the completion of the project will be _____. **[GATE 2017, IIT Roorkee]**

Q.18 Given that the scope of the construction work is well-defined with all its drawings, specifications, quantities and estimates, which one of the following types of contract would be most preferred?

[GATE 2017, IIT Roorkee]

(A) EPC contract

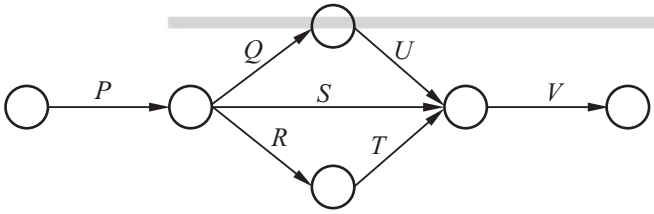
(B) Percentage rate contract

(C) Item rate contract

(D) Lump sum contract

Q.19 For a construction project, the mean and standard deviation of the completion time are 200 days and 6.1 days, respectively. Assume normal distribution and use the value of standard normal deviate $z = 1.64$ for the 95% confidence level. The maximum time required (in days) for the completion of the project would be _____. **[GATE 2017, IIT Roorkee]**

Q.20 The network of a small construction project awarded to a contractors is shown in the following figure. The normal duration, crash duration, normal cost and crash cost of all the activities are shown in the table. The indirect cost incurred by the contractor in INR 5000 per day.



Activity	Normal Duration (Days)	Crash Duration (Days)	Normal Cost (INR)	Crash Cost (INR)
P	6	4	15000	25000
Q	5	2	6000	12000
R	5	3	8000	9500
S	6	3	7000	10000
T	3	2	6000	9000
U	2	1	4000	6000
V	4	2	20000	28000

If the project is target for completion in 16 days, the total cost (in INR) to be incurred by the contractor would be_____.

[GATE 2019, IIT Madras]

A Answer Keys

MCQ & NAT Questions									
1.	C	2.	D	3.	14	4.	30	5.	7
6.	D	7.	B	8.	6	9.	D	10.	A
11.	38	12.	C	13.	A	14.	C		
Practice Questions									
1.	C	2.	C	3.	A	4.	D	5.	B
6.	C	7.	A	8.	D	9.	C	10.	12500
11.	A	12.	B	13.	40	14.	D	15.	C
16.	C	17.	51	18.	C	19.	210	20.	149500