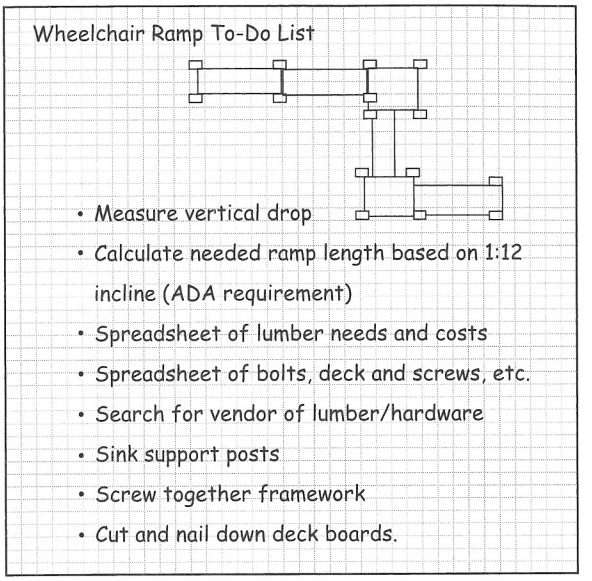

Figure 3.5
Checklist for the design of a wheelchair ramp.

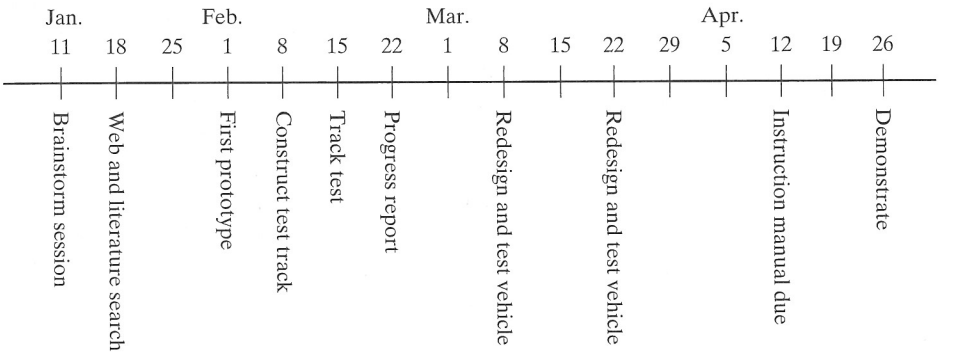

Figure 3.6
Timeline for tasks pertaining to a vehicle design competition.

3.2.3 Gantt Chart

When a project involves parallel tasks and many people, a simple timeline may be inadequate for managing the project. Similarly, if the project's various tasks are interdependent, wherein the completion of one task depends on the success of several others, the **Gantt Chart** of Figure 3.7 may be a more appropriate time-management tool. The Gantt chart is simply a two-dimensional plot in which the horizontal axis reflects time measured in days, weeks, or months, and the vertical axis represents either the tasks to be completed or the individuals responsible for those tasks. Unlike the checklist, which simply enumerates the tasks to be completed, and the one-dimensional timeline, which merely displays sequential time allocations for each phase of the project, the Gantt chart shows how much time is allotted to multiple tasks performed in parallel. It also provides for overlapping time periods that help indicate the interdependency between the various aspects of the project. The Gantt chart is a working document. When a particular task has been completed, it can be shaded in, so that the status of the project can be determined at a glance. Figure 3.7 shows a Gantt chart version of the timeline tasks of Figure 3.6.

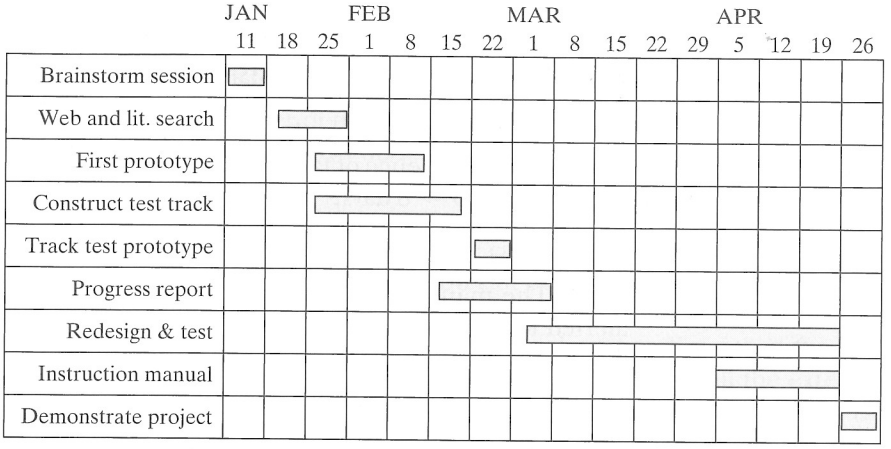

Figure 3.7
A Gantt chart provides a more comprehensive, two-dimensional method of scheduling the tasks shown in Figure 3.6.

3.2.4 PERT Chart

The project evaluation and review technique (PERT) was first proposed by the United States Navy and developed by the consulting firm of Booz, Allen, and Hamilton in 1958. Its purpose at the time was to coordinate the activities of over 10,000 separate subcontractors involved in the Polaris missile development program. The PERT concept resembles *critical path method (CPM)*, and these terms are essentially interchangeable. The PERT technique is fundamentally a method for prioritizing and scheduling complex, interrelated activities. The PERT chart helps to identify the most time-critical events in the design process.

The essence of the technique is embodied in a graphical network called the **PERT chart**, depicted as an example in generic form in Figure 3.8. The PERT chart consists of numbered milestone circles, called *nodes*, and pathway branches that interconnect the nodes. Each branch is labeled by a time interval that indicates the amount of time allocated to the completion of the task between its two nodes. Branches are labeled in appropriate time units (e.g., days, weeks, or months). Like the Gantt chart, the PERT chart summarizes the time allocated for each task and also notes task completion milestones. Unlike the Gantt chart, however, the PERT chart also shows the way in which the tasks and their time allotments depend on one another. This interdependency is indicated by the branch lines that connect the task-completion circles of the chart.

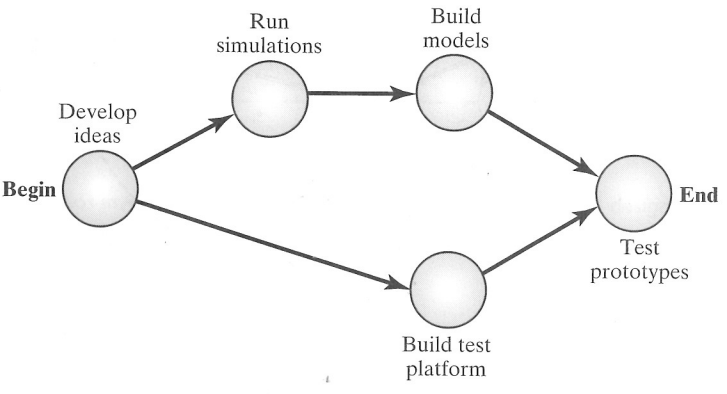

Figure 3.8
The generic form of a PERT chart. The circles represent milestone points, and each arrow represents a task leading up to a node. Each task is allocated a completion time.

A PERT chart must have a starting node and a single ending milestone node (the last node to which all pathways must lead, e.g., the completion of the project). As in the Gantt chart, time progresses from left to right. The time allocated for the pathway between any two nodes (not necessarily adjacent ones) will be equal to the sum of the series of branches that interconnect the nodes. In Figure 3.9, for example, the sequence of tasks leading from milestone A to milestone C is allocated a total of 3 + 5 = 8 days.

Like the Gantt chart, the PERT chart is a working document. As each task depicted on a PERT chart is completed, the project manager checks it off on the chart. The manager can thus monitor the progress of an entire project and be alerted to any possible path delays. Some project managers prefer the PERT chart over the Gantt chart because it clearly illustrates task dependencies. A PERT chart, however, can be much more difficult to interpret, especially on complex projects. Some project managers may choose to use both techniques.

When compiling a PERT chart for project management, it's possible (and often preferable) for the sum of branch times over one pathway to be less than the sum of times over another parallel pathway. The excess in the shorter path, called *slack time*, can be used to compensate for any unforeseen delays in the shorter pathway that occur during the design process. If the delay experienced along a particular pathway does not exceed its slack time, the overall progress of the project via all parallel pathways will still be on track. Of most interest, therefore, are so-called *critical pathways*, which have zero slack time. Any delays in the sequential branches of a critical pathway can jeopardize the time flow of the entire project. They should thus be monitored carefully as the project progresses. The pathway from node **A** to node **E** (via node **D**) in Figure 3.9, for example, is a critical pathway, because it requires 4 + 8 = 12 days, while the path **A-B-C-E** requires only 3 + 5 + 2 = 10 days; this latter pathway thus has 2 days of slack time.

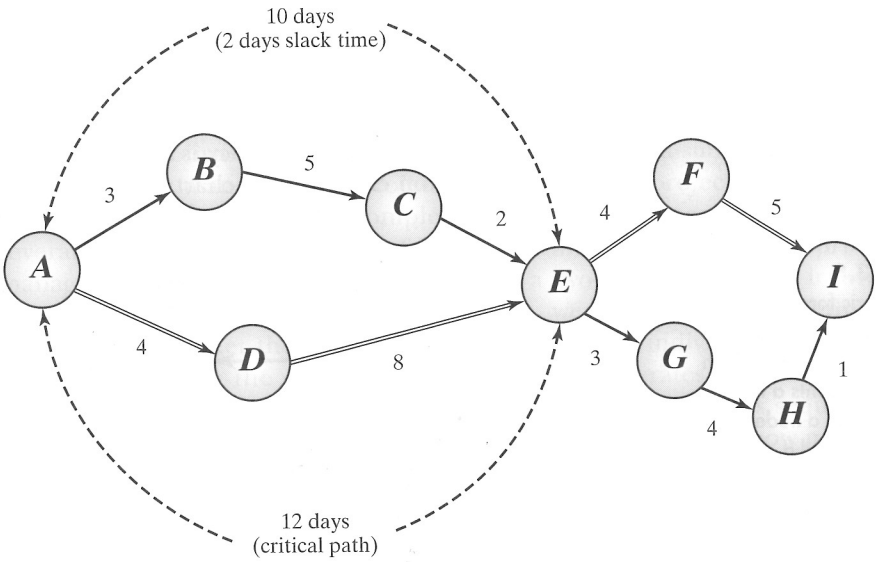

Figure 3.9
A PERT chart showing milestone nodes and task time allocations in days. On this chart, critical pathways are shown as double lines.