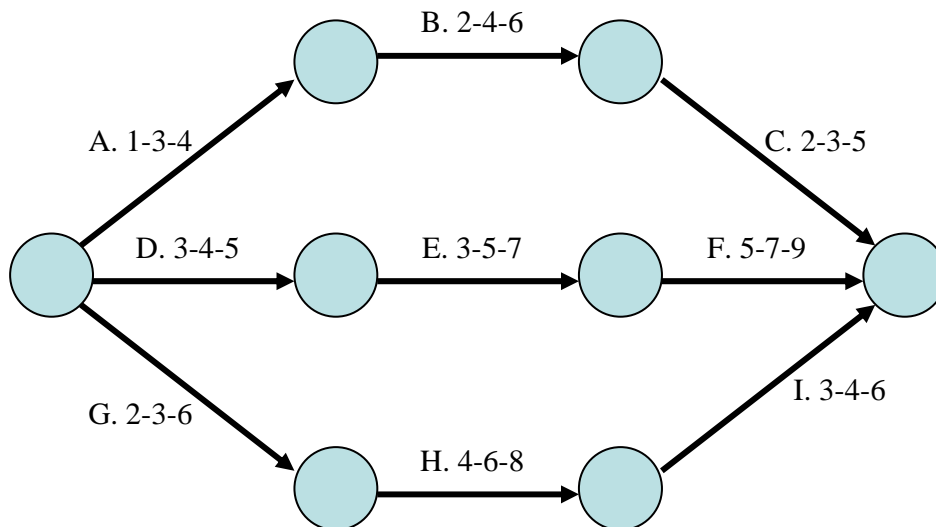


## Lesson 01 Project Management Solutions

#1: The network diagram for a project is shown below, with three time estimates (optimistic, most likely, and pessimistic) for each activity. Activity times are in weeks.



Answer the following:

- Develop the probabilistic project model and compute the Beta distribution expected duration, variance, and standard deviation for each task.

*Task*	Beta Distribution Duration		
	$\mu$	$\sigma^2$	$\sigma$
A	2.8	0.3	0.5
B	4.0	0.4	0.7
C	3.2	0.3	0.5
D	4.0	0.1	0.3
E	5.0	0.4	0.7
F	7.0	0.4	0.7
G	3.3	0.4	0.7
H	6.0	0.4	0.7
I	4.2	0.3	0.5

- Identify
  - How many paths are in the project?
  - The slack, expected duration, variance and standard deviation for each path.
  - The critical path.
  - The expected project duration.
  - Does the critical path have the largest variance? If not, which path has the highest variability?

Path	Time	Crit	Slack	$\sigma^2$	$\sigma$	Tasks	Start	2	3
1	10.0		6.0	0.9	1.0	3	A	B	C
2	16.0	CP	0.0	1.0	1.0	3	D	E	F
3	13.5		2.5	1.1	1.1	3	G	H	I

- c. Calculate each path probability for completing the project in 17 weeks. Show your answer to 4 decimal places of accuracy.

Start	2	3	P (< 17)
A	B	C	1.0000
D	E	F	.8413
G	H	I	.9995

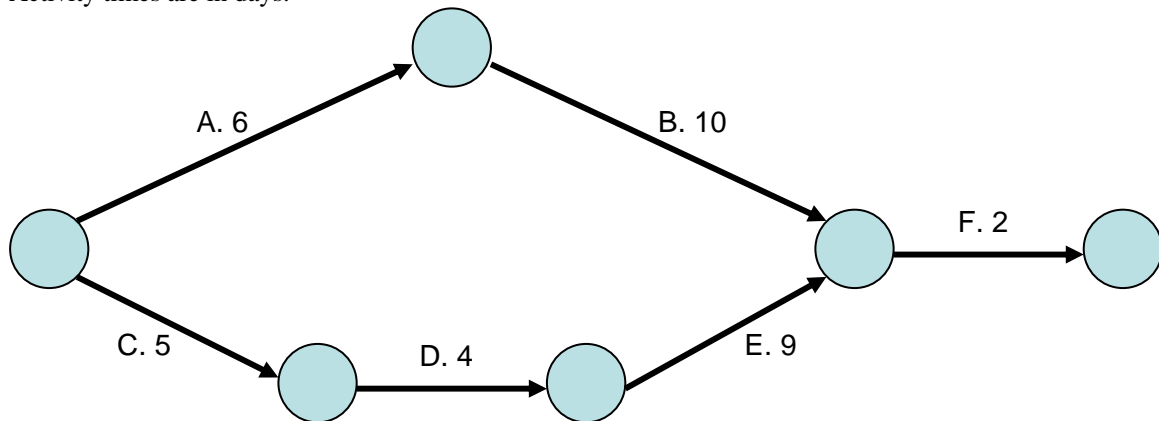
- d. Calculate the project probability for completing the project in 17 weeks. Show your answer as a percent using 2 decimal places of accuracy.  
**.8409 or 84.09%**
- e. How many weeks should you allot if you want to be 100% certain that you complete the project in the allotted time?  
**20 days**
- f. Identify
- The early and late start for each task.
  - The early and late finish for each task.
  - The slack for each task.
  - The critical tasks.

	Early		Late		Task	Crit
Task	Start	Finish	Start	Finish	Slack	Task
A	0.0	2.8	6.0	8.8	6.0	
B	2.8	6.8	8.8	12.8	6.0	
C	6.8	10.0	12.8	16.0	6.0	
D	0.0	4.0	0.0	4.0	0.0	CT
E	4.0	9.0	4.0	9.0	0.0	CT
F	9.0	16.0	9.0	16.0	0.0	CT
G	0.0	3.3	2.5	5.8	2.5	
H	3.3	9.3	5.8	11.8	2.5	
I	9.3	13.5	11.8	16.0	2.5	

- g. Develop the deterministic model using the “most likely” time estimate and answer the following,
- The critical path.
  - The expected project duration.

Path	Time	Crit	Slack	$\sigma^2$	$\sigma$	Tasks	Start	2	3
1	10.0		6.0			3	A	B	C
2	16.0	CP	0.0			3	D	E	F
3	13.0		3.0			3	G	H	I

#2: The network diagram for a project is shown below, with the most likely estimate for each activity. Activity times are in days.



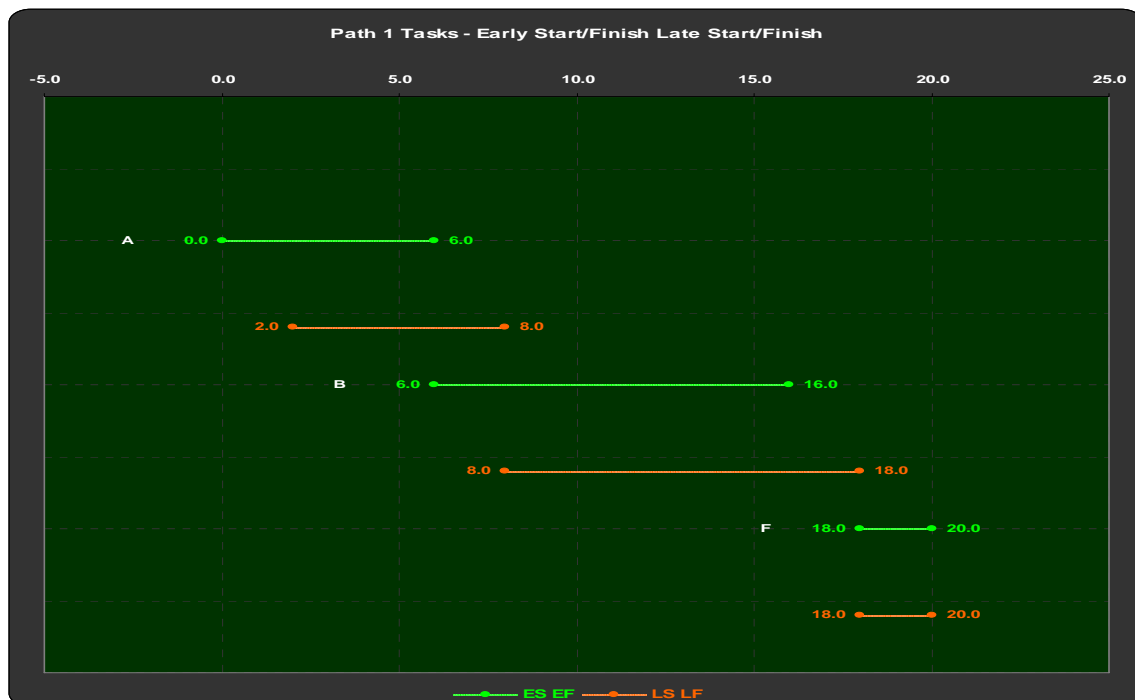
Answer the following:

- Identify all paths, the expected length of each path, the critical path, most likely project duration, and slack time for each task.

Path	Time	Crit	Slack	$\sigma^2$	$\sigma$	Tasks	Start	2	3	4
1	18.0		2.0			3	A	B	F	
2	20.0	CP	0.0			4	C	D	E	F

**Most likely project duration is 20 days.**

- Produce a Gantt chart showing the early start, early finish, late start and late finish for each task on path A B F.



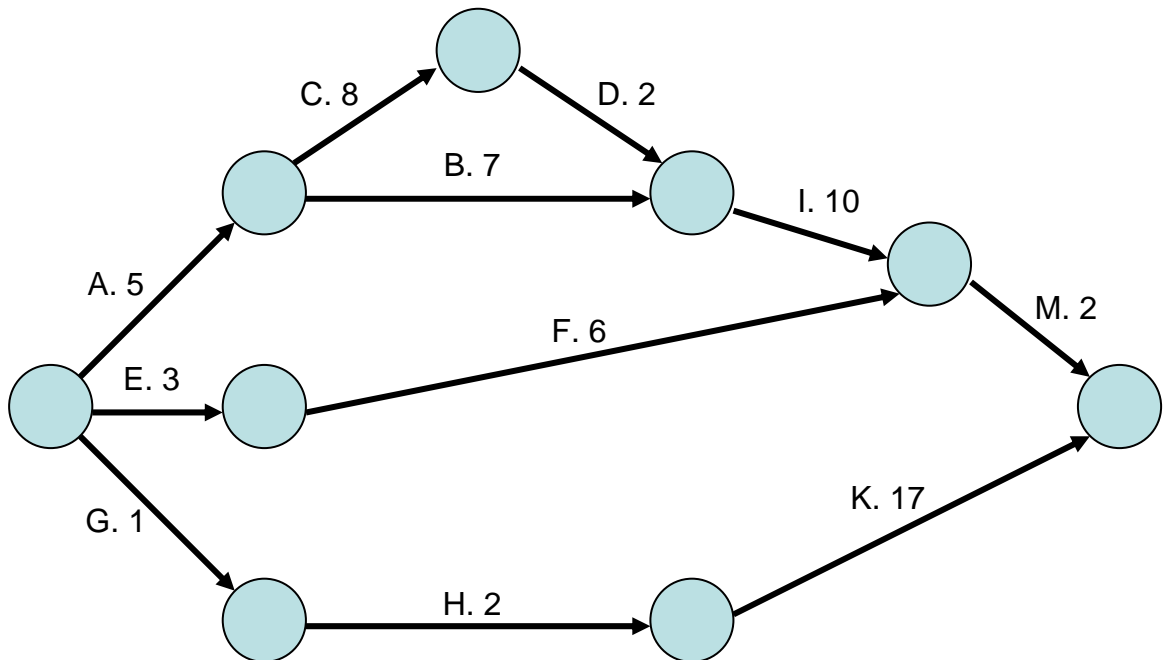
- What is the latest time task B can start if the project is to be successful?

**On day 6**

#3: The following table contains information related to the major activities of a project.

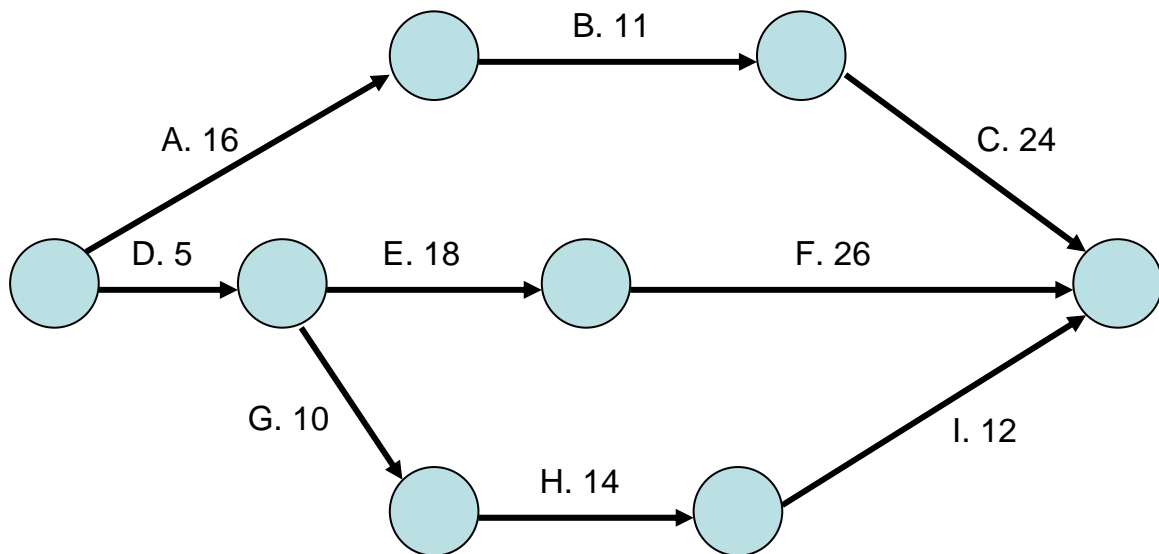
*Task*	Start	*Predecessors*		Duration Times		
		1	2	"O"	"M"	"P"
A	0				5	
C		A			8	
B		A			7	
D		C			2	
I		D	B		10	
E	0				3	
F		E			6	
M		I	F		8	
G	0				1	
H		G			2	
K		H			17	

a. Draw an Activity on Arrow (AOA) diagram.



#4: Intentionally left blank

#5: The network diagram for a project is shown below, with the most likely estimate for each activity. Activity times are in days.

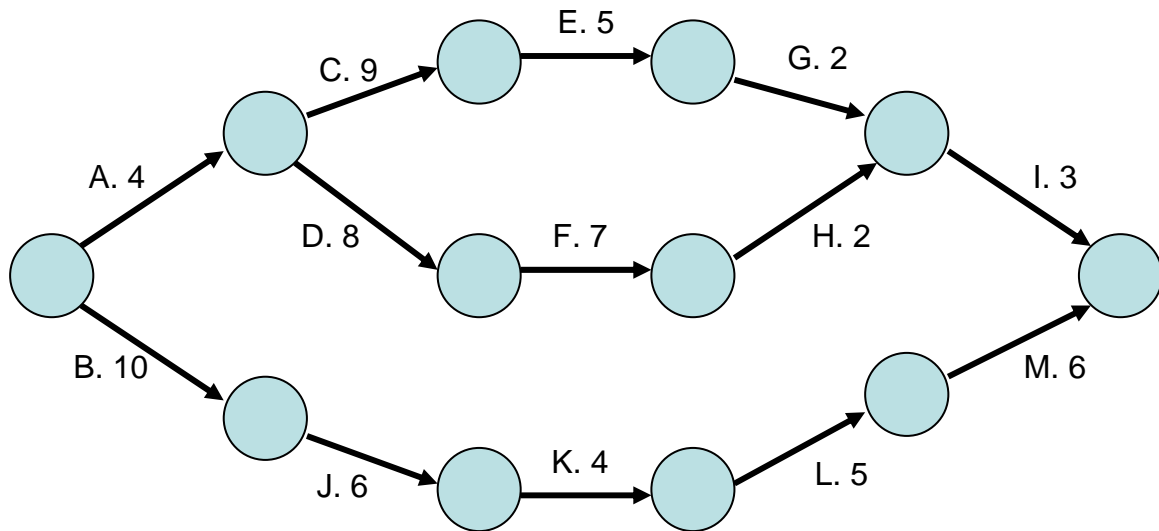


Answer the following:

- What is the most likely project duration?  
**51 days**
- What the slack on path D G H I?  
**10 days**
- What is the most likely time for path D E F?  
**49 days**
- What is the early start, early finish, late start, late finish and slack for task H?

Task	Start	Finish	Start	Finish	Slack
H	15.0	29.0	25.0	39.0	10.0

#6: The network diagram for a project is shown below, with the most likely estimate for each activity. Activity times are in days.

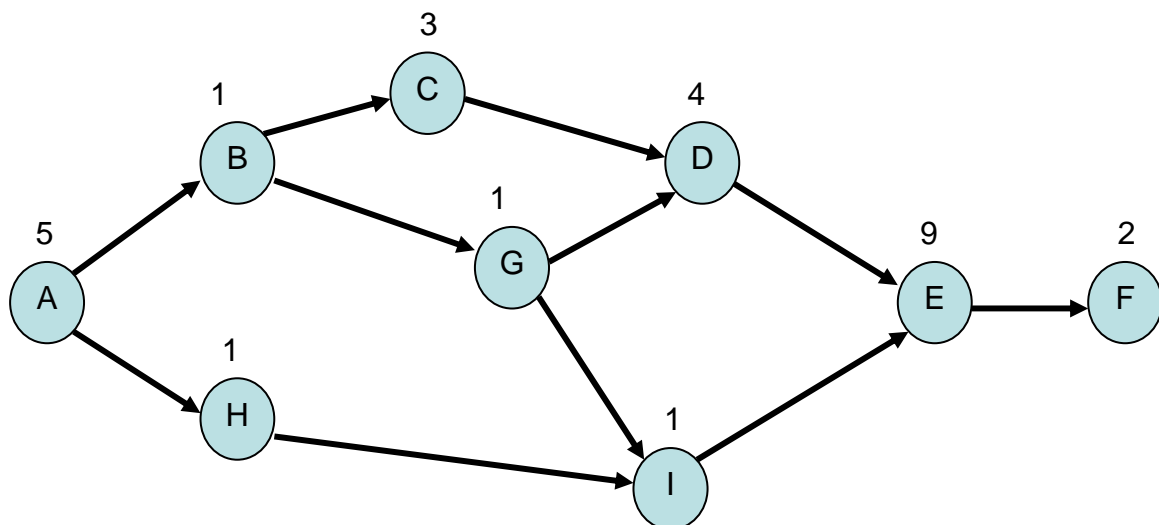


Answer the following:

- Identify all paths, the expected length of each path, the critical path, most likely project duration, and slack time for each path.

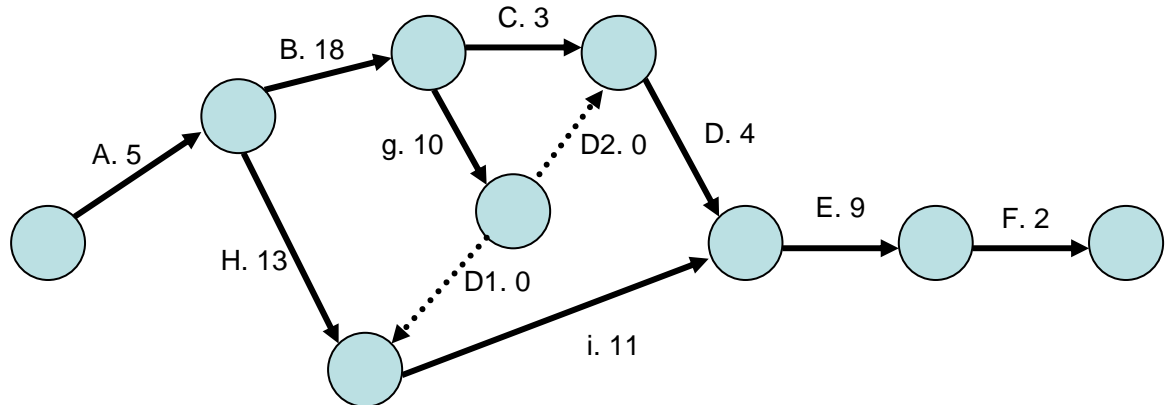
Path	Time	Crit	Slack	$\sigma^2$	$\sigma$	Tasks	Start	2	3	4	5
1	23.0		8.0			5	A	C	E	G	I
2	24.0		7.0			5	A	D	F	H	I
3	31.0	CP	0.0			5	B	J	K	L	M

#7: The AON diagram is shown for a project is shown below, with the most likely estimate for each activity. Activity times are in days.



Answer the following:

- a. Convert the AON diagram to an AOA diagram. Hint: The AOA diagram will require 2 dummy activities which you should label D1 and D2.



- b. Use the AON diagram and identify all paths, the expected length of each path, the critical path, most likely project duration, and slack time for each path.

Path	Time	Crit	Slack	$\sigma^2$	$\sigma$	Tasks	Start	2	3	4	5	6
1	41.0		14.0			6	A	B	C	D	E	F
2	48.0		7.0			6	A	B	G	D	E	F
3	55.0	CP	0.0			6	A	B	G	I	E	F
4	40.0		15.0			5	A	H	I	E	F	

- c. Which task has the largest slack time?

**H**

- d. What is the latest start time for task E?

**Day 44**

	Early		Late	
Task	Start	Finish	Start	Finish
E	44.0	53.0	44.0	53.0

#8: Intentionally left blank.

#9: Chris received new word processing software for her birthday. She also received a check with which she intends to purchase a new computer. Chris's college instructor assigned a paper due in two weeks. Chris decided that she will prepare the paper on the new computer. She made a list of the activities and the pessimistic, optimistic and most likely times in hours for each.

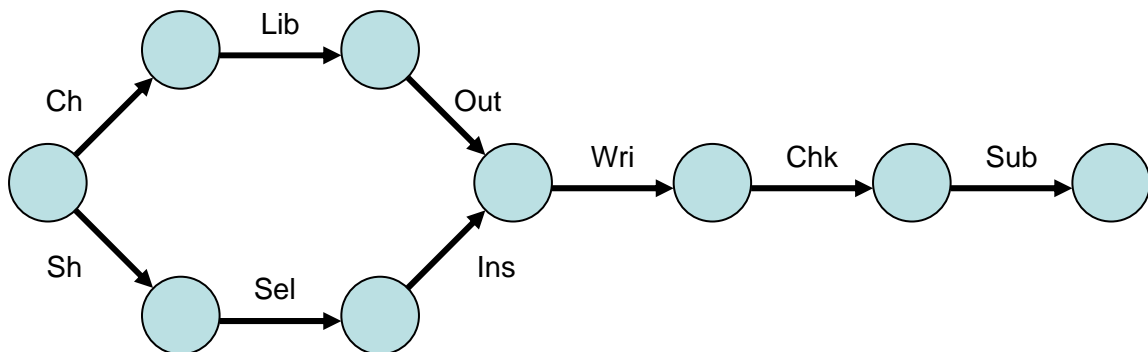
*Task*	Duration Times			*Task*
	"O"	"M"	"P"	
Ch	0.5	1	2	Choose a topic
Sh	1.5	2	2.5	Shop for a new computer
Lib	3	4	5	Library research on chosen topic
Out	0.4	0.5	1	Outline the paper
Wri	3	5	6	Write paper using software
Chk	0.5	1	1.5	Check grammar and make corrections
Sub	0.5	0.5	0.5	Submit paper to instructor
Sel	1.5	2	3	Select/Purchase computer & software
Ins	1	1.5	2	Install word processing software

Answer the following:

- a. Arrange the activities in 2 logical sequences.

**Ch – Lib – Out – Wri – Chk – Sub**  
**Sh – Sel – Ins – Wri – Chk – Sub**

- b. Construct an AOA diagram for the project.



- c. Identify the following deterministic time estimates

- Pessimistic time estimate  
**16 hours**
- Most likely time estimate  
**12 hours**
- Optimistic time estimate  
**8 hours**

- d. Using the probabilistic Beta distribution time estimates answer the following

- What is the expected project duration  
**12 hours**
- Does the critical path have the largest variance? If not, identify the path with the largest variability.  
**Yes, it has a standard deviation of .7 hours**
- What are critical tasks?  
**Ch, Lib, Out, Wri, Chk, Sub**



- How much slack is on the non-critical path?  
**.1 hours**
- Identify each path and the path probability for completion in 12 hours.

Path	Start	2	3	4	5	6	P < 12
1	Ch	Lib	Out	Wri	Chk	Sub	.5098
2	Sh	Sel	Ins	Wri	Chk	Sub	.5527

- What is the probability that Chris will complete project in 12 hours?  
**.2818 or 28.18%**
- How many hours should Chris allow if she wants to be 100% sure that she has the project completed in time to meet the professor's deadline?  
**15 hours**

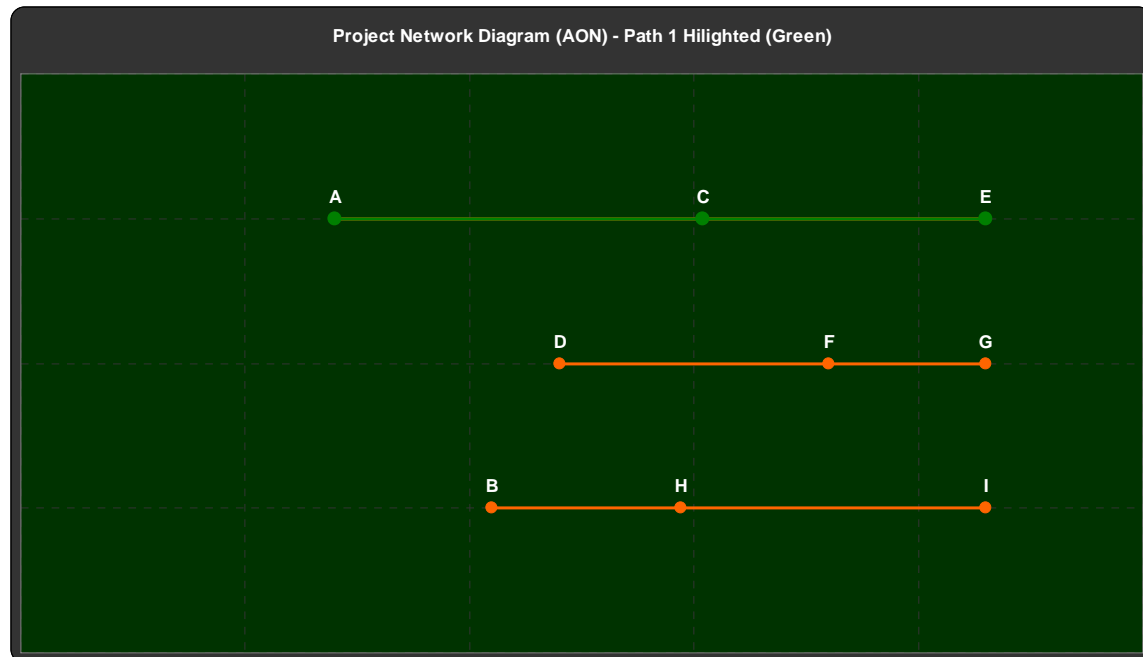
#10: Intentionally left blank.

#11: Three recent college graduates have formed a partnership for an advertising firm. Their first project consists of activities in the following table.

*Task*	Start	*Predecessors*	Duration Times		
		1	"O"	"M"	"P"
A	0		5	6	7
B	0		8	8	11
C		A	6	8	11
D	0		9	12	15
E		C	5	6	9
F		D	5	6	7
G		F	2	3	7
H		B	4	4	5
I		H	5	7	8

Answer the following:

- Draw an AON network diagram.



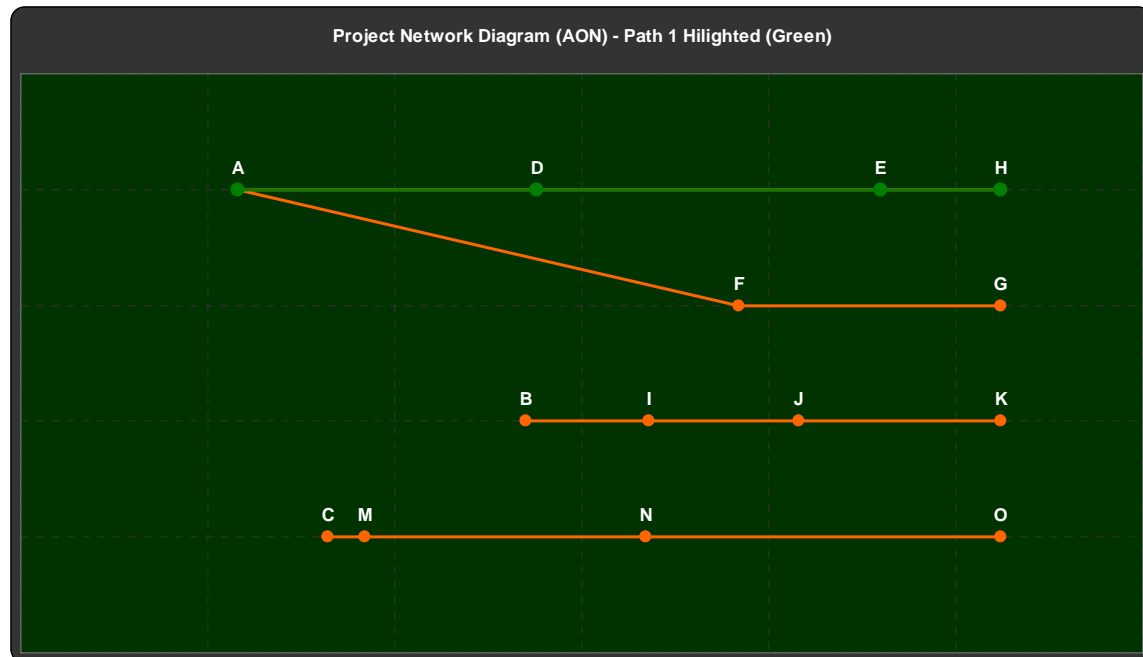
- b. What is the probability the project can be completed in 24 days or less?  
**.9677 or 96.77%**
- c. How many days should be allotted if the advertising firm wants to be at least 100% sure they complete it on time.  
**27 days**

#12: A project manager has compiled a list of major activities that will be required to install a computer information system in her firm. The list includes estimated completion times (in weeks) for activities and precedence relationships shown in the following table.

*Task*	Start	*Predecessors*	Duration Times		
		1	"O"	"M"	"P"
A	0		2	4	6
D		A	6	8	10
E		D	7	9	12
H		E	2	3	5
F		A	3	4	8
G		F	5	7	9
B	0		2	2	3
I		B	2	3	6
J		I	3	4	5
K		J	4	5	8
C	0		5	8	12
M		C	1	1	1
N		M	6	7	11
O		N	8	9	13

Answer the following:

- a. Draw an AON network diagram.



- b. Identify the paths in the project, the critical path, and for each path indicate the path expected duration, variance and standard deviation.

Path	Time	Crit	Slack	$\sigma^2$	$\sigma$	Tasks	Start	2	3	4
1	24.3		1.8	1.8	1.4	4	A	D	E	H
2	15.5		10.7	1.6	1.3	3	A	F	G	
3	14.8		11.3	1.0	1.0	4	B	I	J	K
4	26.2	CP	0.0	2.8	1.7	4	C	M	N	O

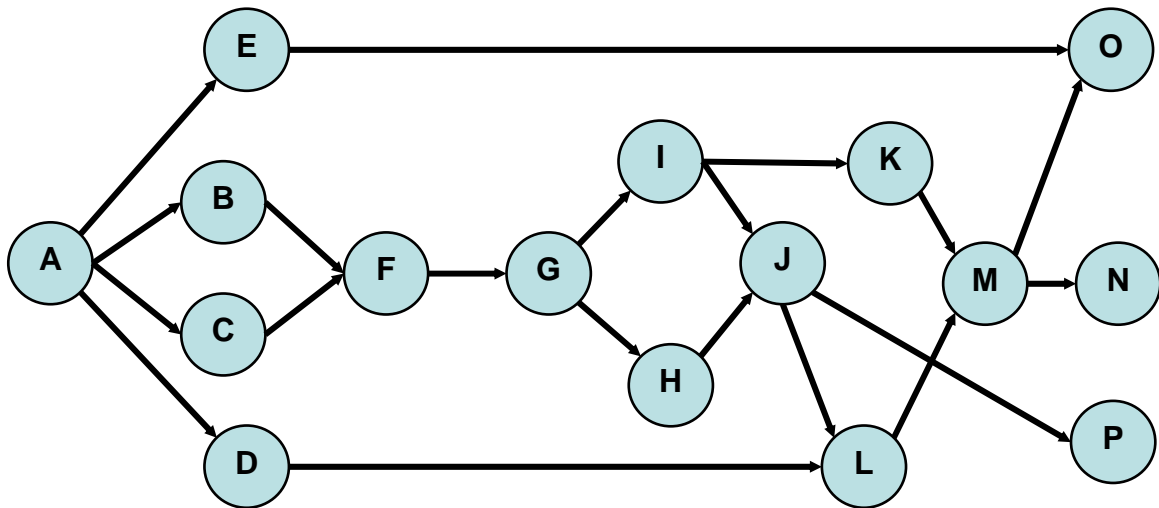
- c. If the project is finished within 26 weeks of its start the project manager will receive a bonus of \$1000, and if the project is finished within 27 weeks of its start, the bonus will be \$500. Find the probability of each bonus.

**P(\$1000) = .4098 or 40.98%**

**P(\$500) = .6754 or 67.54%**

#13: The tasks and AON project network diagram are shown below.

*Task*	Start	*Predecessors*		Duration Times			*Task*
		1	2	"O"	"M"	"P"	
A	0				5		Plan revisions/approvals
B		A			1		Grade land
C		A			3		Purchase materials
D		A			2		Order/receive equipment
E		A			4		Order/receive furniture
F		B	C		1		Pour concrete floor
G		F			4		Erect frame
H		G			2		Install electrical
I		G			4		Install plumbing
J		H	I		2		Install drywall roof
K		I			2		Construct bathrooms
L		D	J		3		Install equipment
M		K	L		3		Finish/paint inside
N		M			3		Tile floors
O		E	M		4		Install furniture
P		J			4		Finish/paint outside



Answer the following:

- a. How many paths are in the project?

**19**

- b. Use the template in the lesson, to reproduce the network diagram.

