Name – Atul Kumar Agrawal
Regn no : 1602040031
Branch – Computer Science and Engineering, CSE-I
Assignment 1

---

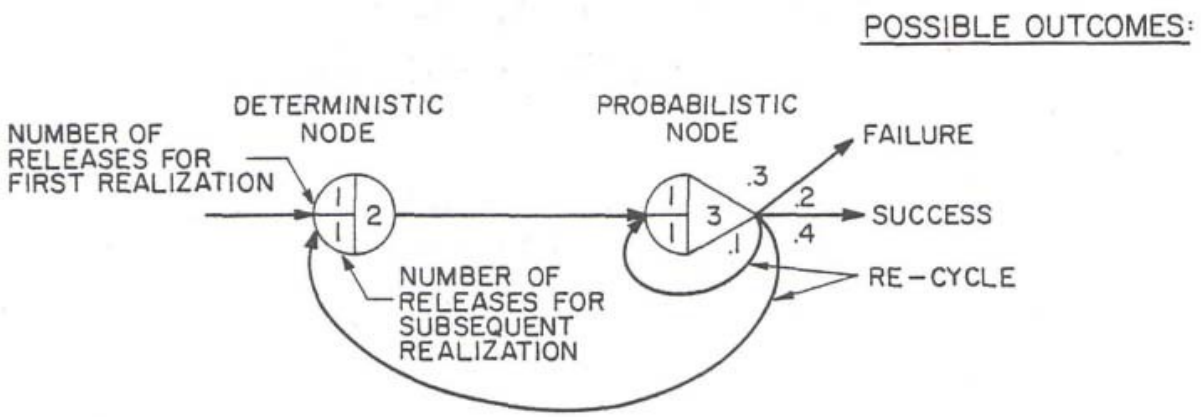
1. Write the advantages and disadvantages of GERT.

Ans -

GERT (Graphical Evaluation and Review Technique) includes features such as probabilistic branching (stochastic models), network looping (feedback loops), multiple sink nodes (multiple outcomes), and multiple node realization (repeat events) which are unavailable in PERT/CPM.

Advantages of GERT :

a. GERT has both types of nodes, deterministic and probabilistic



b. The GERT simulation package has the capability for nine different probability distributions for activity times: constant, normal, uniform, erlang, lognormal, poisson, beta, gamma and the beta fitted to three parameters.

c. The GERT model also has the capability for assigning fixed and variable costs to network activities, (i.e., a fixed cost can be assigned so that each time an activity takes place the cost is accumulated; the variable cost is tabulated depending on the length of time the activity consumes.)

d. GERT has been effectively applied to a number of systems problems including product planning , research and development planning, market research, production planning, quality control, manpower planning and Ph.D. program development among others.

e. GERT simulation leads to unbiased statistical estimates. GERT in its simplest form can be used to replicate PERT networks by employing only deterministic branching and either constant or probabilistic activity time estimates.

f. It has the ability to model complex stochastic projects, and the large amount and variety of statistical data that can be generated.

Disadvantage of GERT:
a. GERT network is not as sensitive to activity time changes as node branching probability changes.

b. if the project activity times are extremely cost sensitive then a slight alteration in an activity time can affect network (project) cost even though the overall network time might not be affected significantly.

c. Complex algorithm required to model the GERT system.

2. Briefly describe the use of GERT in the planning and control of marketing research.

Ans . The GERT simulation results can be used in several ways by management to facilitate and enhance project planning. The primary difference in the GERT results and the results obtained from a PERT or CPM network (apart from the fact that the GERT results reflect a stochastic network) are the cost statistics. These cost statistics provide a significant input into determining whether or not a project should be undertaken and/or how it can be best controlled.

- GERT provides managers with a holistic graphical representation of the concurrent process necessary implementation.
- GERT to a sequential product development process in an attempt to evaluate the adaptability of the model to a business process. GERT as a time-computing scheduling technique to model concurrent NPD processes.
- The GERT network represents the lowest possible level of defined activities within a project. This involves the decomposition of work packages into scheduled activities to provide a basis for estimating, executing and controlling the project.
- In GERT, a directed branch or arrow with transmission parameters of time and probability is used to represent a scheduled activity or communication path between two nodes.

The majority of GERT networks are modelled using either Monte Carlo simulation or Markov Chain Monte Carlo (MCMC), whereby operating characteristics of the system can be observed.

3. Describe the steps for GERT application for an R&D project.

Ans .

it requires only that the project of interest be :
(a) diagrammed in network form
(b) converted to program input data describing the network, and
(c) simulated using the prewritten GERTS-IIIZ simulation package 5 .

By simulating the network, statistical data can be collected at different nodes for network duration and cost.

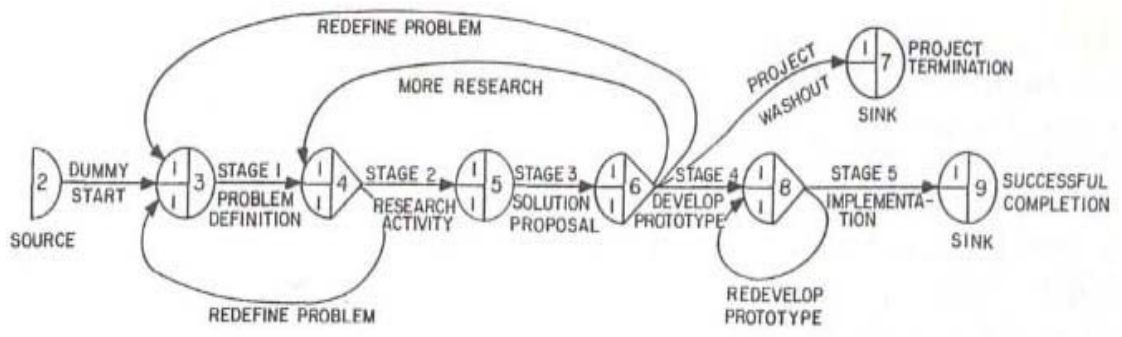


Figure:-GERT Network of an R & D Project.

1. Problem definition:-
   - The project is initiated in activity 2-3 which is followed by the first stage of the R&D process, formal definition of the problem to be attacked by the R&D team.
   - Problem definition is represented by activity 3-4.

2. Research activity:-
   - Following the completion of stage 1, problem definition, the next stage, research activity is normally initiated. However, the possibility that the problem was not sufficiently defined is reflected by activity 4-3 which causes stage 1 to be repeated.

3. Solution proposal:-
   - If the process proceeds to activity 4-5, research activity, the next step is represented by activity 5-6.

4. Prototype development:-
   At the completion of activity 5-6, four alternative outcomes are possible:-
   - First, it may be concluded that the problem was incorrectly defined to begin with, thus prohibiting the development of a viable solution proposal. This possibility is shown by activity 6-3, a loop back to node 3 for redefinition of the problem.
   - Second, the search for a solution proposal may have indicated insufficient research in which case the network loops back (i.e., by activity 6-4) to node 4 for reconducting the research activity.
   - Third, the attempt to propose a solution may indicate that no solution exists. This occurrence ‘is reflected by activity 6-7, defined as project washout. Node 7 is a “sink” node indicating project termination, and the end of the network.
   - Finally, if a solution proposal is successfully developed the network proceeds to activity 6-8, prototype development.

5. Solution implementation:-
   When activity 6-8 is completed, two outcomes are possible:-
   - First,if the prototype was not developed properly, redevelopment is necessary which is shown by activity 88, a self-loop around node 8.
   - Second,if a satisfactory prototype is developed, the solution is implemented in activity 8-9. Node 9 is a second network “sink” node representing successful completion of the R&D project.

4. Write a short note on GERT Modelling with an example.

Ans. The GERT is similar in construction in case of CPM/PERT but GERT has two node:

i. Probabilistic node
ii. Deterministic node

The deterministic node is one whose input will provide us with single outcome but a probabilistic node is one which will give multiple probable outcomes. In the above diagram node 2 is a deterministic node and node 3 is a probabilistic node. The left hand side upper '1' in node 2 and 3 represent the number of releases for the realization and the lower '1' represents the number of releases for subsequent realization. The node 3 in here is a probabilistic node and hence is showcasing four different outcomes, one for the success of the project, second for the failure of the project and the rest two representing recycle, meaning to say that some of the previous steps need to be repeated in order to ensure the completion of the project. The failure outcome leads to the termination of the project with no possible solution for the project and the success outcome leads to the completion of the project with an appropriate solution of the problem for the project. It is to be noted that the deterministic node is represented by the circular half but the probabilistic node is represented by the cone head on half of the side.

5. What are the components of GERT.

Ans.

The components of GERT networks are **directed branches** (arcs, edges, transmittances) and **logical nodes** (vertices).

1. **Directed branches**:-

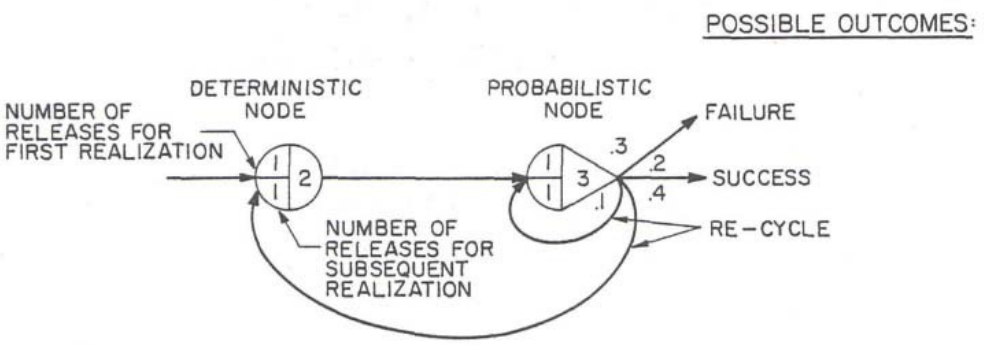
Two parameters are associated with the branch:

i) The probability that a branch is taken, p, given that the node from which it emanated is realized.
ii) A time, t, required, if the branch is taken, to accomplish the activity, which the branch represents. The time, 1, can be a random variable. If the branch is not part of the realization of the network then the time for the activity represented by the branch is zero.

2. **Logical nodes:-**
   - A node in a GERT network consists of an input (emitting, distributive) hnction and an output (emitting, distributing) function.
   - Three logical relations on the input side and two types of relations on the output side will be considered.
   - This yields six types of nodes.
     i) Exclusive-or: The realization of any branch leading into the node causes the node to be realized; however, one and only one of the forward branches leading into this node can be realized at a given time.
     ii) Inclusive-or: the realization of any branch leading into the node causes the node to be realized. The time of the realization is the smallest of the completion times of the activities leading into the inclusive-or node.
     iii) And: The node will be realized only if all the branches leading into the node are realized. The time of the realization is the largest of the completion times of the activities leading into the and node.
     iv) Deterministic: All branches emanating from the node are taken if the node is realized, that is, all branches emanating from this node have a p-parameter equal to one.
     v) Prohabilistic: At most one branch emanating from the node is taken if the node is realized.

6. What is a deterministic node and a probabilistic node?

Ans. GERT has both types of nodes, deterministic and probabilistic.
Deterministic node contains only 1 arrow i.e. it has only one fixed outcome whereas Probabilistic node contains more than one possibility of outcome.
Example :



Instead of one deterministic branch (arrow) as in PERT/CPM there are four possible outcomes each with a probability of occurrence. Thus, at a probabilistic node a choice situation exists where one of several alternatives may be selected based on the associated probabilities. However, the sum of the probabilities for all activities emanating from a probabilistic node must be 1.00 (i.e., there is a 1.0 probability that one of the activities will be realized).

If the activity emanating from node 3 and looping back to node 2 occurs, this would cause activity 2-3 to be repeated. If, on the other hand, the activity labeled “failure” was realized, the network might flow to a “sink” node which ends the network. Alternatively, if the activity labeled “success” is realized, the network might continue for several more activities before the network ended in another (different) “sink” node. The fourth activity at node 3 is activity 3-3 representing a self-loop back to the same node. These alternative activities reflect the feedback, multiple outcome and repeating activities characteristics of GERT.