ABSTRACT

This thesis is concerned with the estimation of (i) the project completion time pdf and its first two moments, (ii) the criticality indices of its activities, and (iii) the allocation of limited resources to various activities in order to maximize the probability of project completion before a target date in PERT type networks where some of the activity durations could be correlated. Explicit consideration of correlation between activity durations in PERT networks is a theoretically important and practically relevant problem. For example, in reducing an irreducible network, one often resorts to duplication of some arcs but ignores the existence of perfect correlation between the original arcs and their duplicates, thus introducing an error in the estimation of project completion time parameters. Similarly, in practical projects, one encounters correlation between two activity durations, if both activities share a common resource or face a common technical difficulty. Ignoring such correlations presents a wrong picture of the project completion time pdf and the criticality indices of its arcs to a project manager. This increases the difficulty in project planning and its control. Besides presenting a concise review of the relevant literature in Chapter 1, this thesis presents the findings of our study on four different aspects of the above problem in four subsequent chapters.

*Chapter 2 develops an approximation to Dodin's[1985c] Bounding Method (**DBM**), a superior (when compared to say, Kleindorfer[1971]) lower bounding method for estimation of project completion time pdf in PERT type networks with independent activity duration distributions. The cardinality adjustment schemes incorporated in the approximation scheme makes **DBM** suitable for application to large PERT networks. In the process, this chapter also develops two (**LPCA** and **TACA**) improved schemes for cardinality adjustment of collapsed arc that are superior to the scheme used by Dodin[1985b] in his Sequential Approximation Procedure.*

Chapter 3 extends the methodology developed in previous chapter to the networks where some of the activities could be correlated. Using a linear predictor to forecast the activity duration of a dependent (correlated) activity for a specific realization of its independent activity duration, the methodology estimates the conditional pdf, mean and variance of the project completion time. Their unconditional values are obtained by multiplying with appropriate probabilities of realization and summation over all possible realization values for the independent arcs.

Chapter 4 modifies and extends the approximate method for computing the criticality indices, originally proposed by Dodin and Elmaghraby[1985], to PERT networks where some of the activities could be correlated.

Chapter 5 deals with the practical problem of project monitoring in the case of correlated PERT networks. Given the realization of some of the activities, the problem is to compute the mean and variance for the work remaining, and the criticality indices of the remaining activities. Further, it also proposes a method for allocating a limited additional resource available to activities in order to maximize the probability of project completion within the target date.

Chapter 6 summarizes the important conclusions of the thesis. It also suggests some areas where further investigations could be fruitful.

KEYWORDS: PERT, CORRELATED ACTIVITY DURATION, CRITICALITY INDEX, RESOURCE ALLOCATION, CONDITIONAL PROBABILITY MATRIX