PERT CPM EXAMPLE PROBLEMS WITH SOLUTION

PERT CPM Example Problems with Solution: Mastering Project Management Techniques

Are you grappling with project scheduling and struggling to understand PERT and CPM techniques? Do complex networks of tasks leave you feeling overwhelmed? Fear not! This comprehensive guide dives deep into PERT (Program Evaluation and Review Technique) and CPM (Critical Path Method) with practical examples and detailed solutions. We'll break down the concepts, demystify the calculations, and equip you with the skills to tackle any project scheduling challenge. By the end, you'll be confidently applying PERT and CPM to optimize your projects and meet deadlines effectively.

Understanding PERT and CPM: A Quick Refresher

Before we jump into the examples, let's quickly recap the core principles of PERT and CPM. Both are project management techniques used to plan, schedule, and control complex projects. They help determine the critical path – the sequence of tasks that directly impacts the overall project duration. Any delay on the critical path directly delays the project completion.

PERT (Program Evaluation and Review Technique): This method emphasizes uncertainty in task durations. It uses three time estimates for each activity: optimistic (O), most likely (M), and pessimistic (P). These estimates are then used to calculate the expected time (te) and variance for each activity. The expected time helps determine the critical path, while the variance helps assess the project's risk.

CPM (Critical Path Method): This method assumes deterministic task durations – meaning, a single, known duration for each activity. It focuses on identifying the critical path and the total project duration. CPM is simpler than PERT when dealing with projects with less uncertainty.

PERT Example Problem 1: The Software Development Project

Let's consider a software development project with the following tasks and time estimates (in days):

Task	Description	Optimistic (O)	Most Likely (M)	Pessimistic (P)
A	Requirements Gathering	2	3	4
B	Design	3	4	5
C	Coding	7	10	13
D	Testing	4	5	6
E	Deployment	1	2	3

Dependencies:

B depends on A
C depends on B
D depends on C
E depends on D

Solution:

1. Calculate the expected time (te) for each task: te = (O + 4M + P) / 6

$t_e(A) = (2 + 43 + 4) / 6 = 3$
$t_e(B) = (3 + 44 + 5) / 6 = 4$
$t_e(C) = (7 + 410 + 13) / 6 = 10$
$t_e(D) = (4 + 45 + 6) / 6 = 5$
$t_e(E) = (1 + 42 + 3) / 6 = 2$

1. Calculate the variance (σ^2) for each task: $\sigma^2 = [(P - O) / 6]^2$

$\sigma^2(A) = [(4 - 2) / 6]^2 = 0.11$
$\sigma^2(B) = [(5 - 3) / 6]^2 = 0.11$
$\sigma^2(C) = [(13 - 7) / 6]^2 = 1$
$\sigma^2(D) = [(6 - 4) / 6]^2 = 0.11$
$\sigma^2(E) = [(3 - 1) / 6]^2 = 0.11$

1. Draw the network diagram: This visual representation shows the task dependencies.

1. Determine the critical path: The critical path is the longest path through the network, in this case, A-B-C-D-E (3 + 4 + 10 + 5 + 2 = 24 days).

1. Calculate the total project duration: The total project duration is the length of the critical path, which is 24 days.

CPM Example Problem 2: The Construction Project

Let's consider a simple construction project with the following tasks and durations (in days):

Task	Description	Duration
A	Foundation	5
B	Framing	7
C	Roofing	3
D	Electrical	4
E	Plumbing	5
F	Interior	6

Dependencies:

B depends on A
C depends on B
| D depends on B |
| E depends on B |
| F depends on C, D, E

Solution:

1. Draw the network diagram: Again, visualize the task dependencies.

1. Determine the critical path: By summing durations along each path, we find the critical path is A-B-F (5 + 7 + 6 = 18 days).

1. Calculate the total project duration: The total project duration is 18 days.

Advanced Considerations and Software Tools

While manual calculations are useful for understanding the concepts, real-world projects often involve hundreds of tasks and complex interdependencies. Project management software like Microsoft Project, Primavera P6, or even free online tools can significantly simplify the process. These tools automate calculations, generate visual project schedules (Gantt charts), and provide advanced features for resource allocation, risk management, and cost control.

Conclusion

Mastering PERT and CPM is essential for effective project management. By understanding how to calculate expected times, variances, and critical paths, you gain crucial insights into project timelines, risks, and resource allocation. Remember to leverage project management software for larger, more complex projects. The examples above provide a solid foundation; practice with different scenarios to build your proficiency.

FAQs

1. What's the difference between Early Start and Late Start times in PERT/CPM? Early Start is the earliest possible start time for a task, while Late Start is the latest possible start time without delaying the project.

1. How do I handle uncertainty in resource availability in PERT/CPM? Resource leveling techniques can help optimize resource allocation to mitigate conflicts and delays caused by resource constraints.

1. Can PERT/CPM be used for projects with iterative development? While traditionally designed for sequential projects, adaptations of PERT/CPM can be used in agile environments by focusing on critical path iterations.

1. What are some common pitfalls to avoid when using PERT/CPM? Inaccurate time estimations, neglecting dependencies, and insufficient communication are common pitfalls.

1. How can I improve the accuracy of my time estimates in PERT/CPM? Involve experienced team members in the estimation process, use historical data, and incorporate contingency buffers for unexpected delays.

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