PROJECT SIMULATION USING EXCEL WITHOUT ADD-INS

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ABSTRACT

This paper demonstrates a simulation application using Excel without add-ins in calculating PERT and CPM of a project with random activity times. PERT/CPM and PERT distribution are reviewed and PERT-distribution random number generation is discussed. The development of the simulation model is presented in detail. We take advantage of the capabilities of one-variable data table to run the simulation of the project. Our approach avoids the add-ins with little additional efforts to execute the simulation.

***Keywords**: PERT/CPM; PERT distribution; simulation*

1. INTRODUCTION

Program evaluation and review technique (PERT) and critical path method (CPM) are two important techniques that help project managers to manage and execute projects. Both techniques were developed concurrently, but independently, during the 1950s. CPM identifies the most critical step and the longest path needed to complete a project. The function of PERT is to analyze and represent the tasks involved in a given project. The task completion time required in PERT is a random variable, generally assumed to come from independent Beta distributions in which expected values and variances can be easily estimated from three parameters of the underlying distributions, a – the optimistic completion time, c – the most likely completion time, and b – the pessimistic completion time. Over the years, the combination of the two techniques has been used by practitioners and academicians. These two techniques have made significant contributions in the area of project management (Dougherty et al., 1984; Kazan, 2005; Davis, 2008) and thus have been widely included in the business school curriculum. Among available software to teach these techniques, Microsoft Excel seems to be very popular. The use of Excel has helped instructor to teach project management in a context which students can easily follow. Albright and Winston (2005) used RISK software, an Excel add-in, to run the project simulation. Later Dan Fyltra and his crew at Frontline Systems have developed Analytic Solver Platform (ASP), another Excel add-in. Limited access to the two Excel add-ins has caused tremendous inconvenience for the instructors to use them in the classroom. The purpose of this paper is to show an easy way to perform a project simulation using Excel without add-ins. There are several probability distributions one could choose for the random activity times. Our demonstration assumes the activity duration time follows the PERT distribution due to its popularity in project scheduling.

2. PERT DISTRIBUTION RANDOM NUMBER GENERATION

One of the requirements of almost any simulation model is some facility for generating random numbers. In this section, we briefly discuss the procedure for generating random numbers from the PERT distribution.

The PERT distribution is a re-parameterization of the beta distribution A random variable X has a PERT distribution with parameters a, b and c (b > c > a), if its probability density function X is as follows:

$$f(x|\alpha,\beta) = \begin{cases} \frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)}\left[\frac{(x-a)^{\alpha-1}(b-x)^{\beta-1}}{(b-a)^{\alpha+\beta-1}}\right] & for\ a < x < b, \\ 0 & otherwise \end{cases}$$