LAB Manual

PART A

(PART A : TO BE REFERRED BY STUDENTS)

Experiment No.06

A.1 Aim:

To determine the schedule of the project using PERT/CPM

A.2 Prerequisite:

- Clearly defined activities/processes
- Activities/processes that run concurrently
- Activities/processes that precede it
- Activities/processes that follow it

A.3 Outcome:

After successful completion of this experiment students will be able to:

1. Estimate the schedule of the project
2. Estimate the critical path of the project

A.4 Theory:

- PERT (Program Evaluation & Review Technique) is a management technique used with responsibility accounting and to attain well defined objectives. It is designed for scheduling complex interrelated tasks of the projects.
- PERT System of Three Time Estimate
    - Optimistic Time
    - Most likely Time (tm)
    - Pessimistic Time (tp)
- CPM (Critical Path Method) is used to schedule and control the project.
- It is used to estimate the total project duration and to assign starting and finishing times to all activities involved in the project.
- CPM Systems

- Activity-On-Arrow (AOA) Network
- Activity-On-Node (AON) Network

A.5 Procedure/Algorithm:

Algorithm for PERT :

1. Develop a list of activities that made up the project including immediate predecessors.
2. For each activity, a rough PERT network is drawn on the basis of which activity precedes, which activity follows which one, which activity are concurrent with which one.
3. The network is sketched to conform to rules and conventions.
4. Events are numbered in ascending order from left to right.
5. Time estimates (Optimistic Estimate, Most Likely Estimate, Pessimistic Estimate)for each activity are obtained.
6. Then upon the assumption of beta distribution for the activity duration, the expected time te for each activity is computed using te = 1(1+4m+b)/6.
7. Using the expected activity time estimates, determine the earliest start time and the earliest finish time for each activity, the earliest finish time for the complete project corresponds to the earliest finish time for the last activity.
8. After determining the latest start time and the latest finish time for each activity, compute the float associated with each activity, the critical path activities are the activities with zero float. Determine now the critical path through the given network.
9. Using the values for b and a, which were determined in step 5. calculate the variance (σ^2) of each activities time estimated by $\sigma^2 = [(b-a)/6]^2$.
10. Use the variability in the activity times to estimate the variability of the project completion date, then using this estimate compute the probability of meeting a specified completion date by using the standard normal equation
11. Z = Due date – Expected date of completion

Algorithm for CPM:

1. Break down the project into various activities systematically. Label all activities. Arrange all the activities in logical sequence. Construct the network diagram.
2. Number all the nodes (events) and activities. Find the time for each activity considering it to be deterministic. Indicate the activity times on the arrow diagram.
3. Calculate earliest start time, earliest finish time, latest start time and latest finish time. Tabulate activity normal times, earliest times and latest times.
4. Determine the total float for each activity by taking difference between the earliest time and latest time for each node.
5. Identify the critical activities and connect them with the beginning node and the ending node in the network diagram by double line arrow. This gives the critical path.
6. Calculates the total project duration.
7. Reduce the total project duration, crash the critical activities of the network.
8. Optimize the cost.
9. Update the network and smooth the network resource.

PART B

(PART B : TO BE COMPLETED BY STUDENTS)

(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the Blackboard or emailed to the concerned lab in charge faculties at the end of the practical in case there is no Black board access available)

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Date of Experiment: 20-02-2023	Date of Submission 20-02-2023
Grade :	

B.1 Answers of Task to be written by student:

(Paste your answers completed during the 2 hours of practical in the lab here)

Let's assume that our project involves the following tasks:

Task 1: Conduct Market Research

Task 2: Develop Product Design

Task 3: Prototype Development

Task 4: Testing and Quality Assurance

Task 5: Marketing and Promotion

Task 6: Launch

The dependencies between these tasks are as follows:

- Task 1 must be completed before Task 2 can begin
- Task 2 must be completed before Task 3 can begin
- Task 3 must be completed before Task 4 can begin
- Task 4 must be completed before Task 5 can begin
- Task 5 must be completed before Task 6 can begin

Now, let's estimate the optimistic (O), most likely (M), and pessimistic (P) completion times for each task:

Task 1: Conduct Market Research

- O = 4 weeks
- M = 6 weeks
- P = 8 weeks

Task 2: Develop Product Design

- O = 5 weeks
- M = 7 weeks
- P = 9 weeks

Task 3: Prototype Development

- O = 7 weeks
- M = 10 weeks
- P = 13 weeks

Task 4: Testing and Quality Assurance

- O = 4 weeks
- M = 5 weeks
- P = 6 weeks

Task 5: Marketing and Promotion

- O = 6 weeks
- M = 8 weeks
- P = 10 weeks

Task 6: Launch

- O = 1 week
- M = 2 weeks
- P = 3 weeks

Using these estimates, we can calculate the expected **completion time (TE), variance (V), and standard deviation (SD)** for each task:

Task 1: Conduct Market Research

- TE = (4 + 6 + 8) / 3 = 6 weeks
- V = [(8 - 4) / 6]^2 = 0.44
- SD = √0.44 = 0.66 weeks

Task 2: Develop Product Design

- TE = (5 + 7 + 9) / 3 = 7 weeks
- V = [(9 - 5) / 6]^2 = 0.44
- SD = √0.44 = 0.66 weeks

Task 3: Prototype Development

- TE = (7 + 10 + 13) / 3 = 10 weeks
- V = [(13 - 7) / 6]^2 = 1.44
- SD = √1.44 = 1.20 weeks

Task 4: Testing and Quality Assurance

- TE = (4 + 5 + 6) / 3 = 5 weeks
- V = [(6 - 4) / 6]^2 = 0.11
- SD = √0.11 = 0.33 weeks

Task 5: Marketing and Promotion

- TE = (6 + 8 + 10) / 3 = 8 weeks
- V = [(10 - 6) / 6]^2 = 0.44
- SD = √0.44 = 0.66 weeks

Task 6: Launch

- TE = (1 + 2 + 3) / 3 = 2 weeks
- V = [(3 + 1) / 6]^2 = 0.11
- SD = √0.11 = 0.33

Now, we can use this information to calculate the PERT and CPM for the project.

PERT Calculation:

To calculate the expected completion time for the entire project using PERT, we simply sum up the expected completion times for each task:

TE Project = TE Task 1 + TE Task 2 + TE Task 3 + TE Task 4 + TE Task 5 + TE Task 6 TE Project = 6 + 7 + 10 + 5 + 8 + 2 TE Project = 38 weeks

CPM Calculation:

To calculate the critical path for the project using CPM, we first need to calculate the **earliest start time (EST), earliest finish time (EFT), latest start time (LST), and latest finish time (LFT)** for each task:

Task 1: Conduct Market Research

- EST = 0 weeks
- EFT = 6 weeks
- LST = 0 weeks
- LFT = 6 weeks

Task 2: Develop Product Design

- EST = 6 weeks
- EFT = 13 weeks
- LST = 7 weeks
- LFT = 14 weeks

Task 3: Prototype Development

- EST = 13 weeks
- EFT = 23 weeks
- LST = 15 weeks
- LFT = 25 weeks

Task 4: Testing and Quality Assurance

- EST = 23 weeks
- EFT = 28 weeks

- LST = 23 weeks
- LFT = 28 weeks

Task 5: Marketing and Promotion

- EST = 28 weeks
- EFT = 36 weeks
- LST = 29 weeks
- LFT = 37 weeks

Task 6: Launch

- EST = 36 weeks
- EFT = 38 weeks
- LST = 37 weeks
- LFT = 39 weeks

Using these values, we can calculate the **slack time (ST)** for each task:

Task 1: Conduct Market Research

- ST = LFT - EFT = 0 weeks

Task 2: Develop Product Design

- ST = LFT - EFT = 1 week

Task 3: Prototype Development

- ST = LFT - EFT = 2 weeks

Task 4: Testing and Quality Assurance

- ST = LFT - EFT = 0 weeks

Task 5: Marketing and Promotion

- ST = LFT - EFT = 1 week

Task 6: Launch

- ST = LFT - EFT = 1 week

The critical path is the path that includes all tasks with zero slack time. In this case, the critical path is:

Task 1 -> Task 2 -> Task 3 -> Task 5 -> Task 6

The expected completion time for the project using CPM is equal to the sum of the expected completion times for the tasks on the critical path:

TE Project = TE Task 1 + TE Task 2 + TE Task 3 + TE Task 5 + TE Task 6 TE Project = 6 + 7 + 10 + 8 + 2 TE Project = 33 weeks

B.2 Observations and learning:

(Students are expected to comment on the output obtained with clear observations and learning for each task/ sub part assigned)

Observation:

- The PERT and CPM methods provide different perspectives on the project timeline.
- The PERT method provides an estimated completion time for the entire project, whereas the CPM method identifies the critical path and the expected completion time based on the tasks on the critical path.
- In this particular project, the expected completion time using PERT is 38 weeks, while the expected completion time using CPM is 33 weeks.

Learning:

- It is important to use multiple project management tools and techniques to ensure accurate planning and scheduling of a project.
- PERT and CPM are two commonly used techniques in project management that can provide valuable insights into the project timeline.
- PERT is useful for estimating the expected completion time for the entire project, while CPM is useful for identifying the critical path and determining the expected completion time based on the tasks on the critical path.
- By using both PERT and CPM, project managers can have a better understanding of the project timeline and make informed decisions to optimize the project schedule.

B.3 Conclusion:

(Students must write the conclusion as per the attainment of individual outcome listed above and learning/observation noted in section B.3)

In conclusion, the project feasibility report has shown that the proposed project is technically feasible, economically feasible, and strategically aligned with the business. Additionally, using both PERT and CPM techniques, we have gained valuable insights into the project timeline and identified the critical path. It is recommended that the project moves forward with the proposed timeline and budget, with appropriate project management tools and techniques to ensure successful completion. By carefully planning and executing the project, the company can achieve its objectives and gain a competitive advantage in the market.