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COMPARATIVE ANALYSIS OF RISK REDUCTION USING PERT & CPM TECHNIQUE

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***Abstract*— The PERT/CPM produce begins with the hardwork of developing an estimate of the cost each activity when it is performed in the planning way (including any crashing). A various of details must be considered in planning how to coordinate all these activities, in developing a realistic schedule, and then in monitoring the progress of the project.**

Fortunately, two closely related operations research techniques, PERT (program evaluation and review techniques) and CPM (critical path method) were developed in the 50's, within different contexts: the CPM was developed for planning and control of DuPont engineering projects and the PERT was developed for the management of the production cycle of the Polar is missile.

The usual PERT procedure may lead to overly optimistic results as many path which are not critical but slightly shorter than critical on the basis of estimated activity duration or average durations. This paper analyzed the traditional probability analysis method for duration risk in program evaluation and review technique(PERT) and Critical Path Method (CPM). On the basis of that it simulates the project's duration and analyzes the risk by Monte Carlo simulation method.

They share the same objectives such as defining the project duration and the critical task. The PERT/CPM technique is based on two straight steps; a forward propagation to define the earliest start and finish dates (and subsequently the project duration and the free floats), and a backward promulgation for the latest start and finish dates (and the total floats). Initially, the activity times are static with in the CPM technique and probabilistic with in the PERT technique. In a software project, predicting the likelihood of duration may play a key role to wards project success.

***Index Terms*— PERT, CPM, Monte carlo simulation technique.**

I. INTRODUCTION

Our life we all depend on management such that business world management, organizations management and institutions management and many more are highly using project management techniques for effective results. Constant change and complexity have become two consecutive aspects. We are all working in a similar environment which is constantly changing very fast and with the increase in complexity we need to be focused, profitable and productive for our environment. Project management is the process for time-limited, focused, nonrepetitive, activities with some degree of risk and usually scope of operational activities for the company is responsible.

Project Management is the process of obtaining goals of the project from a defined set of activities which reducing the probability of failure and confirm the completion with quantifiable and quality dealing. Project management is a process but also a collection of processes to be used to meet the project requirements. An effective Project Manager must manage the four basic factors of a project that are cost, resources, scope, and time. Each factor must be managed very carefully for a good project. All these factors are interrelated to each other and must be standby together if the project, and the project manager, both want to be a success.

A. Managing Resources

This is very important to manage resources for making an effective project. A successful Project Manager can carefully manage the resources that are assigned to the project. This includes time, cost and cost of labor of the project team. Project manager can managed project resources frequently and also involves more than people management. It also includes vendor cost, in which managing labor subcontracts and vendors.

In resource managing also manage the people resources that mean having the right people, with proper knowledge of tools and the good skills, in the right quantity used at the right time. The project manager also manages the tools which is used to making a project and the material that are assigned to the project.

B. PERT (Project Evaluation and Review Technique)

PERT is stands for “Project Evaluation and Review Technique. It was invented initially to clarify the planning and scheduling of big and complex projects. PERT was developed for the U.S. Navy Special Projects Office in 1957 to support the U.S. Navy's Polaris nuclear submarine project.

It is a tool for project management which is used to plan and track schedule to analyze risks in the project and to organize activities within the project. The project evaluation and survey technique, commonly known as PERT, is a statistical tool it is used in project management, which was developed for analysis and represents the tasks for completing a given project.

The main goal of PERT computations is to approximate the total time proceed from the start to the end of the project and also defined the same as getting that end date across with the calculation of risk.

C. CPM (Critical Path Method)

The Critical Path Method (CPM) is a way of minimizing the series of scheduled activities, or tasks, in this project. This is a tool of management designed to ensure a project's complete on the time. Since it's invented in the 1950s, CPM has been adapted to the Theory of Constraints and Critical Chain concepts idea devised by Israeli physicist Eliyahu Goldratt.

The basics of CPM were traced by "Du Pont" when he was working on project management for planning and scheduling on the UNIVAC machine in middle 1959. The variation in the value is quantity of time that all the activities can be late without increasing the all project execution time.

It is a project management method which covers all the critical and non-critical tasks throughout the critical path are recognized. It helps us to complete the project under a given timeframe without any delays.

Therefore we list all the activities in the project with their execution times and the preference among them. After that a network flow chart figure is maintaining with calculation earliest and latest start and finish times. A floaters lack value is calculated.

Hence, the critical path will always contain of activities which have zero slack.

Slackorfloat=latest(startorfinish)time–earliest(startorfinish) time

In which the activities having no slack or slack value 0 shown as the critical activities. Those activities defined the critical path which is the largest path for the finishing of the project. However, the tasks in the critical path can't be delayed because a small delay in these can affect the result and in overall delay of the project.

CPM is often used to compute the earliest and latest possible start time for every activity. Here we identify the critical activities is that, if one are activity is delay, it will affect the whole process to suffer without a reason. Hence, it is named as Critical Path Method.

In this approach, a list is create consisting of all the activities required to complete a project, shown by the computation of time needed to complete each activity. Therefore the dependency between the activities is evaluated. Hence, 'path' is defined as a sequence of activities in a network system. Therefore we found that the critical path is the path with the longest length.

II. Analysis of Previous Research

Through the previous year research paper survey has been done for the improving knowledgebase for the PERT/CPM techniques and to study all the demerits which are found through the previously used several types of strategy, methods and algorithms.

From the basis of (**D.G. Malcolm, C.E. Clark and W. Fazzar, 1959**) are derive the concept of PERT originally for the clarification of schedule of projects, which are very complex or large. That was identified in 1957, for the office of U.S navy to support the Polaris nuclear submarine project of navy(U.S.).[1]That was an efficient for including variation, with probability to schedule the activities with the knowledge of the exact details and duration for the described activities.

(**Aravind.M, Aravindhababu.V, Balamurugnan.K, 2015**), are given the new simulation approach to be determine the accurate value of the time of completion. Here the mean project time crashed notify by the traditional PERT analysis is always gives to us an underestimate of the original completion time for the project. [2] This paper advices an improved methodology to calculate the mean project time for completing using simulation. For Simulation, ARENA simulation software is preferred.

The attributes can be represented in graphical notation form in two different ways, first either by explain the activities by the nodesi.e; AoN dag or activities with the edges / arcs i.e; AoA dag. In the paper [4], (**Nasser Eddine Mouhoub, Abdelhamid Benhocine, 2012**) a new algorithm is introduced to get an Activity starting from the (Node as activity) dag uses the line graphs notation. The general idea is taken from the paper [17], (**Nasser Eddine Mouhoub, Ho-cineBelouadah,2011**). It is very simple to apply this new method.

(**Wayne A. Haga, Tim O'keefe,2001**) presented a simulation approach [5] to defined the order of erasing of activities along with the optimized erasing technique for a network of PERT to lessen the regional value of cost adding crash and overrun for a given maintainable penalty function for delay project completion.

The activity time of the project are distributed as distributions in beta sampling and the approximated project duration as in the original Normal distribution. It is better than suppose as to be constant, but the sedefined notions are specifically possibility. The approach in this paper[10] (**Le**

Roy F. Simmons, 2002) illustrate how the simulation with Process Model can found this unrequited limitation.

This paper [11] (**Wanan Cui, Jiajun Qin and Chaoyuan Yue,2006**) is systematically found the drawbacks of a some indexes to calculate the task's criticality in the network of PERT, which have some factors as, the critical activity index (CAI), the significance index (SI), cruciality index (CI) and the sensitivity analysis. After the survey of these problems, (ACCI) thatis; activity critical comprehensive index was derived. Solve the example proved that the (ACCI) notify the deficiencies of all three adding sensitive analysis for some level.

In the study we found [12](Chen-Tung Chen and Sue-FenHuang,2007), Fuzzy PERT approach was used for solving this problem. In the activity time were represented by the triangular fuzzy numbers in the project network system. For each and every activity, fuzzy limits were calculated for the initiating and completing times.

III. Proposed Methods

In which the proposed approach construct use of the Monte Carlo simulation across with the triangular division for random variant generation is used to finding the three activity time aspects used in the PERT/CPM technique. PERT considers the variability in activity time by considering approximate of time. Although of this the results achieve from PERT have a divergence from practical project completion time. The forecasting of the completion times in the project management is one of them ost challenging tools for the project managers.

The schemes overruns are very general to appear due to the uncertainty in approximate the amount of time and need of an activity. The main complication with Pert is that it consistently under estimates the schedule of risk and the most appropriate solution to this problem is known as Monte Carlo Simulation. Monte Carlo Simulation is the modern way to estimate the risk of the project schedule along random sets of activities duration that gives the various number of different critical paths and results into the minimization of risk under the project scheduling.

A. Monte Carlo Simulation

Monte Carlo Simulation, in which each input, is varied inside a predefined range hundreds of times and to produce a set of outputs across with the frequency of occurrence. Hence, the frequency is translated into the possibility of the respective output's occurrence. When we use Monte Carlo simulation, we can produce a mathematical distribution and the likely range of out comes. Monte Carlo simulation was initiated in 1940's, and that time the scientists were working on the atomic bombs. It is a type of probabilistic simulation and it is used to understand the risk effect and variability in the project management system and further type of financial models. Figure-3showsthemethodologythatis used in this study.

B. Mathematical functions

Monte Carlo Simulation method is the fundamental procedure for measuring the uncertainty of any system contains of basic steps.

1) Design a model holds the conditional probabilistic attributes.
2) Produce the random set of inputs.
3) Evaluate and store the results
4) Repeat the steps bands for required number of iterations
5) Evaluate the results with the information.

There is process of inputs and outputs are defined across with the probabilistic distribution. After that we run the simulation to the number of the described iterations and calculate the outputs correctly. In the previous work are related, at the different places it has been express that how to find the criticality indication of discrete activity times. Throughout my work, a method is identified to find the criticality indexes of the project with the priority of relationships included between them. In which with the criticality index of the activity, we can show a percentage value between 0 and 1 and which is represent how many times the activity goes critical for the specific number of iterations.

ALGORITHM 1: Activity Criticality index along with preference

Input: In a project, each and every activity Ai, the three time attributes optimistic ‘ai’, most likely ‘bi’ and pessimistic ‘ci’ will be the inputs, the dependencies, Count, and number of iterations.

Step 1: For all the activities in the project, the a, m and b attributes are passed to the triangular distributed random variant function defined for the random variable ‘R’

a) If R=m-a/b-a then return m;

b) If R<m-a/b-a then return a + √ R*(b-a)*(m-a)

c) If R>m-a/b-a then return b-√(1-R)*(b-a)*(b-m)

Step2: The minimum activity time mini from the triangular function is obtained.

Step3: For all activity Ai, Check for dependencies,

Step 4: If there is no dependency Check

If mini < bi Count ++Else

Add the mini value of the dependency to all the activity time attributes and for more than one dependencies select the one which has greater value and repeat the same process.

Step5: Return the count value for all the activities.

Step6: The criticality index for an activity Aii scalculated as CI=total no.of iterations–count value

Total no.of iterations.

Step7: Repeat the process for all the activities in the project.

ALGORITHM1: Risk optimization of the algorithm

Input: In a project, each activity Ai, the 3 time of a attributes optimistic‘ai’,most likely‘bi’ and pessimistic‘ci’ will give as the dependencies, the inputs, and number of iterations.

Step 1: For all the activities in the project, the a,mandbattri but esare passed to the triangular distributed random variant function defined for the random variable ‘R’

d) If R=m-a/b-a then return m;

e) If R<m-a/b-a then return a + √ R*(b-a)*(m-a)

f) If R>m-a/b-a then return b- √ (1-R)*(b-a)*(b-m)

Step 2 : The minimum activity time mini from the triangular function is found.

Step 3 : With the seactivity times for each activity, finish time, the earliest and latest start is calculated.

Step 4 : Slack or float values are calculated to find the critical activities.

Step 5 : Completion time Te inform of critical path length is obtained.

Step 6 : The completion time probability is calculated through z-score formula.$Z=Td-TeSD$

Here, SD is the standard deviation and Td is the deadline.

Step 7 : Calculate the risk percentage.

Step 8 : Repeat steps 1-5 for the different simulation runs for the defined knoo fiterations.

IV. Analysis and Results

The results acquire were more reliable than the common method of PERT/CPM. The probability of obtaining the project to be completed on a definite expected date is enhanced, with this new approach which was calculated through the z-score and hence the risk for the project is minimized or decreased which was our essential objective. The initial model has been tested on five distinct project datasets and it’s taken from different project management based on research papers or websites for different the accuracy of the completion times and also reduces the schedule risk in the project. In this chapter we analysis about the results is done with all the factual examples with the previously described methods in research papers.

Project Data Set-1:

Inside the data set project is obtained for the network analysis, it’s based on case study document in all the PERT/CPM methodology is used for the complete knowledge of project.

Table 1: Project data set1

Activities	**Predecessor**	**Optimistic time**	**Most likely time**	**Pessimistic time**
A	-	3	6	12
B	-	1	2	4
C	A	1.5	3	6
D	B	1	2	4
E	C	2	4	8
F	D	0.5	1	2
G	E,F	0.5	1	2
H	G	3	6	12
I	H	1.5	3	6
J	H	0.5	1	2
K	I,J	0.5	1	2

Activity Criticality Index: The result of critical index is defined in the figure below that illustrates the criticality index of the activities are shown in the project dataset1.

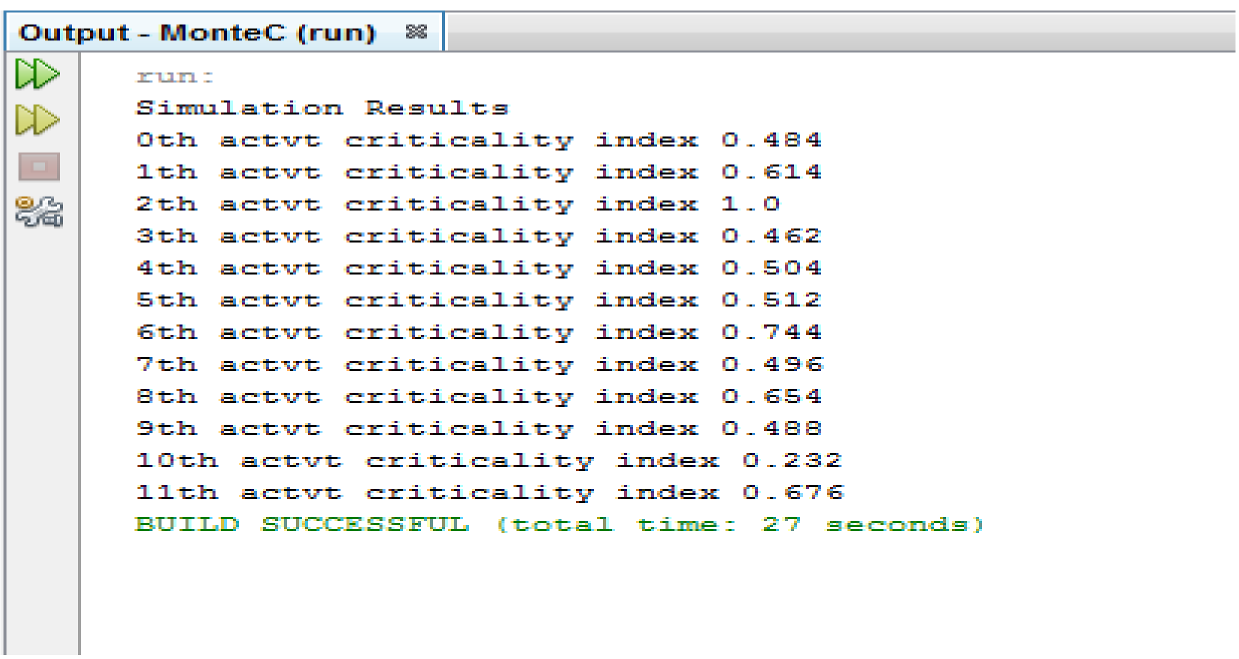


Figure 3 : 1st data set activity and criticality index

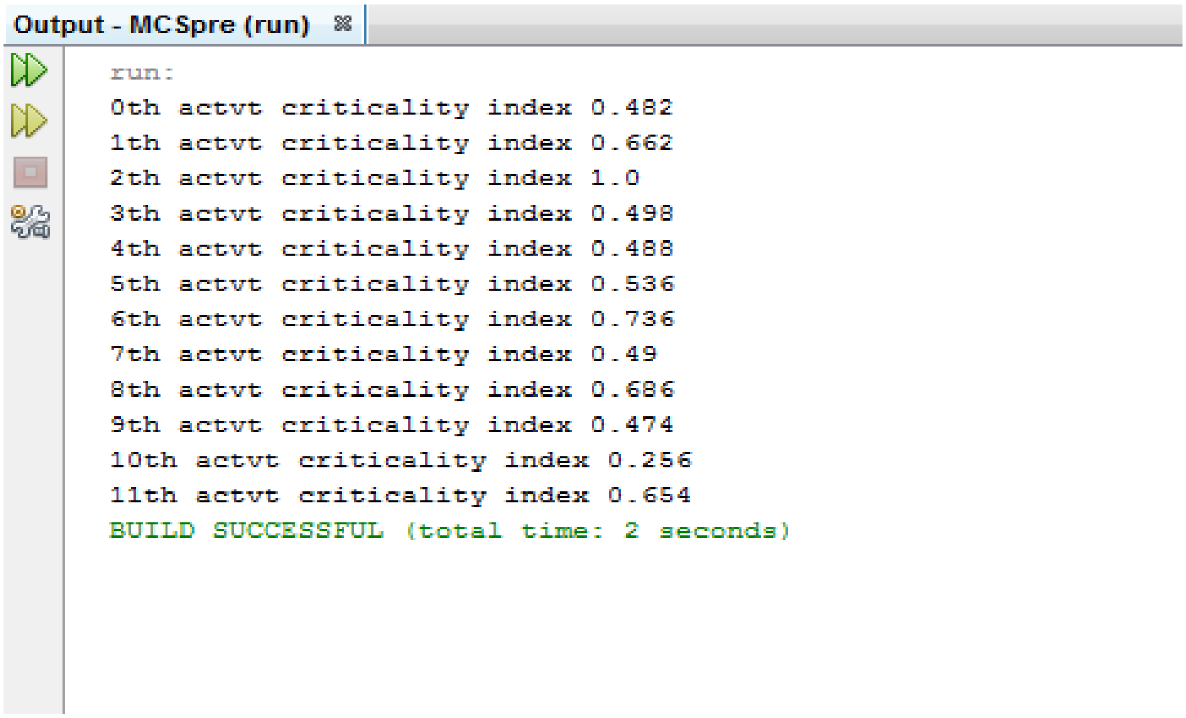


Figure 4: 1st data set Criticality Index with included precedence

Comparative Analysis:

From the above both of figure in dataset 1, we can decide the criticality indexes of the action in the project. But in our next figure the values shown are defined with the activities having their precedence's. After these two set of results, it can be included that the criticality indexes are increased for several activities of the project due to the concluded dependencies among the activities. In the next two activities, we can be notice the values increased from 0.46 to 0.49 and0.65to0.68.

4.1.2. Completion times: Here project manger are decided the deadlines of the project is 27weeks.

Table 2 : project data set-1

Method		Estimated Completion time	Critical path
Pert/CPM method		26 weeks	A-C-E-G-H-I-K
Proposed Method	1stSimulationrun	24.24weeks	A-E-G-H-I-K
	2ndSimulationrun	29.58weeks	A-C-E-G-H-I
	3rdSimulationrun	25.63weeks	A-G-H
	4thSimulationrun	23.82weeks	A-C-E-I-K
	5thSimulationrun	21.56weeks	A-E-G-H-I-K

Comparative Analysis:

The above table defined the completion times of the project explained through the original PERT/CPM approach and the time with the given proposed algorithm with many type of simulation runs. In which we observed that completion times acquire from the proposed algorithm are more reliable and for each and every simulation run the critical paths change for the project activities. Hence, we can b e seen along the above table that 26 week time is vary to24.24andmanyothervalues.

```
Critical path length (cost): 25.9999
Initial nodes: Start

Task      ES    EF    LS    LF    Slack Critical?

Start     0.0   0.0   0.0   0.0   0.0   Yes
A         0.0   6.5   0.0   6.5   0.0   Yes
B         0.0   2.1667 8.666600000000003 10.833300000000003 8.666600000000003 No
C         6.5   9.75  6.5   9.75  0.0   Yes
D         2.1667 4.3334 10.833300000000001 13.000000000000002 8.6666 No
E         9.75  14.083300000000001 9.75  14.083300000000001 0.0   Yes
F         4.3334 5.416700000000005 13.000000000000002 14.083300000000001 8.666600000000003 No
G         14.083300000000001 15.1666 14.083300000000001 15.1666 0.0   Yes
H         15.1666 21.666600000000003 15.1666 21.666600000000003 0.0   Yes
I         21.666600000000003 24.916600000000003 21.666600000000003 24.916600000000003 0.0   Yes
J         21.666600000000003 22.749900000000004 23.8333 24.916600000000003 2.1666999999999987 No
K         24.916600000000003 25.999900000000004 24.9166 25.9999 -3.552713678800501E-15 No
End       25.999900000000004 25.999900000000004 25.9999 25.9999 -3.552713678800501E-15 No
```

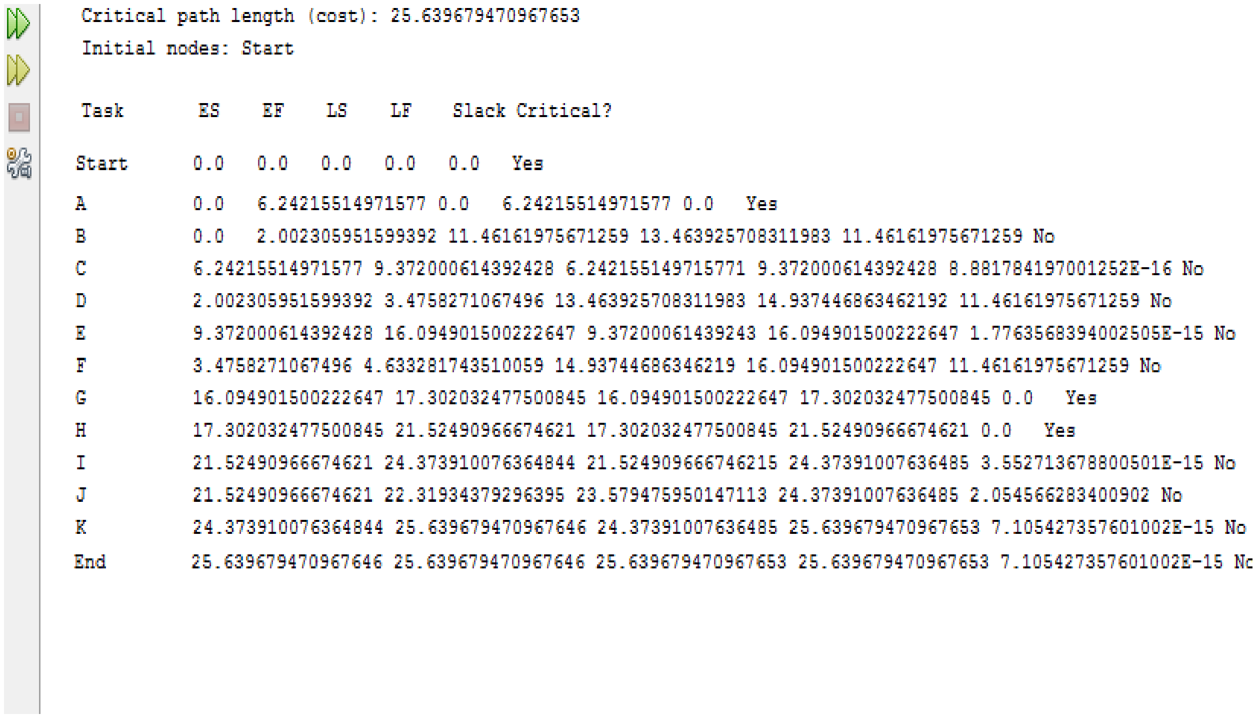
Figure 5 : PERT/CPM output for project dataset-1

```
Critical path length (cost): 24.244102262254266
Initial nodes: Start

Task      ES    EF    LS    LF    Slack Critical?

Start     0.0   0.0   0.0   0.0   0.0   Yes
A         0.0   6.703265658292149 0.0   6.703265658292149 0.0   Yes
B         0.0   2.504730372101683 7.85718200556024 10.361912377661923 7.85718200556024 No
C         6.703265658292149 10.571050774366789 6.70326565829215 10.571050774366789 8.881784197001252E-16 No
D         2.504730372101683 5.236420686901825 10.361912377661923 13.093602692462065 7.85718200556024 No
E         10.571050774366789 13.705743305250325 10.571050774366789 13.705743305250325 0.0   Yes
F         5.236420686901825 5.848561299690085 13.093602692462065 13.705743305250325 7.85718200556024 No
G         13.705743305250325 15.11394720811818 13.705743305250325 15.11394720811818 0.0   Yes
H         15.11394720811818 19.979011140044292 15.11394720811818 19.979011140044292 0.0   Yes
I         19.979011140044292 23.306970376503738 19.979011140044292 23.306970376503738 0.0   Yes
J         19.979011140044292 21.04791209441824 22.23806942212979 23.306970376503738 2.2590582820854976 No
K         23.306970376503738 24.244102262254266 23.306970376503738 24.244102262254266 0.0   Yes
End       24.244102262254266 24.244102262254266 24.244102262254266 24.244102262254266 0.0   Yes
```

Figure 5 : 1st simulation output for project data set-1



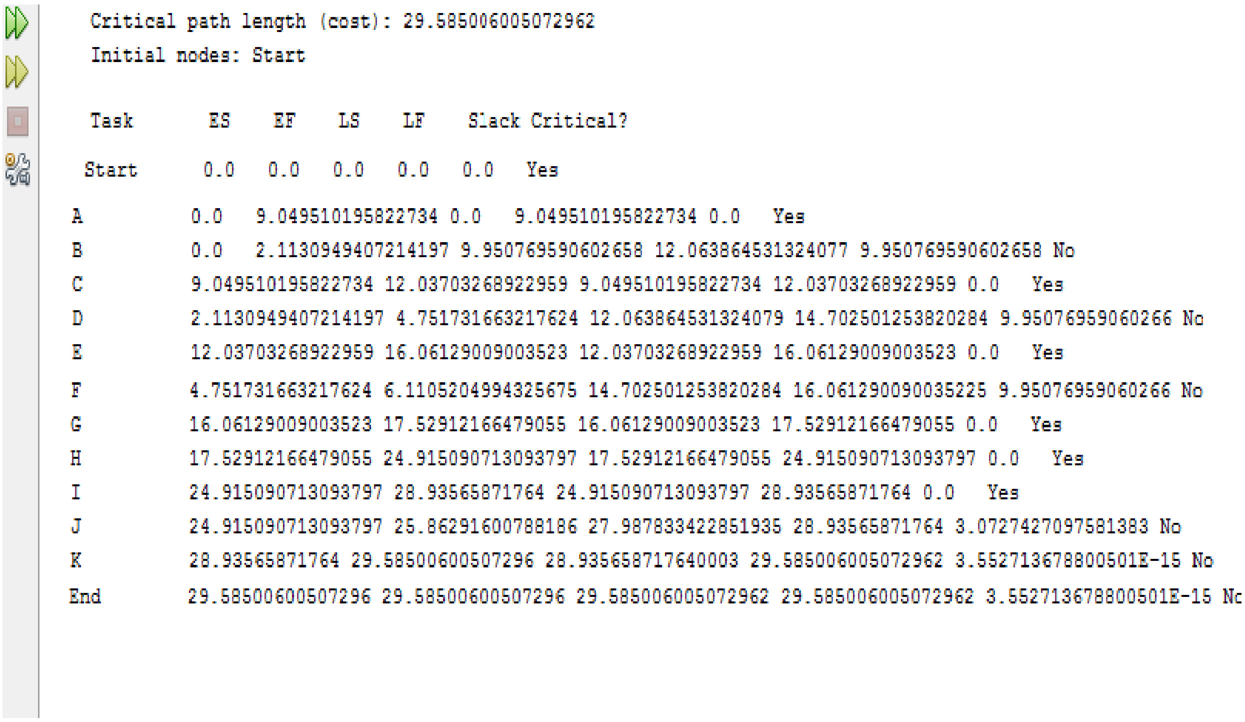
```
Critical path length (cost): 25.639679470967653
Initial nodes: Start

Task      ES    EF    LS    LF    Slack Critical?

Start     0.0   0.0   0.0   0.0   0.0   Yes

A         0.0   6.24215514971577 0.0   6.24215514971577 0.0   Yes
B         0.0   2.002305951599392 11.46161975671259 13.463925708311983 11.46161975671259 No
C         6.24215514971577 9.372000614392428 6.242155149715771 9.372000614392428 8.881784197001252E-16 No
D         2.002305951599392 3.4758271067496 13.463925708311983 14.937446863462192 11.46161975671259 No
E         9.372000614392428 16.094901500222647 9.37200061439243 16.094901500222647 1.7763568394002505E-15 No
F         3.4758271067496 4.633281743510059 14.93744686346219 16.094901500222647 11.46161975671259 No
G         16.094901500222647 17.302032477500845 16.094901500222647 17.302032477500845 0.0   Yes
H         17.302032477500845 21.52490966674621 17.302032477500845 21.52490966674621 0.0   Yes
I         21.52490966674621 24.373910076364844 21.524909666746215 24.37391007636485 3.552713678800501E-15 No
J         21.52490966674621 22.31934379296395 23.579475950147113 24.37391007636485 2.054566283400902 No
K         24.373910076364844 25.639679470967646 24.37391007636485 25.639679470967653 7.105427357601002E-15 No
End       25.639679470967646 25.639679470967646 25.639679470967653 25.639679470967653 7.105427357601002E-15 Nc
```

Figure 5.2 : 2nd simulation output for project dataset-1



```
Critical path length (cost): 29.585006005072962
Initial nodes: Start

Task      ES    EF    LS    LF    Slack Critical?

Start     0.0   0.0   0.0   0.0   0.0   Yes

A         0.0   9.049510195822734 0.0   9.049510195822734 0.0   Yes
B         0.0   2.1130949407214197 9.950769590602658 12.063864531324077 9.950769590602658 No
C         9.049510195822734 12.03703268922959 9.049510195822734 12.03703268922959 0.0   Yes
D         2.1130949407214197 4.751731663217624 12.063864531324079 14.702501253820284 9.95076959060266 No
E         12.03703268922959 16.06129009003523 12.03703268922959 16.06129009003523 0.0   Yes
F         4.751731663217624 6.1105204994325675 14.702501253820284 16.061290090035225 9.95076959060266 No
G         16.06129009003523 17.52912166479055 16.06129009003523 17.52912166479055 0.0   Yes
H         17.52912166479055 24.915090713093797 17.52912166479055 24.915090713093797 0.0   Yes
I         24.915090713093797 28.93565871764 24.915090713093797 28.93565871764 0.0   Yes
J         24.915090713093797 25.86291600788186 27.987833422851935 28.93565871764 3.0727427097581383 No
K         28.93565871764 29.58500600507296 28.935658717640003 29.585006005072962 3.552713678800501E-15 No
End       29.58500600507296 29.58500600507296 29.585006005072962 29.585006005072962 3.552713678800501E-15 Nc
```

Figure 5.3 : 3rd simulation output for project dataset-1

Critical path length (cost): 21.564472516143155
Initial nodes: Start

Task	ES	EF	LS	LF	Slack	Critical?
Start	0.0	0.0	0.0	0.0	0.0	Yes
A	0.0	4.143363492469435	0.0	4.143363492469435	0.0	Yes
B	0.0	2.3588430803067935	4.3940428404595835	6.752885920766377	4.3940428404595835	No
C	4.143363492469435	7.3110087861228	4.143363492469433	7.311008786122798	-1.7763568394002505E-15	No
D	2.3588430803067935	4.618095422569644	6.752885920766376	9.012138263029227	4.394042840459583	No
E	7.3110087861228	10.205727177619385	7.3110087861228	10.205727177619385	0.0	Yes
F	4.618095422569644	5.811684337159802	9.012138263029227	10.205727177619385	4.3940428404595835	No
G	10.205727177619385	10.917172723693627	10.205727177619385	10.917172723693627	0.0	Yes
H	10.917172723693627	17.677153763379696	10.917172723693627	17.677153763379696	0.0	Yes
I	17.677153763379696	20.575684326213896	17.677153763379696	20.575684326213896	0.0	Yes
J	17.677153763379696	19.488400997242266	18.764437092351322	20.575684326213892	1.0872833289716262	No
K	20.575684326213896	21.564472516143155	20.575684326213896	21.564472516143155	0.0	Yes
End	21.564472516143155	21.564472516143155	21.564472516143155	21.564472516143155	0.0	Yes

Figure 5.4.:4th simulation output for project dataset-1

Critical path length (cost): 23.82212522447359
Initial nodes: Start

Task	ES	EF	LS	LF	Slack	Critical?
Start	0.0	0.0	0.0	0.0	0.0	Yes
A	0.0	5.70876225147407	0.0	5.70876225147407	0.0	Yes
B	0.0	2.023737108877385	5.839098637832894	7.862835746710279	5.839098637832894	No
C	5.70876225147407	8.083874132050315	5.70876225147407	8.083874132050315	0.0	Yes
D	2.023737108877385	4.776875498144942	7.86283574671028	10.615974135977837	5.839098637832895	No
E	8.083874132050315	11.700762802261707	8.083874132050315	11.700762802261707	0.0	Yes
F	4.776875498144942	5.86166416442881	10.615974135977837	11.700762802261705	5.839098637832895	No
G	11.700762802261707	12.636811615783696	11.700762802261705	12.636811615783694	-1.7763568394002505E-15	No
H	12.636811615783696	19.356878762059644	12.636811615783694	19.356878762059644	-1.7763568394002505E-15	No
I	19.356878762059644	22.844998039684565	19.356878762059644	22.844998039684565	0.0	Yes
J	19.356878762059644	20.696401580244764	21.505475221499445	22.844998039684565	2.1485964594398013	No
K	22.844998039684565	23.82212522447359	22.844998039684565	23.82212522447359	0.0	Yes
End	23.82212522447359	23.82212522447359	23.82212522447359	23.82212522447359	0.0	Yes

Figure5.5.: 5th simulation output for project dataset-1

Table 3: Risk percentage of dataset 1

Method		Z-score	Probability	Percentage	Risk
Pert/CPMmethod		0.16	0.5668	56.68%	43.32%
Proposed Method	**1stSimulation run**	0.5257	0.7004	70.04%	29.96%
	2ndSimulation run	0.4486	0.6741	67.41%	32.59%
	3rdSimulation run	0.4215	0.6631	63.31%	36.69%
	4thSimulation run	0.7482	.7728	77.28%	22.72%
	5thSimulation run	1.0361	0.8499	84.99%	15.01%

Comparative Analysis:

We found the results shown in the above table defined the probability and the output of schedule risk for the project dataset1. It can be simply determined that the completion time and accuracy is refining with the proposed technique in comparison of regular PERT/CPM method. With the early method the probability value attained is 0.56 and with this technique, it is enhance to 0.67and the risk value is optimized similarly to 43.32 per to 32.59 per. Hence, it is proved that the describe algorithm provides more exact results in comparison of last one. All the results are produces in java on net beans.

V. Conclusion and Future Work

We found that PERT/CPM method is widely used in project scheduling for a better project. The project scheduling is of the major step of the project management procedure. Different type of project management methods are currently being used by many industries and organizations. We have executed a small survey on this topic and establish that it has been used with several methodologies which perform effectively under certain circumstances. We evaluate that this technique has its main restriction that is underestimation or above estimation of completion times of the project in project management.

This paper present a new improved method and its uses the concept of Monte Carlo simulation with triangular distribution to discover throughout the activity time attributes of the project. Here we proposed the algorithm results to the expand rate of probability of the project. The project is completed under the certain defined deadline.

In future work may include increasing the proposed algorithm or a new approach with some different modifications for the better results. The resource limitation can also be included in the analysis to improve the performance of the method.

After the experimentation results have proven that the initiate method illustrates them or accurate values of the completion times for the better project which lead to the increased prospects for the predefined deadlines of the projects that are given by project manager. We also discover that risk in project is reduced with this new method and this was the main objective of this research work. Hence, the proposed approach gives the improving the results comparison between the PERT/CPM approach.

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