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ANALYSIS OF PROJECT PLANNING USING CPM AND PERT

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Abstract—This project presents an analysis of the Critical Path Method (CPM) and Project Evaluation Review Technique (PERT) in Project Planning. It highlights the means by which a network diagram is constructed from a list of project activities and the computation involved for each method. The project will consist of examples problems, along with a complex problem constructed from scratch, using both CPM and PERT, and compare results highlighting advantages and disadvantages of each methods.

Keywords— CPM, PERT, Sequence

I. INTRODUCTION

In the 1950s both government agencies and the private sector became more interested in efficiency pertaining to large projects. One example was a study conducted in Great Britain by the Operational Research Section of the Central Electricity Generating Board, which examined problems with refurbishing a generating plant. By 1957 they devised a technique which reduced the overhaul time to 42project. There are two main techniques pertaining to project planning in use today: the Critical Path Method (CPM) and the Project Evaluation and Review Technique (PERT).

II. BACKGROUND

A. Critical Path Method

The Critical Path Method, sometimes referred to as Critical Path Analysis (CPA) was developed in the 1950s by DuPont Corporation and Remington Rand Corporation. It was specifically developed to manage power plant maintenance projects. They wanted to develop a management tool that would help in the scheduling of chemical plant shut downs for maintenance and then restarting them once maintenance was complete. The CPM methods saved the company one million dollars in the first year of use.

B. Project Evaluation and Review Technique

Separate but similar work was also being conducted in the mid 1950s by the United States Navy. The US government discovered the Russians were developing their own missile technology, and because national security was at stake the Navy immediately launched their own program to close the missile gap. 8 The project was enormous, and so it was important for the Navy to conduct research on planning and controlling complicated projects. The research was referred to as the Program Evaluation Research Task (code-name PERT). In February of 1958, Dr. C.E. Clark, from the PERT team, introduced the first arrow diagram. PERT, later referred to as the Program Evaluation and Review Technique, was applied to the Fleet Ballistic Missile Program later that year. With over 3,000 contractors, vendors, and other teams involved, it was of strategic importance to complete the project quickly and efficiently. PERT proved its worth, and was given credit for taking two years off the estimated time needed to develop the Polaris missile, and is still the standard for all Navy projects today.

III. EXPERIMENT

CPM and PERT were developed independently, but their main difference is that CPM uses deterministic (known) activity durations and PERT consists of probabilistic activity durations. In this project I will be analyzing both methods and demonstrating their application through example. I will also create an example from scratch, solve using both methods, and analyze the results, highlighting advantages and disadvantages of both methods. Both CPM and PERT are network based techniques. They are vital tools in the planning, scheduling, and control of projects. A project is a collection of interrelated activities with each activity consuming time and resources.

A. Constructing the network

Each activity is represented by an arc pointing in the direction of progress. The nodes establish precedence relationships among different activities. There are three rules for constructing the network:
1. Each activity is represented by one, and only one, arc.
2. Each activity must be identified by two distinct end nodes.

B. CPM Computations

A critical activity is an activity that has no leeway in determining its start and finish times. If a critical activity runs late, then the entire project will run late. A noncritical activity is an activity that allows something slack, meaning it can be advanced or delayed (within limits) without affecting the completion time of the project. An event is defined as a point in time when activities are completed and another activity is started. In terms of a network, an event corresponds to a node.

C. CPM Computations

The purpose of PERT is to analyze the probability that a critical path will be finished by any given time. The analysis proceeds as followed:

1) Let T equal the total time that will be taken by the activities on a critical path. 2) Find the probability that the value of T will turn out to be less than or equal to any specified value of interest. a. The activity times are independent random variables. This is a valid assumption for most PERT networks. b. The random variable T has an approximately normal distribution. This assumption relies on the central limit theorem, which in broad terms states that the sum of independent random variables is approximately normally distributed. Then T 22 We will want to convert T to a standard normal random variable and use a Z table. The first step is to find the standard deviation of T (standard deviation of the path). To do this we need the variance of T (variance of the path). To find the variance of a path, we add all the variance for a path we wish to take. For example if we have a path consisting of activities starting at activity A and finishing at activity D, such that, ABCD, and we wish to find the probability that we can complete activity D within 5 days, we 18 will need to know the standard deviation of the path, but to do that we must know the variance of the path. The variance of the path is just calculated by adding the variance of each activity.

IV. CONCLUSION

In conclusion if you as a project manager are working with a project for the first time it would probably be best to use PERT. After using the method and getting more consistent completion times for activities, they at that point can become the duration of those activities using CPM. While both methods were invented separate from each other I observed a definite link between the two.