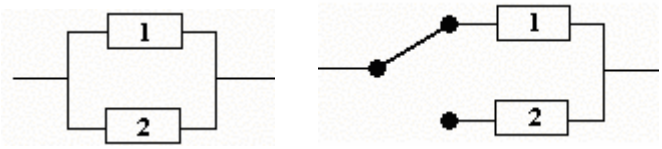
≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈

57:022 Principles of Design II - Quiz #8

Spring 2002

≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈≈

Part I: Redundancy A system requires a certain unreliable component in order to function, so that redundancy has been included in the design. Assume that failure rates are constant and equal to λ, and that any switches are 100% reliable.



_+_ a. The block diagram on the left above represents "hot" standby of the redundant unit.

_+_ b. In the block diagram on the right, unit #2 does not begin its lifetime until unit #1 has failed.

_+_ c. In the block diagram on the right, the expected system lifetime is the same as the expected time of second arrival in a Poisson process with rate λ.

_o_ d. In the case of "cold" standby, there is always some probability that the standby unit cannot be started.

_o_ e. The reliability of the system on the left is at least as large as that of the system on the right.

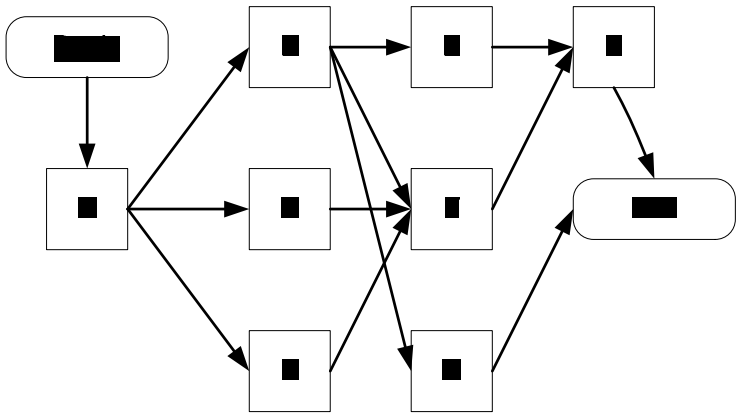
_o_ f. A system with "hot" standby is at least as reliable as one with "cold" standby.

_o_ g. In the block diagram on the left, the system failure time has Erlang-2 distribution.

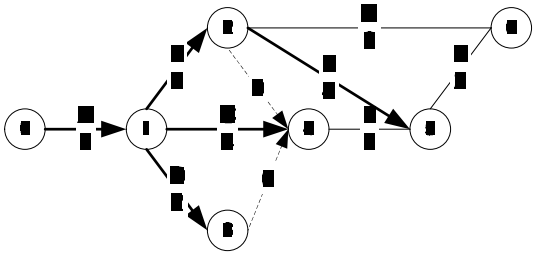
Part II: Project Scheduling. The activity descriptions and estimated durations for a project are:

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

Draw the arrows to complete the *AON* (activity-on-node) network representing this project:



Draw the arrows to represent any required "dummy activities" to complete the *AON* (activity-on-node) network representing this project:



_+_ a. A "dummy" activity always has zero duration.
_o_ b. The quantity LT(i) [i.e. latest time] for each node i is determined by a *forward* pass through the network.
_+_ c. If an activity is represented by an arrow from node i to node j, then ES (earliest start time) for that activity is ET(i).
_o_ d. If an activity is represented by an arrow from node i to node j, then LS (late start time) for that activity is LT(j).
_o_ e. If an activity is represented by an arrow from node i to node j, then that activity has zero "float" or "slack" if and only if ET(i)=LT(j).
_+_ f. An activity is critical if and only if its total float ("slack") is zero.
_o_ g. A "dummy" activity cannot be critical.
_+_ h. The forward and backward pass methods for scheduling a project are applied to the AOA network representation of the project.
_+_ i. Except perhaps for "begin" and "end" activities, "dummy" activities are unnecessary in the AON ("Activity-on-Node") representation of a project.