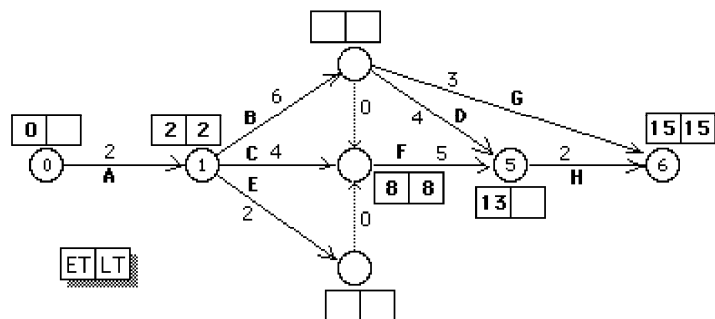


57:022 Principles of Design II  
Quiz #9 - April 24, 2002

Part I: Project Scheduling with Uncertainty

Activity	Description	Predecessor Activities	Duration (days)	
			Expected	Std. Dev.
A	Clear & level site	none	2	1
B	Erect building	A	6	2
C	Install generator	A	4	1
D	Install maintenance equipment	B	4	2
E	Install water tank	A	2	1
F	Connect generator & tank to building	B,C,E	5	2
G	Paint & finish work on building	B	3	1
H	Facility test & checkout	D,F	2	1

1. Three nodes in the AOA network below are not labeled. Label them.



2. Complete the computation of the earliest & latest expected times for the events (indicated in the boxes ABOVE).  
There are six values to be computed!

3. If each duration is its expected value, indicate whether activities D & F are critical, and for activity G, compute:

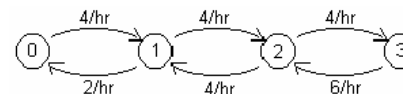
ES = earliest start time      LS = latest start time  
EF = earliest finish time      LF = latest finish time  
TF = total float (slack)

Activity	Duration	ES	LS	EF	LF	TF	Critical?
A	2	0	0	2	2	0	Yes
B	6	2	2	8	8	0	Yes
C	4	2	4	6	8	2	No
D	2	8	9	12	13	1	—
E	4	2	6	4	8	4	No
F	5	8	8	13	13	0	—
G	3	—	—	—	—	—	No
H	2	13	13	15	15	0	Yes

4. What is the expected completion time for the project? \_\_\_\_\_  
 5. Under the assumptions of PERT, what is...  
 the standard deviation of the completion time? \_\_\_\_\_  
 the probability distribution of the completion time?  
 (circle one: Exponential Triangular Beta Normal Gamma Weibull)

Part II. Birth-death model of queue

Consider the birth-death process:



1. The probability of state 0 in steady-state is found by  
 a.  $\frac{1}{\pi_0} = 1 + \frac{2}{4} + \frac{4}{4} + \frac{6}{4} = 4$   
 b.  $\frac{1}{\pi_0} = 1 + \frac{4}{2} + \frac{4}{4} + \frac{4}{6} = \frac{14}{3}$   
 c.  $\frac{1}{\pi_0} = \frac{4}{2} \times \frac{4}{4} \times \frac{4}{6} = \frac{4}{3}$   
 d.  $\frac{1}{\pi_0} = 1 + \frac{4}{2} + \frac{4}{2} \times \frac{4}{4} + \frac{4}{2} \times \frac{4}{4} \times \frac{4}{6} = 6$   
 e. None of the above
2. The probability of state #1 in steady-state is found by  
 a.  $\pi_1 = 2\pi_0$   
 b.  $\pi_1 = \frac{1}{2}\pi_0$   
 c.  $\pi_1 = \frac{3}{4}\pi_0$   
 d.  $\pi_1 = \frac{4}{3}\pi_0$   
 e.  $\pi_1 = \pi_0$   
 f. None of the above
3. The average time between arrivals when the queue is empty is (choose nearest value)  
 a. ten minutes  
 b. fifteen minutes  
 c. twenty minutes  
 d. thirty minutes  
 e. forty-five minutes  
 f. one hour  
 g. None of the above
4. The average time to serve a "customer" is (choose nearest value)  
 a. ten minutes  
 b. fifteen minutes  
 c. twenty minutes  
 d. thirty minutes  
 e. forty-five minutes  
 f. one hour  
 g. None of the above
5. How many servers are there for the queue which is modeled above?  
 a. one  
 b. two  
 c. three  
 d. four  
 e. five  
 f. None of the above
6. The queue modeled above would have  
 a. a finite source population  
 b. infinite source population  
 c. None of the above