Solutions

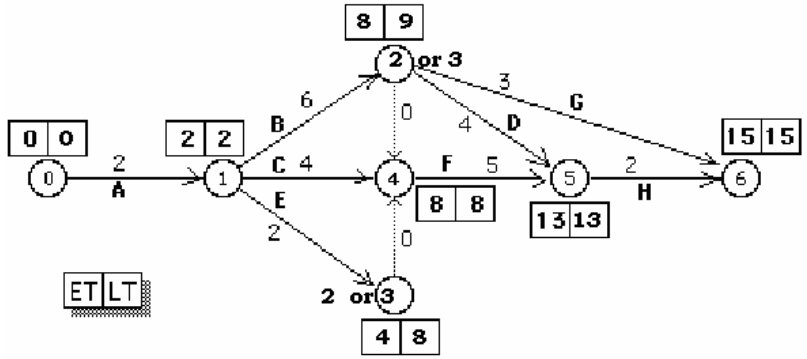
■■■■ 57:022 Principles of Design II ■■■■

Quiz #9 Solutions -- Spring 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 TF = total float (slack)
EF = earliest finish time LF = latest finish time

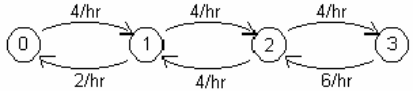
Activity	Duration	ES	LS	EF	LF	TF	Critical?
A	2	0	0	2	2	0	Yes
B	6	2	2	8	8	0	Yes
C	4	2	4	6	8	2	No
D	2	8	9	12	13	1	No
E	4	2	6	4	8	4	No
F	5	8	8	13	13	0	Yes
G	3	**8**	**12**	**11**	**15**	**3**	No
H	2	13	13	15	15	0	Yes

4. What is the expected completion time for the project? **15**
5. Under the assumptions of PERT, what is...
the standard deviation of the completion time? **3.162**

Sum variances of critical activities: $\sigma^2 = 1^2 + 2^2 + 2^2 + 1^2 = 10 \Rightarrow \sigma = \sqrt{10} \approx 3.162$

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:



_d_ 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*

_a_ 2. The probability of state #1 in steady-state is found by

a. $\pi_1 = 2\pi_0$ c. $\pi_1 = \frac{3}{4}\pi_0$ e. $\pi_1 = \pi_0$

b. $\pi_1 = \frac{1}{2}\pi_0$ d. $\pi_1 = \frac{4}{3}\pi_0$ f. *None of the above*

_b_ 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*

_d_ 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*

_c_ 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*

_b_ 6. The queue modeled above would have

a. a finite source population b. infinite source population c. *None of the above*