

# Foundations of Project Management — Complete Course Study Guide

---

**Robert Caldwell · Six recorded sessions · August 24–September 14, 2026 Version 1.2 · Lectures + Foundations workbook v8.1 + supplied module reviews · Updated October 5, 2026**

This guide consolidates the teaching across all six supplied Foundations sessions. Repeated explanations are merged into one account, with recording timestamps and segment references for checking the source. It includes the course's definitions, comparisons, calculations, examples, and instructor emphasis. Introductions, registration, breaks, credential eligibility, and unrelated conversation are omitted. Student suggestions are used only when Caldwell endorses or explains them.

**Scope:** the six Foundations lectures plus the supplied *Foundations of Project Management*, version 8.1, including its explanatory text, embedded slides, glossary, sample solutions, and study checklist, and the two supplied module reviews. Workbook additions and differences are identified. The supplied *Project Finance & Control*, version 8.0, has its own study package; its later-course teaching is not blended into Foundations. This remains a course study guide, not a verified current certification syllabus.

**Page key:** workbook citations give both the number printed on the page and its position in the PDF viewer. For the Foundations body and appendices, **PDF page = printed page + 6**. For example, printed p.136 is PDF page 142. References to the separate PMBOK book are not page references into this workbook. Instructor claims about exam questions remain guidance, not guarantees.

**How to use it:** read the explanations first, reproduce the calculations without looking at the answers, then use the quick review sheet. A citation such as “Aug 31 · segments 119–121” refers to the normalized transcript numbering supplied in the ZIP; the timestamp lets you find the same material in the recording. Timestamps are recording-relative, not wall-clock time.

---

## Contents

1. [The project management framework](#)
2. [Organizations, authority, and PMOs](#)
3. [Success, constraints, and competencies](#)
4. [Initiation: business need, charter, and priorities](#)
5. [Team, stakeholders, communication, and kickoff](#)
6. [Scope planning and the WBS](#)
7. [Assigning responsibility: RAM and RACI](#)
8. [Estimating effort, duration, and uncertainty](#)
9. [Dependencies, leads, and lags](#)

10. [Critical path, early/late dates, and float](#)
11. [Gantt charts and schedule compression](#)
12. [Resource loading and leveling](#)
13. [Cost estimating, budgets, and the S-curve](#)
14. [Risk analysis and response planning](#)
15. [Execution and team development](#)
16. [Reporting, monitoring, and controlling](#)
17. [Change control](#)
18. [Closing and lessons learned](#)
19. [Instructor emphasis: study priorities](#)
20. [Practice questions and answer key](#)

---

# 1. The project management framework

**Workbook lookup:** (*Workbook v8.1, printed pp. 9–11 [PDF 15–17]; 19–25 [PDF 25–31]; 28–33 [PDF 34–39]; 47–51 [PDF 53–57]; 211 [PDF 217]*)

## Projects, operations, and programs

The workbook's definition of a **project** is "A temporary initiative in a unique context undertaken to create value." Caldwell's spoken explanation emphasizes temporary, unique work creating a product, service, or result. Learn the workbook wording and the lecture's explanation together: the output is how the initiative delivers value, rather than the only test of success. (*Workbook v8.1, printed pp. 10 [PDF 16]; 28 [PDF 34]; 211 [PDF 217]*)

Temporary means it has an endpoint; similar projects may still differ in circumstances, budget, resources, or requirements. A process-improvement effort can be a project even when it produces no physical object.

**Operations** are continuing, routine work. Producing the same item repeatedly on a manufacturing line illustrates operations; developing or changing how that line works can be a project. (*Aug 24 · 01:23:51 · segments 243–263*)

**Project management** involves planning, scheduling, and controlling activities to meet objectives. Planning considers what work is needed and the time, money, and resources needed to do it. **Execution** puts that plan into action. Someone can perform project management in a hybrid job without formally holding the title "project manager." (*Aug 24 · 01:18:14 · segments 227–228; 01:29:32 · segments 263–270*)

A **program** coordinates related projects, subsidiary programs, or activities to obtain benefits that would not be available from managing each individually. Caldwell's department/division analogy is an illustration of coordination; simply grouping unrelated work in one department does not supply the defining benefit. (*Aug 24 · 01:55:55 · segments 313–315*)

The workbook glossary describes **project management** as applying knowledge, skills, tools, and techniques to project activities to meet or exceed the intended value. The planning/scheduling/controlling definition used in class is attributed to James P. Lewis in the workbook; it is a complementary teaching definition, not the glossary's exact wording. (*Workbook v8.1, printed pp. 10 [PDF 16]; 29 [PDF 35]; 211 [PDF 217]*)

## The five focus areas used in the course

| Area                       | Main question                                            | Typical course output or activity                              |
|----------------------------|----------------------------------------------------------|----------------------------------------------------------------|
| Initiating                 | Why should we do this, and who authorizes it?            | Business need, charter, sponsor authorization                  |
| Planning                   | What will we do, how, with whom, when, and for how much? | Scope/WBS, RAM, schedule, budget, communication and risk plans |
| Executing                  | Are we doing the planned work?                           | Coordinate people/resources and accomplish deliverables        |
| Monitoring and controlling | How are we performing, and what needs correction?        | Collect data, compare with the plan, analyze, act              |
| Closing                    | Is delivery and administrative wrap-up complete?         | Final actuals/reports, documentation, archive, lessons learned |

Executing and monitoring/controlling operate together. Caldwell also says control can occur during planning and closing. His description of initiation as “pre-project” means before authorization and detailed planning in his walkthrough. The workbook formally includes initiating among the focus areas and describes it as obtaining authorization to start a project **or a new phase of an existing project**. (*Workbook v8.1, printed pp. 23 [PDF 29]; 55 [PDF 61]; 64 [PDF 70]*) (*Aug 26 · 00:34:44 · segments 64–66; 01:20:12 · segments 227–229*) (*Sep 14 · 01:57:49 · segments 231–257; 02:35:04 · segments 337–338; 02:48:27 · segments 376–383*)

**Learning-target distinction:** a project life cycle covers the project's phases through closure; a product/system may continue in operations after the delivery project closes and can be changed by later projects. This study explanation connects the workbook's stated learning target to its project/operations and value-delivery model; it does not prescribe one universal product life-cycle stage list. (*Workbook v8.1, printed pp. 2 [PDF 8]; 19 [PDF 25]; 25 [PDF 31]*)

## Predictive, Agile, and hybrid

| Approach                             | Course description                                                   | Selection clue                                                     |
|--------------------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------|
| Predictive / traditional / waterfall | More planning up front, followed by execution, review, and closure   | Scope and deliverables are relatively clear in advance             |
| Agile                                | Short cycles of planning and work, customer feedback, and refinement | Product scope or deliverables need clarification through iteration |
| Hybrid                               | A combination of predictive and Agile elements                       | Different parts of the work benefit from different approaches      |

Caldwell contrasts a relatively predictable building project with software whose shape is still being clarified. Use the uncertainty and feedback requirements in the scenario rather than assuming every project in one industry must use the same approach. (*Aug 24 · 03:15:50 · segments 573–582*)

The workbook explains **progressive elaboration** as refining the plan and product characteristics as information improves. **Rolling wave / planning horizon** means planning the near phase in detail while later phases remain broadly defined. Caldwell illustrates it with iterative plan–execute–review cycles and links it to Agile; the workbook's definition does not make rolling wave planning synonymous with Agile. (*Workbook v8.1, printed pp. 75–76 [PDF 81–82]; 84 [PDF 90]*) (*Aug 26 · 03:13:06 · segments 533–536*)

## PMBOK as a reference

Caldwell describes the PMBOK Guide as a collection of practices, processes, approaches, tools, and techniques, rather than one prescribed methodology. The course resources are his recommended primary study materials; PMBOK is a supporting reference. (*Aug 24 · 01:12:45 · segments 215–221; 00:44:40 · segments 140–143*) (*Aug 26 · 00:31:06 · segments 58–63; 00:42:13 · segments 111*)

The supplied workbook explicitly presents seven performance domains and six delivery principles as its PMBOK Eighth Edition framework. Its process list contains **40 entries** (9 + 6 + 3 + 4 + 7 + 5 + 6). This verifies what the workbook teaches; the separately published PMBOK and a current certification outline have not been independently checked. Caldwell's Guide page 9 and Standard pages 35–55 references remain references to a different book, whose sections restart numbering. (*Workbook v8.1, printed pp. 20–24 [PDF 26–30]; 49–50 [PDF 55–56]*)

| Domain       | Course organizing purpose                                                                  | Processes listed |
|--------------|--------------------------------------------------------------------------------------------|------------------|
| Governance   | Integrate decisions/plans, align value, direct work, and manage change/closure             | 9                |
| Scope        | Define required work and requirements, develop scope structure, control and validate scope | 6                |
| Schedule     | Plan/develop the schedule and control timing                                               | 3                |
| Finance      | Plan finances, estimate costs, budget, and control spending                                | 4                |
| Stakeholders | Identify/engage stakeholders and plan/manage/monitor communication                         | 7                |
| Resources    | Plan, estimate, acquire, lead, and control resource use                                    | 5                |
| Risk         | Plan risk management; identify, analyze, respond, implement, and monitor                   | 6                |

## Workbook addition: value delivery and tailoring

The workbook connects **strategy → portfolios → programs/projects → operations/products → business value realization**. Delivery is not the endpoint of the value argument: assess whether the expected benefit actually reaches the organization, then use that information in future investment decisions. A **portfolio** sits in this investment/strategy picture; a **program** is distinguished by coordinating related work for benefits. The workbook does not supply a detailed portfolio definition here. (*Workbook v8.1, printed pp. 19 [PDF 25]; 47 [PDF 53]*)

**Tailoring** deliberately adapts approach, governance, processes, and tools to the environment and work. The PM collaborates with the team, sponsor, or organizational management. The workbook's class exercises intentionally use a standalone, single-iteration predictive project to teach techniques; this does not require every real project to use that model. (*Workbook v8.1, printed pp. 20 [PDF 26]; 25 [PDF 31]; 48 [PDF 54]; 51 [PDF 57]*)

## Workbook addition: six delivery principles

| Principle                                         | Study meaning                                                                          |
|---------------------------------------------------|----------------------------------------------------------------------------------------|
| Adopt a Holistic View                             | Consider integration across the life cycle and the effects of decisions on the whole   |
| Focus on Value                                    | Keep work aligned with business objectives, benefits, and value                        |
| Embed Quality Into Processes and Deliverables     | Build agreed quality/acceptance expectations into both work methods and outputs        |
| Be an Accountable Leader                          | Lead with integrity, responsible decisions, and trust                                  |
| Integrate Sustainability Within All Project Areas | Consider sustainability across the work and its life cycle                             |
| Build an Empowered Culture                        | Enable collaboration and shared objectives among diverse stakeholders and team members |

These are the six labels in the supplied workbook, not six additional process groups. Principles guide behavior; domains organize related activities; focus areas describe major functions across project management. (*Workbook v8.1, printed pp. 22 [PDF 28]; 49 [PDF 55]*)

## Workbook addition: historical context

Module 2 traces project work from historic construction through wartime logistics, post-WWII developments, RAND, and PMI's organization of practices. It gives 1969 as PMI's founding year. Its project-failure figures cite studies from the 1990s; treat them as historical motivation, not current failure rates. One percentage differs between the prose and slide, so the guide does not ask you to memorize it. (*Workbook v8.1, printed pp. 9 [PDF 15]; 13–14 [PDF 19–20]; 27 [PDF 33]; 36–38 [PDF 42–44]*) (Aug 26 · 00:26:22 · segments 50–55; 00:32:56 · segments 61–66; 00:39:48 · segments 105–110)

---

## 2. Organizations, authority, and PMOs

**Workbook lookup:** (*Workbook v8.1, printed pp. 12 [PDF 18]; 34–35 [PDF 40–41]*)

## Organizational structures

| Structure                      | Arrangement                                                                  | Authority clue in Caldwell's teaching                                               |
|--------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Organic / simple               | Small business; flexible roles and little formal structure                   | A formal PM role may not exist                                                      |
| Functional                     | Departments such as HR, finance, marketing, and IT                           | Functional managers hold most authority                                             |
| Divisional                     | Divisions based on products or geography, sometimes with their own functions | Identify the division arrangement; do not infer a particular matrix authority level |
| Matrix                         | Projects and functional departments share people                             | Dual reporting and competing demands on shared staff                                |
| Projectized / project-oriented | Organization centered on project teams                                       | PM has very high authority in the lecture comparison                                |

Virtual or hybrid work arrangements can occur within different structures. They do not, by themselves, establish whether an organization is functional, matrix, or projectized. The subsidiary/division comparison in the lecture was tentative, not an equivalence of legal terms. (Aug 24 · 01:58:32 · segments 318–337; 02:21:40 · segments 388–397)

## Strong, weak, and balanced matrix

| Matrix type | Authority over shared resources                          | Scenario cue                                               |
|-------------|----------------------------------------------------------|------------------------------------------------------------|
| Strong      | PM has greater authority                                 | Project work wins when the priorities cannot be negotiated |
| Weak        | Functional manager has greater authority                 | Department work takes priority over project work           |
| Balanced    | Authority is balanced in the lecture's brief description | Assess how the scenario distributes authority              |

Matrix benefits include sharing existing staff and connecting expertise across functions. Risks include conflicting directions, communication problems, and managers competing for an employee's time. Those problems are possible, not inevitable. A request to an accounting employee to process an invoice is insufficient evidence of a matrix; look for shared responsibilities and dual authority. (Aug 24 · 02:07:10 · segments 345–358; 02:15:52 · segments 366–368; 02:19:03 · segments 381; 02:21:20 · segments 387) (Sep 9 · 00:14:36 · segments 15–16)

## Project Management Office (PMO)

| Type        | What it does                                                 | Recognition clue                                          |
|-------------|--------------------------------------------------------------|-----------------------------------------------------------|
| Supportive  | Offers templates, tools, resources, training, and consulting | Assistance is available; the PM has discretion to use it  |
| Controlling | Establishes standards and compliance requirements            | Required methods/templates/software or audits             |
| Directive   | Directly manages or oversees projects                        | PMs report to the PMO; it exercises substantial authority |

Identify the function, not just the title: an organizational unit can perform PMO functions under another name. Caldwell corrects his initial expansion of the acronym to **Project Management Office**. (Aug 24 · 02:25:54 · segments 400–418; 02:35:01 · segments 425; 02:35:59 · segments 430)

## 3. Success, constraints, and competencies

**Workbook lookup:** (Workbook v8.1, printed pp. 13–19 [PDF 19–25]; 37–48 [PDF 43–54])

### The six competing constraints

| Constraint | Meaning                                                       | Recognition cue                                |
|------------|---------------------------------------------------------------|------------------------------------------------|
| Scope      | Work required to complete the project and deliver its product | What must be done / included                   |
| Schedule   | Time allocated to complete the work                           | When / how long                                |
| Quality    | Meeting the relevant expected or satisfactory standard        | Fit for intended purpose / acceptance standard |
| Budget     | Money allocated                                               | Financial plan / spending limit                |
| Resources  | People, equipment, materials, supplies, or capital            | Who or what is needed                          |
| Risk       | Something uncertain that may affect the project               | If / might / potential consequence             |

The course teaches six constraints and notes that some presentations omit risk. A change in one can affect others: more product features can mean more work, time, resources, cost, or risk. Priorities are therefore needed to guide tradeoffs. (Aug 24 · 03:04:51 · segments 522; 03:06:24 · segments 529–568) (Aug 31 · 00:20:54 · segments 16–35)

## Success has more than one measure

Evaluate time, cost, quality, deliverables, stakeholder/customer satisfaction, and team outcomes together. A project can satisfy a customer while exceeding its budget, or finish on time but disappoint users. **Team cohesion is one measure of success**, not proof that the entire project succeeded. (Aug 24 · 02:37:00 · segments 443–444; 02:45:58 · segments 467–476)

Caldwell identifies recurring contributors to success: customer/end-user involvement, leadership support, and capable resources. Clear requirements and feedback reduce misunderstandings; leadership supplies support; suitable people and technology make delivery credible. A PM can advocate early for resources and explain how shortages affect the plan even when authority is limited. (Aug 24 · 02:37:56 · segments 445–464)

## Three competency areas

| Area            | Course meaning                                                                     | Example                                                  |
|-----------------|------------------------------------------------------------------------------------|----------------------------------------------------------|
| Ways of working | Methods, tools, approaches, and technical practices                                | Build a schedule or estimate                             |
| Power skills    | Leadership, empathy, respect, and interpersonal effectiveness                      | Resolve conflict and support a team                      |
| Business acumen | Understanding the industry's language, regulations, norms, organization, and roles | Recognize requirements and constraints in a new industry |

The combination matters: knowing tools does not automatically supply people skills or industry understanding. Caldwell calls the course slide outdated and directs students to the updated book presentation. The supplied workbook still labels its triangle **Technical, Leadership, and Strategic & Business Management**, while Caldwell teaches **Ways of working, Power skills, and Business acumen** and says the slide is outdated. Keep both visible: the skill descriptions substantially overlap, but the PDF does not verify his claim of an official rename. (Workbook v8.1, printed pp. 18 [PDF 24]; 45 [PDF 51]) (Aug 24 · 02:55:40 · segments 495–519)

## Hierarchical teams versus teams of peers

Hierarchical teams have reporting layers. Layers can create communication overhead, silos, or opportunities to lose information through indirect communication. In a team of peers, the PM coordinates goals and work without necessarily being everyone's boss or technical expert. Clear roles, mutual respect, ownership, empowerment, and consensus help that arrangement work. Caldwell's comments about the frequency of these arrangements and exam questions are observations from his experience. (Aug 24 · 02:48:40 · segments 477–494)

---

# 4. Initiation: business need, charter, and priorities

**Workbook lookup:** (Workbook v8.1, printed pp. 55–69 [PDF 61–75]; 200 [PDF 206]; 216–217 [PDF 222–223])

## From business need to authorization

**Mission** states the overall organization's scope; **vision** describes its desired future state. Mission/vision guide strategy, business plans, and project objectives. The workbook's vision definition applies to an organization, system, process, product, service, or project outcome. (*Workbook v8.1, printed pp. 11 [PDF 17]; 31 [PDF 37]; 210 [PDF 216]; 213 [PDF 219]*)

The **business need** explains why the organization should undertake the project: a process improvement, customer requirement, or stakeholder need. **Strategic alignment** connects the proposed result to the organization's mission or vision. Caldwell treats mission as purpose and whom the organization serves, with mission/vision providing overall direction. (*Aug 24 · 01:33:12 · segments 280–306*)

A **project charter** presents the proposed project for authorization. In the course, it is a high-level document: need/problem, proposed solution, objectives, executive summary, assumptions, preliminary scope boundaries, priorities, and early cost/duration estimates. Its format and length vary. It is not the fully detailed project plan. The PM, a task force, or another group may prepare it; a PM need not already be assigned. (*Aug 26 · 01:23:53 · segments 246–251; 01:29:20 · segments 261–270; 01:48:48 · segments 326–327*)

| Role            | Course distinction                                                                  |
|-----------------|-------------------------------------------------------------------------------------|
| Sponsor         | Provides or secures funding, authorizes the project, and supplies authority/support |
| Project manager | Leads day-to-day planning, team coordination, and execution                         |

This sponsor-versus-PM distinction is explicitly identified as exam material. Do not assume the sponsor performs the PM's daily coordination simply because the sponsor has authority. (*Aug 26 · 01:26:50 · segments 253–260*)

**Class example:** a community garden's gazebo can be justified by increasing use of the space and bringing community members together. State what belongs to this project and what does not; Caldwell excludes later marketing work from one scope example. (*Aug 26 · 01:31:01 · segments 267–270; 01:48:48 · segments 326–327*)

## Priority matrix

Ask the appropriate stakeholders how they prioritize constraints, then record the answer. A matrix may use high/medium/low or numeric ratings. If everything is "highest," it provides little help when tradeoffs arise. Cost might be least flexible on a grant-funded project, while a deadline or early-completion incentive can make schedule dominant in another project. Do not assume budget is always the highest priority. (*Aug 26 · 01:32:57 · segments 271–297*)

These priorities later inform schedule compression, resource decisions, and risk tolerance. Ask: **Which constraint can we move, and who can authorize that movement?** This is the connection between the charter and later planning/control decisions. (*Sep 2 · 03:19:13 · segments 500–503*) (*Sep 9 · 01:59:06 · segments 234–242*) (*Sep 14 · 00:33:18 · segments 85–91*)

## Rough Order of Magnitude (ROM)

ROM is a broad early estimate of cost or duration, based on limited information, experience, or a best guess. It is refined during planning. **Confirmed in the workbook:** ROM is **–50% / +100%: lower bound = base ÷ 2; upper bound = base × 2**. The explicit slide and estimate-range table agree with Caldwell. Treat it as the assigned course

range; independent certification guidance may need separate checking. (*Workbook v8.1, printed pp. 67 [PDF 73]; 110 [PDF 116]; 126 [PDF 132]*) (*Aug 26 · 01:40:11 · segments 297–323*) (*Aug 31 · 02:33:30 · segments 316–317*)

| Base estimate | Course lower bound | Course upper bound |
|---------------|--------------------|--------------------|
| \$1,000       | \$500              | \$2,000            |
| \$11,420      | \$5,710            | \$22,840           |
| 4 days        | 2 days             | 8 days             |

The percentage is asymmetric: +100% doubles the base; it does not mean  $\pm 50\%$ . For a multi-component class project, Caldwell adds component estimates to estimate the whole. The three-to-five-day project size and number of components are classroom exercise constraints, not universal project requirements. (*Aug 26 · 01:42:11 · segments 303–312; 01:46:26 · segments 320; 01:50:10 · segments 335–338; 02:44:52 · segments 398–400*)

## 5. Team, stakeholders, communication, and kickoff

**Workbook lookup:** (*Workbook v8.1, printed pp. 71–86 [PDF 77–92]; 212 [PDF 218]*)

### Project team versus stakeholders

The **team** carries out day-to-day project work: the PM and implementers. The course distinguishes the sponsor as a key stakeholder external to that day-to-day team. Contractor membership depends on participation: a consultant working with the team every week may be treated as a member; a specialist performing one isolated service may not. Treat these as course distinctions rather than fixed rules for every organization. (*Aug 26 · 02:54:08 · segments 452–482*)

A **stakeholder** has an interest in, or is affected by, the project. Stakeholders include the team, sponsor, customer/end user, leadership, vendors, partners, and community members. The workbook glossary also includes people/groups/organizations who may **affect**, be affected by, or **perceive themselves to be affected by** project decisions or outcomes; identify them even before they actively participate. Not all have the same influence or information needs. (*Workbook v8.1, printed pp. 72–74 [PDF 78–80]; 212 [PDF 218]*) **Stakeholder analysis** identifies and prioritizes them so communication and engagement can be tailored. (*Aug 26 · 03:01:19 · segments 488–526*)

### Communication plan

Record **who, what, when, and how**. The following is an illustrative template based on the lecture; the cadences are choices, not mandatory frequencies.

| Audience | Information / purpose                 | Timing                         | Method                    |
|----------|---------------------------------------|--------------------------------|---------------------------|
| Team     | Work coordination, progress, blockers | Daily or weekly as appropriate | Meeting or shared tracker |

| Audience                   | Information / purpose                         | Timing                       | Method                             |
|----------------------------|-----------------------------------------------|------------------------------|------------------------------------|
| Customer/end user          | Progress, feedback, decisions                 | Milestones or agreed reviews | Review meeting and written summary |
| Sponsor / key stakeholders | Current condition, issues requiring decisions | Agreed reporting cadence     | Status report                      |

A good plan makes feedback possible as well as sending information outward. Connect communication to stakeholder needs instead of giving everyone the same volume of material. (Aug 26 · 03:04:09 · segments 503–526) (Sep 14 · 02:09:04 · segments 268–271)

## Working policies

- **Meeting minutes:** assign someone to document decisions and agreements; store the notes where the team can find them.
- **Change procedures:** identify how proposed changes will be evaluated for scope, time, and cost before plans are altered.
- **Project glossary:** shared definitions, acronyms, terminology, and formulas reduce ambiguity.
- **Document management:** use a shared location and clear naming/organization so current information is easy to locate.

The point is reliable coordination and accountability. The lecture's "project dictionary" also includes terms, formulas, and acceptance tolerances; do not automatically equate that usage with a formal WBS dictionary. (Aug 26 · 03:15:04 · segments 537–575) (Sep 14 · 02:31:04 · segments 326–329; 02:35:44 · segments 339–340)

## Kickoff meeting

In Caldwell's course sequence, kickoff is early in planning after initiation. Introduce the people and roles, purpose/vision, goals, charter, expected timeline, and relevant communication plans. Establish shared understanding and momentum. Include the team and relevant stakeholders; duration and format depend on the project. The meeting is explicitly emphasized for exams. (Aug 26 · 03:27:02 · segments 581–603)

# 6. Scope planning and the WBS

**Workbook lookup:** (Workbook v8.1, printed pp. 87–105 [PDF 93–111]; 218 [PDF 224])

**Planning** establishes the total scope, refines objectives, and develops the course of action to achieve them. The WBS is one planning deliverable, not the whole plan. (Workbook v8.1, printed pp. 210 [PDF 216])

## Product scope versus project scope

**Product scope** is the features and functions of the product, service, or result. **Project scope** is all the work needed to deliver it. For Caldwell's house example, eight windows, a white exterior, an asphalt roof, and air conditioning are product features; buying and installing the windows are work needed to produce those features. (Aug 31 · 00:27:23 · segments 42–44; 00:30:41 · segments 59–62; 00:35:08 · segments 81–91)

A **deliverable** is a verifiable product, result, or capability. An installed roof is a deliverable; the tasks required to install it are the work. Avoid treating any vague action phrase as proof that a verifiable result has been defined. (Aug 31 · 00:32:57 · segments 70–77; 00:40:28 · segments 101–102; 00:44:05 · segments 118–119)

## Workbook addition: statement of work and scope alignment

A **Statement of Work (SOW)** narrates the products, services, or results to be delivered. The workbook connects vision/strategy to project objective, scope statement, SOW, requirements, and WBS. Use the narrative/requirements to clarify the outcome, then the WBS to organize the work needed to deliver it. (Workbook v8.1, printed pp. 88–90 [PDF 94–96]; 96–98 [PDF 102–104])

## Work Breakdown Structure (WBS)

The WBS is a **hierarchical decomposition of the total project scope**. The course stresses 100% of the project, not just the most interesting component. It can be presented as a diagram or an indented list. At the levels taught:

1. Project.
2. Deliverables.
3. Work packages.
4. Optional further activity detail used for planning.

The **work package** is the lowest official WBS level in Caldwell's teaching and the workbook. It groups related work that can be estimated and managed for cost, effort, duration, and resources. Activities may be elaborated below it for scheduling, but the course answer to "lowest WBS level" is **work package**. (Aug 31 · 00:37:27 · segments 93–104; 00:44:32 · segments 119–128; 01:24:11 · segments 164–168; 03:02:58 · segments 428–430)

The **code of accounts** is the unique numbering/identification system for WBS components. For example: deliverable 2.0, work packages 2.1, 2.2, and so on. The identifiers provide traceability; they are not cost estimates. Workbook pp.94/103 show the numbered landscape example, while pp.93–94/103 explain that different branches need not be decomposed to identical depths: stop where the work can be managed effectively. (Workbook v8.1, printed pp. 93–94 [PDF 99–100]; 103 [PDF 109]) (Aug 31 · 00:46:22 · segments 124–128)

## Class example: countertop replacement

| Deliverable group | Work discussed                                |
|-------------------|-----------------------------------------------|
| Preparation       | Requirements, kickoff/planning, and materials |
| Tear-out          | Remove and dispose of old countertop          |
| Fabrication       | Design and cut the new countertop             |
| Installation      | Deliver, extend/mount as needed, install sink |
| Finish            | Sealing, finishing, and plumbing work         |

This example shows how to split a result into manageable groups. The class suggestions of roughly 12–18 packages are exercise guidance, not a required WBS size. Caldwell mentions the **8–80-hour rule** as a practical work-package heuristic and explicitly says it is not exam material for this discussion; smaller class packages are acceptable. (Aug 31 · 00:48:42 · segments 129–139)

**Check your scope:** can you account for every deliverable in the charter? Is a component missing? Are boundaries clear? Scope omissions propagate into responsibility assignments, time estimates, resource plans, and budgets. (Aug 31 · 03:02:58 · segments 428–438) (Sep 9 · 00:13:36 · segments 13–14)

## 7. Assigning responsibility: RAM and RACI

**Workbook lookup:** (Workbook v8.1, printed pp. 108–109 [PDF 114–115]; 123–124 [PDF 129–130]; 201 [PDF 207]; 219–220 [PDF 225–226])

A **Responsibility Assignment Matrix (RAM)** connects work to people and their involvement. **RACI** is the letter model used in the course's RAM. The matrix gives a way to see who owns completion, approves, contributes, or needs information. (Aug 31 · 01:26:51 · segments 169–176; 02:28:16 · segments 290)

**Workbook-confirmed course variant:** the embedded RAM image on printed p.124 (PDF 130) uses the same meaning as Caldwell: R = responsible overall, A = approval authority, C = contributor, I = informed. Text extraction missed this image, so the labels were visually checked. They are the assigned course labels, not an independently verified certification convention. (Workbook v8.1, printed pp. 124 [PDF 130])

| Letter | Caldwell's label     | Meaning in his examples                                   |
|--------|----------------------|-----------------------------------------------------------|
| R      | Responsible          | Ensures the work is completed; may also perform work      |
| A      | Approver / Authority | Authorizes or approves the work/materials                 |
| C      | Contributor          | Performs or contributes work                              |
| I      | Informed             | Receives information needed for awareness or coordination |

These A/C meanings are confirmed for this workbook and lecture; do not silently replace them with another RACI convention. The garden-shed sample uses a different **O/A/I** model: **Owner** responsible for results/work, **Approval, Implementer** performing work. In that model, I means implementer, not informed. Always read the matrix legend before interpreting letters. (Workbook v8.1, printed pp. 219–220 [PDF 225–226]) (Aug 31 · 01:28:47 · segments 175–176; 01:31:09 · segments 188; 01:33:21 · segments 198–206)

In his exercise, use one R and no more than one A for a row, with Cs and Is as appropriate; a cell uses one letter, and irrelevant cells may remain blank. The R may contribute labor without being marked both R and C. A contractor can perform work while the PM retains responsibility for checking delivery against the agreed scope. These are the course's matrix conventions. (Aug 31 · 01:35:14 · segments 202–206; 01:43:03 · segments 223; 02:26:01 · segments 278–290)

**Class example:** Bill, the PM, is R; Jennifer contributes sprinkler installation and is informed when materials are available; Frank contributes planting/fence work; Tanya, the homeowner, approves materials and work. Informing Jennifer when Frank starts the next phase is different from assigning Jennifer more work. (Aug 31 · 01:39:40 ·

## Workbook addition: five steps to assign roles

1. List the skills needed for the work.
2. Select suitable people based on skills/experience and identify training needs.
3. Discuss roles, responsibilities, and the larger purpose of the work.
4. Gain commitment from the person and, when relevant, the functional manager.
5. Document the agreed responsibilities in the RAM.

The workbook recommends documented/signed commitments to establish shared understanding, especially with matrix resources. (*Workbook v8.1, printed pp. 108–109 [PDF 114–115]; 123 [PDF 129]*)

## 8. Estimating effort, duration, and uncertainty

**Workbook lookup:** (*Workbook v8.1, printed pp. 109–111 [PDF 115–117]; 125–127 [PDF 131–133]; 220 [PDF 226]*)

### Three different quantities

| Quantity                | Meaning                                                     | Example                                               |
|-------------------------|-------------------------------------------------------------|-------------------------------------------------------|
| Effort                  | Labor units required; usually hours in these exercises      | 12 labor-hours of fence construction                  |
| Duration                | Working time periods occupied by an activity                | 2 workdays under the class's 8-hour-day rounding rule |
| Calendar / elapsed time | Placement across actual dates, including nonworking periods | A weekend or holiday affects the completion date      |

Do not confuse effort with elapsed time. Two people, availability limits, waiting periods, or parallel work can change the relationship. Caldwell's effort-to-duration exercise is a simplified convention, not a universal staffing formula. (*Aug 31 · 02:29:07 · segments 293–315; 02:54:30 · segments 390–398*)

For that exercise, define the workday first. With an 8-hour workday and positive work, round effort up to whole workdays: 4 hours → 1 day; 8 → 1; 12 → 2; 18 → 3. His “duration cannot be zero” instruction applies to these work activities; the start/finish milestones in network diagrams have no work assigned. (*Aug 31 · 02:55:29 · segments 393–398*) (*Sep 2 · 00:36:25 · segments 115–116*)

### Estimation approaches introduced

| Approach        | Course description                  | Caution                                                  |
|-----------------|-------------------------------------|----------------------------------------------------------|
| Expert judgment | Experienced person's quick estimate | Accuracy depends on experience and available information |

| Approach       | Course description                                                          | Caution                                                           |
|----------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------|
| Group judgment | SMEs discuss estimates and seek consensus                                   | Use the workbook's independent-estimate and consensus steps below |
| Single-point   | One informed best/most-likely estimate, potentially using past project data | Does not explicitly show a range                                  |
| Three-point    | Optimistic, most likely, and pessimistic estimates                          | Keep units consistent and choose the specified formula            |

SME means **Subject Matter Expert**. The workbook clarifies **modified Delphi**: gather independent initial estimates from a small group of experts, compare/discuss them, allow each expert to revise, and repeat until consensus. This is more specific than the lecture's focus-group description. Independence at the initial stage is the key extra detail supplied by the text. (*Workbook v8.1, printed pp. 110 [PDF 116]*)

## Workbook addition: estimate maturity and duration types

| Stage in this workbook     | Estimate label | Course range | Example at a \$10,000 base |
|----------------------------|----------------|--------------|----------------------------|
| Initiating                 | ROM            | –50% / +100% | \$5,000–\$20,000           |
| Planning                   | Budgetary      | –10% / +25%  | \$9,000–\$12,500           |
| Executing / implementation | Definitive     | –5% / +10%   | \$9,500–\$11,000           |

The ranges narrow as more information becomes available. These are the workbook's ranges, not a guarantee that every estimate achieves that accuracy. The garden-shed sample's 20 days  $\pm 10$  differs from its own ROM rule; use the explicit range table for course calculation questions and keep the sample discrepancy visible. (*Workbook v8.1, printed pp. 110 [PDF 116]; 126 [PDF 132]; 217 [PDF 223]*)

**Fixed duration:** adding people does not shorten the planned activity; a meeting is the workbook example.

**Variable duration:** additional useful resources can reduce duration. The slide also lists **level of effort** as a third type, but this workbook does not explain it; the formal definition remains a question for the instructor/additional reading. (*Workbook v8.1, printed pp. 110 [PDF 116]; 125 [PDF 131]; 127 [PDF 133]*)

Five workbook estimating steps: define the activity/deliverable/performance criteria; collect historical data; estimate individual and total effort; identify duration type; develop/document duration estimates and assumptions. The sample RAM shows why total person-hours must not be blindly converted to business-days: a multi-person meeting can total 12 effort-hours but occupy one day. (*Workbook v8.1, printed pp. 109–110 [PDF 115–116]; 125 [PDF 131]; 220 [PDF 226]*) (Aug 31 · 02:34:08 · segments 318–327)

## Three-point formulas

Let **O** = optimistic, **M** = most likely, and **P** = pessimistic. Optimistic is best case; pessimistic is the adverse case considered; most likely is the expected typical case.

**Triangular estimate:**  $(O + M + P) / 3$  **PERT beta estimate taught in class:**  $(O + 4M + P) / 6$

PERT weights M four times as heavily as either endpoint. The weights are  $1 + 4 + 1 = 6$ . Caldwell repeatedly circles/emphasizes PERT and says it is the default he expects when an exam question does not specify the method. Treat that as instructor advice, not a verified universal exam rule or proof that a weighted average is always more accurate. (Aug 31 · 02:36:47 · segments 324–340; 03:07:11 · segments 463) (Sep 9 · 00:12:28 · segments 8–11)

## Worked lecture example: Liam's commute

O = 16 minutes; M = 20 minutes; P = 35 minutes.

- Triangular:  $(16 + 20 + 35) / 3 = 71 / 3 = 23.67$  minutes.
- PERT:  $(16 + 4 \times 20 + 35) / 6 = 131 / 6 = 21.83$  minutes.

Multiply  $4 \times M$  before adding, and divide the entire numerator. The PERT result moves toward the most-likely estimate because of its greater weight. (Aug 31 · 02:42:56 · segments 352–366)

**Second lecture example:** O = 5, M = 7, P = 13 minutes. PERT =  $(5 + 28 + 13) / 6 = 46 / 6 = 7.67$  minutes. (Aug 31 · 02:50:29 · segments 375–384)

## 9. Dependencies, leads, and lags

**Workbook lookup:** (Workbook v8.1, printed pp. 111–114 [PDF 117–120]; 128–131 [PDF 134–137])

**Activity:** a distinct, scheduled portion of project work. Elaborate work packages into activities as needed for estimating and sequencing. (Workbook v8.1, printed pp. 107 [PDF 113]; 207 [PDF 213])

A **predecessor** comes before a related successor in the schedule logic. Relationships specify which event in one activity constrains which event in another. Learn both names and abbreviations; Caldwell stars this material. (Sep 2 · 00:09:08 · segments 23–25)

| Relationship          | Scheduling constraint             | Caldwell's example                                                                   |
|-----------------------|-----------------------------------|--------------------------------------------------------------------------------------|
| Finish-to-start (FS)  | B cannot start before A finishes  | Finish baking before frosting the cake                                               |
| Start-to-start (SS)   | B cannot start before A starts    | Start preparing frosting once cake baking starts                                     |
| Finish-to-finish (FF) | B cannot finish before A finishes | "Here comes the bride" must continue until the bride finishes walking down the aisle |
| Start-to-finish (SF)  | B cannot finish before A starts   | Refrigerated storage continues until cake pickup/delivery starts                     |

The lecture sometimes says SS activities "start together" or FF activities "finish together." Those are the pictured examples; the constraint describes what is permitted, rather than proving all such activities must have identical event times. Left sides of activity boxes represent starts and right sides finishes in his diagrams; one early spoken reversal is corrected by his later explanation. (Sep 2 · 00:10:59 · segments 28–42; 00:18:30 · segments 50–57)

## Two different dependency classifications

| Pair                                    | Meaning                                       | Example                                     |
|-----------------------------------------|-----------------------------------------------|---------------------------------------------|
| Mandatory / hard logic                  | Required sequence                             | Build a prototype before crash testing it   |
| Discretionary / soft or preferred logic | Chosen sequence that may be changed           | Furnish the living room before the bedrooms |
| Internal                                | Team controls the work relationship           | Two team-performed activities               |
| External                                | Dependence on work outside the team's control | Customer review or an external service      |

These pairs can combine: a relationship can be external and mandatory, or internal and discretionary. External dependencies generally offer less direct control. (*Sep 2 · 00:23:45 · segments 71–86*)

## Lead and lag

A **lead** allows overlap/acceleration relative to the original sequencing. A **lag** is a delay or waiting interval between related activities. Caldwell's photo example has four days of shooting and six days of editing; starting some editing before the shoot is complete can shorten the overall sequence. His customer-proof review has a 15-day waiting period. Concrete curing is another endorsed lag example. (*Sep 2 · 00:29:40 · segments 87–113*) (*Sep 9 · 00:48:23 · segments 73–79*)

A lead is possible only when the work can actually overlap safely; do not ignore hard logic. His statement that leads only occur with discretionary dependencies is a teaching simplification to review against the workbook. The photo example's "perhaps eight days" is illustrative, not an exact calculation that can be reconstructed from all activity data. (*Sep 2 · 00:32:25 · segments 100–113*)

## Workbook addition: network development checks

The workbook's six sequencing steps are: identify work-package activities; assign roles; estimate effort/duration; determine dependencies; identify leads/lags; plot the network. It calls the rectangle-and-arrow technique **Precedence Diagramming Method (PDM)**. Include start/finish and significant phase/deliverable milestones; a milestone marks an event, not an additional work package. (*Workbook v8.1, printed pp. 107–114 [PDF 113–120]; 122 [PDF 128]; 131 [PDF 137]*)

Check for **hangers, loops, and redundant dependencies**—the three error labels listed in the workbook. Ensure the work is properly connected, dependencies do not form a circular sequence, and duplicate logic does not obscure the actual relationship. The text recommends mandatory dependencies for its exercise, while also teaching discretionary ones; treat that as a class modeling recommendation, not permission to ignore a real preferred sequence that is part of the authorized plan. (*Workbook v8.1, printed pp. 112 [PDF 118]; 129 [PDF 135]; 202 [PDF 208]*)

## 10. Critical path, early/late dates, and float

**Workbook lookup:** (Workbook v8.1, printed pp. 114–117 [PDF 120–123]; 132–137 [PDF 138–143]; 222 [PDF 228])

### Critical path

The **critical path** is the longest-duration path through the schedule network. Under the estimates and dependency assumptions, it determines the shortest possible project duration. Add durations, not the number of activity boxes. There can be more than one critical path: Caldwell's landscaping example has two equal-length parallel activities that are both critical. (Sep 2 · 00:40:35 · segments 130–154; 02:18:01 · segments 365–367)

Start and finish milestones anchor the diagram and have no work. Activity boxes hold work and duration; arrows show relationships. The course uses time zero as the start for its calculations. Use one consistent unit throughout—hours or days—and remember that the small-project exercises sometimes substitute hour effort estimates for duration under a simplified staffing assumption. (Sep 2 · 00:36:25 · segments 115–128; 00:50:19 · segments 174–180; 01:34:06 · segments 233–235; 01:53:36 · segments 253–257)

### Four activity dates

| Symbol | Name         | Meaning                                                          |
|--------|--------------|------------------------------------------------------------------|
| ES     | Early start  | Earliest the activity can start                                  |
| EF     | Early finish | Earliest it can finish                                           |
| LS     | Late start   | Latest it can start without delaying the planned project finish  |
| LF     | Late finish  | Latest it can finish without delaying the planned project finish |

**Total float** is the available delay before project finish is affected. In the simple, unconstrained examples taught, critical activities have zero float. Float on a noncritical sequence is shared: delaying the first activity uses time available later; it is not a fresh allowance for every activity. (Sep 2 · 01:53:36 · segments 253–254; 01:59:33 · segments 296–333)

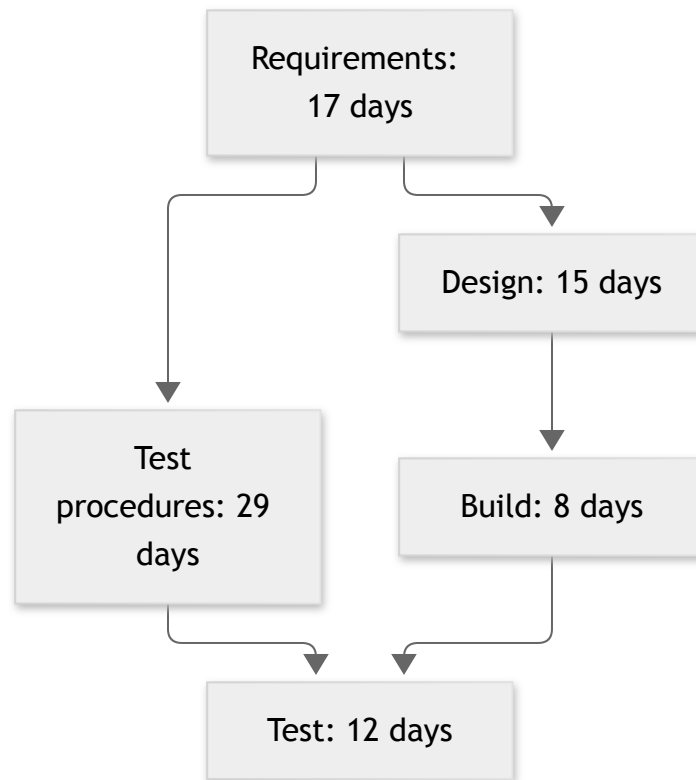
For the **FS-only, zero-lag example below**, the arithmetic can be organized as follows:

1. Move forward:  $EF = ES + \text{duration}$ ; at a merge use the latest predecessor EF as the successor ES.
2. Set final finish to the project's computed duration.
3. Move backward:  $LS = LF - \text{duration}$ ; at a branch use the earliest successor LS as the predecessor LF.
4. Check  $\text{total float} = LS - ES = LF - EF$ .

This is an arithmetic reconstruction of Caldwell's worked example, not a substitute for handling other relationship types, lags, resource limits, or imposed deadlines. Do not apply an FS-only shortcut indiscriminately.

## Reconstructed lecture example: 58 days

The spoken data describe: requirements (17 days), then two parallel branches—test procedures (29 days) versus design (15) followed by build (8)—then test (12). The graph and table below were reconstructed from the transcript and are now **checked against the workbook's actual diagram** on printed pp.134–136 (PDF 140–142). (Workbook v8.1, printed pp. 134–136 [PDF 140–142]) (Sep 2 · 01:55:28 · segments 259–278; 02:01:10 · segments 302–326)



| Activity        | Duration | ES | EF | LS | LF | Total float |
|-----------------|----------|----|----|----|----|-------------|
| Requirements    | 17       | 0  | 17 | 0  | 17 | 0           |
| Test procedures | 29       | 17 | 46 | 17 | 46 | 0           |
| Design          | 15       | 17 | 32 | 23 | 38 | 6           |
| Build           | 8        | 32 | 40 | 38 | 46 | 6           |
| Test            | 12       | 46 | 58 | 46 | 58 | 0           |

Critical path:  $17 + 29 + 12 = 58$  days. Other path:  $17 + 15 + 8 + 12 = 52$  days. Difference: **6 days**. Test cannot begin at day 40 just because build is complete; it also waits for test procedures, which finish at day 46. Design may start at day 23 and finish at day 38, and build may finish at day 46, without changing the final day 58. (Sep 2 · 01:59:33 · segments 296–326)

If design uses two of those six days, the design/build branch has four remaining; the six-day values in both activity rows are not additive. Caldwell calls a remaining-allowance example “free float,” but the workbook supplies a different, precise definition: **free float is delay that does not delay any successor's early start or violate a schedule constraint. Total float** protects the project finish (and schedule constraints). (*Workbook v8.1, printed pp. 117 [PDF 123]; 135–137 [PDF 141–143]*)

For this FS-only, zero-lag example, free float = the earliest successor ES minus the activity EF. Design has **0 free float**, because build's early start is 32 and design's early finish is 32. Build has **6 free float**, because test's early start is 46 while build finishes at 40. Both design and build have **6 total float**. A two-day delay to design delays build's early start but need not delay project finish—exactly why the two concepts differ. The final activity has zero free float relative to the finish milestone. (*Workbook v8.1, printed pp. 134–136 [PDF 140–142]*)

“Always starts at zero” and “never float on a critical path” remain conventions for these simple examples, not assertions about every constrained schedule. (*Sep 2 · 01:55:03 · segments 257; 02:00:52 · segments 300–301; 02:08:08 · segments 327–333*)

## 11. Gantt charts and schedule compression

**Workbook lookup:** (*Workbook v8.1, printed pp. 118–119 [PDF 124–125]; 138–140 [PDF 144–146]; 223 [PDF 229]*)

### Gantt chart

A **Gantt chart** maps activities against time. Use the WBS, effort/duration estimates, and network sequence as inputs. Bars show when work occurs, including overlaps and gaps. The class versions are simple; richer schedules may also show assigned people, dependencies, progress, and percent complete. (*Sep 2 · 03:04:43 · segments 453–469*) (*Sep 9 · 00:22:44 · segments 56–62*)

Once agreed, the schedule becomes a control tool. Update actual progress and compare it with the plan to identify late work or other deviations. The chart is useful because it connects planned timing to current performance; a polished graphic does not compensate for incorrect logic. (*Sep 2 · 03:10:06 · segments 467–469*)

The workbook's six Gantt steps are: list activities; mark start/finish and duration from CPM; add start/finish symbols; draw dependency lines; show float; highlight the critical path. These are drawing conventions for the class chart, not requirements that every software view display the same symbols. (*Workbook v8.1, printed pp. 118 [PDF 124]; 138 [PDF 144]*)

### Compressing the schedule

| Technique     | What changes                                              | Main tradeoff Caldwell emphasizes                                                |
|---------------|-----------------------------------------------------------|----------------------------------------------------------------------------------|
| Fast tracking | Overlap work originally sequenced separately              | Greater risk of rework or quality problems; only feasible where work can overlap |
| Crashing      | Add resources to speed work while preserving the sequence | Additional cost                                                                  |

In his example, three sequential four-week stages make 12 weeks; overlap or added resources may target nine weeks. This is an illustration, not a promise that doubling staff halves all durations. Consider the charter's priorities: if cost is tightly constrained, crashing may be unsuitable; if cost is flexible and quality risk is a concern, added resources may be preferable. (Sep 2 · 03:11:33 · segments 470–503)

The lecture sometimes describes fast tracking as a definite “quality compromise” and crashing as not compromising quality. Study the **risk tradeoff** rather than treating either outcome as guaranteed. Both proposals must be feasible under the actual work relationships and the authorized plan.

---

## 12. Resource loading and leveling

**Workbook lookup:** (Workbook v8.1, printed pp. 143–146 [PDF 149–152]; 152–154 [PDF 158–160]; 204 [PDF 210]; 224 [PDF 230])

**Resource loading** assigns people to scheduled work and calculates their time commitments. **Resource leveling**, as the course uses the term, addresses overload so available resources can meet competing demands. Both are explicitly circled/emphasized. (Sep 9 · 00:51:49 · segments 95–104; 01:03:31 · segments 136–167)

For the uniform allocation in Caldwell's example:

Commitment per period = individual effort / activity duration in that period's units

Thirty labor-hours across 2.5 weeks is 12 hours/week. One hundred across four weeks is 25 hours/week. Twenty-eight across 1.5 weeks is 18.67 hours/week. Then **sum commitments from all activities occurring in the same period**. Do not assess each assignment in isolation. (Sep 9 · 00:54:12 · segments 101–104)

A **resource histogram** shows the resource's time load by period. Mark the availability threshold—40 hours/week in the John example, eight hours/day in the small-project exercise. Multiple concurrent assignments are acceptable if their total fits capacity. Thresholds are stated assumptions, not universal work rules. (Sep 9 · 00:58:47 · segments 120–135; 01:10:50 · segments 174–181)

### Worked overload example

John has concurrent demands of 25 and  $28 / 1.5 = 18.666\dots$  hours/week. Total = **43.67 hours/week**. With 40 hours available, overload = **3.67 hours**. The instructor's later “three and a half” phrasing is approximate; the exact arithmetic is retained here. (Sep 9 · 00:55:34 · segments 103–104; 00:59:47 · segments 122–132)

Options discussed in class:

- Use available **float** to shift noncritical work while maintaining dependencies and the finish date. Caldwell recommends checking this first.
- Reassign suitable work to another available, capable resource.
- Extend an activity or the schedule, obtaining approval if the baseline changes.
- Resequence discretionary work where feasible.
- Reduce scope only with the appropriate authorization.
- Accept overtime as a conscious cost/capacity decision; Caldwell distinguishes that from actually leveling the overload away.

Check cost and scope priorities before adding people. After moving work, check the whole schedule again: using float still changes activity dates, and availability or dependencies may make a proposed move unsuitable. The workbook confirms those remedies and likewise uses "leveling" broadly; it does not separately define smoothing. Its narrative says John's week 5 is "almost 40" while the slide table/graph show **43.7**, so use the checked data and threshold. The sample-solution phrase "breaking dependencies" must not be taken as permission to break mandatory physical logic; any feasible resequencing still has to respect the work. (*Workbook v8.1, printed pp. 143 [PDF 149]; 146 [PDF 152]; 153–154 [PDF 159–160]; 224 [PDF 230]*) (Sep 9 · 01:03:31 · segments 136–165; 01:59:06 · segments 234–242)

## 13. Cost estimating, budgets, and the S-curve

**Workbook lookup:** (*Workbook v8.1, printed pp. 147–149 [PDF 153–155]; 155–158 [PDF 161–164]; 205 [PDF 211]; 225 [PDF 231]*)

### Three cost-estimating approaches

| Approach             | Basis                                            | Course comparison / recognition cue                               |
|----------------------|--------------------------------------------------|-------------------------------------------------------------------|
| Analogous / top-down | Similar previous project, possibly adjusted      | Quick and less detailed; "last project cost \$70,000"             |
| Parametric           | Historical relationship or model, often per-unit | Statistical model / rate × quantity; good data and skill required |
| Bottom-up            | Estimate detailed work, then aggregate upward    | More time-intensive and more accurate in Caldwell's comparison    |

Bottom-up adds activities into work-package estimates, work packages into deliverables, and deliverables into the total. Accuracy still depends on scope coverage and credible data; the instructor's rankings do not guarantee that any method always wins. (Sep 9 · 02:09:54 · segments 270–281)

### Building the budget

Define cost categories appropriate to the work. Examples include wages/labor, benefits, materials/supplies, equipment, and overhead. Definitions and thresholds depend on the organization; Caldwell explicitly says not to memorize the example supply/equipment dollar thresholds for the exam. The class exercise limits categories to labor and materials to keep it manageable. (Sep 9 · 02:02:28 · segments 246–269; 02:20:17 · segments 303–308)

**Labor cost = hours × hourly rate**, calculated for each resource and added. Add material purchases in the applicable period. **Period total** is that period's planned cost. **Cumulative total** is planned cost from the start through that period. A budget remains a plan; calling its numbers "spent" in a lecture walkthrough does not make them actual expenditures. (Sep 9 · 02:14:58 · segments 283–299; 02:23:05 · segments 310–325)

**Workbook addition — direct vs indirect costs:** direct costs arise from a specific activity and go away if that activity is eliminated; indirect costs are allocated burdens that need not disappear when that one activity is removed. The workbook gives senior management, employee benefits, and facility expense as possible indirect examples. Classification depends on the cost arrangement; the category name alone is insufficient. (*Workbook v8.1, printed pp. 147 [PDF 153]*)

The slide's additional categories include contingency/reserve, overhead, burden, travel, opportunity cost, inflation, currency fluctuation, and direct/indirect costs. Distinguish **estimating cost** (approximating resource costs) from **determining the budget** (aggregating them into an authorized baseline). (*Workbook v8.1, printed pp. 155–156 [PDF 161–162]*)

## Reconstructed five-day lawn budget

The lecture uses a PM rate of \$40/hour and laborer rate of \$25/hour. Materials: sprinkler system \$1,000; sod \$400; shrubs \$750; fence \$2,000. These are instructional estimates, not researched current prices. (*Sep 9 · 02:20:17 · segments 303–314*)

| Day          | Labor basis                           | Labor          | Materials      | Daily total    | Cumulative     |
|--------------|---------------------------------------|----------------|----------------|----------------|----------------|
| 1            | PM: 8 × \$40                          | \$320          | \$1,000        | \$1,320        | \$1,320        |
| 2            | Laborer: 8 × \$25                     | \$200          | \$1,150        | \$1,350        | \$2,670        |
| 3            | Two laborers: 16 × \$25; PM: 4 × \$40 | \$560          | \$2,000        | \$2,560        | \$5,230        |
| 4            | Two laborers: 16 × \$25               | \$400          | \$0            | \$400          | \$5,630        |
| 5            | Laborer: 4 × \$25; PM: 4 × \$40       | \$260          | \$0            | \$260          | \$5,890        |
| <b>Total</b> |                                       | <b>\$1,740</b> | <b>\$4,150</b> | <b>\$5,890</b> | <b>\$5,890</b> |

The result matches Caldwell's \$5,890 total. The evolving landscaping examples across sessions are not all one identical final schedule: use each example's stated assumptions, rather than mixing its durations or role assignments with another version. (*Sep 9 · 02:23:05 · segments 310–325*)

## S-curve / cost baseline

Plot **time on the horizontal axis** and **cumulative planned cost on the vertical axis**. This is the course's S-curve representation of the cost baseline. For the table above, plot 1,320; 2,670; 5,230; 5,630; 5,890 against days 1–5. Plotting only daily cost would describe period spending, not this cumulative baseline. The curve need not have a perfect letter-S shape in a small example. (*Sep 9 · 02:18:43 · segments 297–300; 02:28:22 · segments 326–334; 03:03:56 · segments 417–423*)

The larger lecture example has monthly totals of \$7,500, \$7,500, \$8,500, \$11,000, and \$7,000, and cumulative totals of \$7,500, \$15,000, \$23,500, \$34,500, and **\$41,500**. This provides another way to practice period versus cumulative totals. (*Sep 9 · 02:16:26 · segments 291–296*)

If rebuilding in a spreadsheet, calculate row totals and use a running sum; check cell references and units before trusting the graph. Spreadsheet software carries out the specified formulas, so an incorrect formula or missing cost can still produce an incorrect budget.

## 14. Risk analysis and response planning

**Workbook lookup:** (*Workbook v8.1, printed pp. 159–175 [PDF 165–181]; 206 [PDF 212]; 212 [PDF 218]; 226–227 [PDF 232–233]*)

### Identify the risks

The lesson's response examples focus on **threats**, but the workbook glossary defines risk more broadly: an uncertain event/condition can have a **positive or negative effect** on an objective. Remember both signs even though this course practices negative-risk responses. (*Workbook v8.1, printed pp. 212 [PDF 218]*) Ask “what if?” rather than assuming a problem will occur. There is no risk-free project. Examples endorsed by Caldwell include supply disruption, staff changes, weather, technical/security failure, misunderstood requirements, withdrawn funding, and contractor failure. (*Sep 14 · 00:07:04 · segments 20–40*)

Use previous projects and their risk registers, team brainstorming, stakeholders, and SMEs. A **risk register** records identified risks; the risk management plan brings together analysis, priorities, response strategies, expected impacts, and reserve planning in the course exercise. (*Sep 14 · 00:16:25 · segments 42–45; 00:56:35 · segments 161–163*)

### Workbook risk-planning sequence

1. Identify risks.
2. Evaluate qualitatively.
3. Evaluate quantitatively.
4. Prioritize and determine a tolerance threshold.
5. Manage risks above that threshold.
6. Determine contingency reserve.
7. Document the risk management plan.

This is the workbook's seven-step list; revisit analysis after responses to assess residual exposure. (*Workbook v8.1, printed pp. 160 [PDF 166]; 169 [PDF 175]; 232 [PDF 238]*)

### Qualitative analysis: prioritize

Assess **probability** (likelihood) and **impact** (consequence) on a defined scale such as low/medium/high or 1–5. Plot the risks in a probability–impact matrix. Numerical rating labels do not, by themselves, make the analysis the expected-value calculation introduced next. (*Sep 14 · 00:17:45 · segments 45–55*)

| Combination                   | Course planning interpretation                         |
|-------------------------------|--------------------------------------------------------|
| High probability, high impact | Highest attention and most strategic response planning |

| Combination                  | Course planning interpretation                             |
|------------------------------|------------------------------------------------------------|
| High probability, low impact | Monitor and prepare for a likely but more manageable event |
| Low probability, high impact | Monitor carefully because consequences can be serious      |
| Low probability, low impact  | Lower priority; possible acceptance                        |

These are classroom prioritization examples. Low likelihood does not justify dismissing a catastrophic consequence. Involve stakeholders and use charter priorities to set a **risk tolerance threshold** that identifies which risks require active attention. The line's physical direction on a slide is not essential; its meaning depends on labeled axes and the agreed scale. (Sep 14 · 00:21:09 · segments 56–64; 00:33:18 · segments 85–91)

## Quantitative analysis: expected value

The course uses **expected value (EV) = probability × impact**. Convert percentages to decimals. Keep time and money separate.

| Probability | Impact if it occurs | Expected value             |
|-------------|---------------------|----------------------------|
| 10%         | 20 days             | $0.10 \times 20 = 2$ days  |
| 5%          | 100 days            | $0.05 \times 100 = 5$ days |
| 10%         | 10 days             | 1 day                      |
| 12%         | \$40,000            | \$4,800                    |

An expected value is a weighted planning quantity, not a guarantee that an event will cost exactly that amount or occur for that fraction of a day. The lesson's **EV means expected value**, while the workbook glossary also defines **earned value** as completed work expressed in its authorized budget. Context determines which EV is meant; a risk-exposure calculation is not an earned-value performance calculation. (Workbook v8.1, printed pp. 208–209 [PDF 214–215]) (Sep 14 · 00:25:25 · segments 65–74)

Caldwell emphasizes the sequence **qualitative first, quantitative second**. Segment 76 initially repeats/misstates “quantitative,” then immediately corrects to that order; the corrected wording is used here. His exercise later calculates residual exposure after response choices, so analysis may be revisited as the plan develops. (Sep 14 · 00:31:08 · segments 75–83; 00:54:00 · segments 154–155; 01:01:13 · segments 176–177)

## Risk response strategies

| Strategy | Meaning                                                                               | Course example / clue                        |
|----------|---------------------------------------------------------------------------------------|----------------------------------------------|
| Escalate | Refer to the appropriate higher authority when beyond project scope or responsibility | Risk belongs above the PM's authority        |
| Avoid    | Change the plan to eliminate the relevant threat                                      | Risk no longer exists under the revised plan |

| Strategy | Meaning                                                              | Course example / clue                                             |
|----------|----------------------------------------------------------------------|-------------------------------------------------------------------|
| Transfer | Shift responsibility for a defined risk/consequence to a third party | Insurance or a contract allocating the consequence                |
| Mitigate | Reduce probability or impact while risk remains                      | Improve the approach so the event is less likely or less damaging |
| Accept   | Recognize and retain the risk                                        | Passive acceptance or active contingency planning                 |

The lecture first groups four strategies, then discusses acceptance for residual risks. Do not drop acceptance just because it is introduced afterward. **Avoidance eliminates; mitigation reduces.** Caldwell calls avoidance the preferred option when feasible and escalation a last resort unless clearly appropriate. Choose based on the actual risk, authority, feasibility, and cost rather than treating either as an absolute rule. (Sep 14 · 00:35:46 · segments 92–107; 00:44:35 · segments 126–146; 00:53:10 · segments 152–153)

Insurance is the clearest transfer example in the lecture. Outsourcing alone does not tell you precisely which consequences are transferred; the allocation depends on the contract. Caldwell was uncertain about a student's example of moving a budget between departments, so that example is not treated as an established transfer technique. (Sep 14 · 00:41:55 · segments 115–131)

## Residual risk, contingency, triggers, and owners

**Residual risks** are the risks remaining after the chosen responses. **Passive acceptance** recognizes them without a specific additional action plan. **Active acceptance** can include a contingency plan: what to do if the event occurs. A **trigger** is an observable alert or condition prompting attention/action; an **owner** is the designated person who watches and takes responsibility for the risk. A flashing equipment-warning light is Caldwell's trigger example. (Sep 14 · 00:49:51 · segments 144–151)

For the class's simple reserve calculation, sum the expected values of retained residual risks, separately for time and cost. For example, two time exposures of 2 and 5 days produce a **7-day expected exposure**; \$250 and \$4,800 produce **\$5,050**. This combined example is study arithmetic using the lecture formula, not an additional reported class case. Do not add seven days to \$5,050. (Sep 14 · 00:26:26 · segments 67–70; 00:54:00 · segments 154–159)

A **contingency reserve** provides capacity for the retained risk exposure; it is not discretionary money to spend on unrelated improvements. The workbook explicitly teaches **sum of residual-risk EV = contingency reserve** for this method. It does not supply a complete reserve taxonomy or establish that this amount is universally sufficient. (Workbook v8.1, printed pp. 163 [PDF 169]; 172 [PDF 178]) (Sep 14 · 00:54:00 · segments 154–163)

## Workbook worked example: garden-shed residual risks

After responses, the sample retains a 5% permit risk with a 20-day impact, eliminates the inadequate-tools risk ( $0\% \times 2$  days), and retains a 25% weather risk with a one-day impact. Expected exposure =  $1 + 0 + 0.25 = 1.25$  days, added as schedule contingency in that example. It distinguishes buying/having a tarp (risk mitigation preparation) from deploying it when bad weather occurs (contingency action). These are workbook sample assumptions, not actual legal permit rules. (Workbook v8.1, printed pp. 226–227 [PDF 232–233])

## Putting the risk plan together

For each risk, document the description, probability/impact assessment, priority, response, remaining exposure, contingency action, trigger, and owner. Record any reserve assumptions. Also include probable causes; the workbook's plan checklist names risk description, causes, probability/impact analysis, and response plans. Its glossary distinguishes the **risk management plan** (how risk processes will be organized/performed) from the **risk response plan** (identified risks, causes, exposure, responses, owners, and status). Keep the process plan and specific-risk records conceptually distinct even when the class combines them in one deliverable. The exercise limits the list to six or seven risks for time reasons; a real register is not capped at seven. (*Workbook v8.1, printed pp. 163 [PDF 169]; 173 [PDF 179]; 212 [PDF 218]*)

## Workbook addition: finalize the baseline

A **baseline** is an approved work product used to compare actual results and changed through formal change control. A draft schedule or cost table is not automatically the approved baseline. The workbook's finalization steps are:

1. **Validate:** appropriate experts/team/stakeholders review; check calculations and assumptions.
2. **Get approvals:** obtain the relevant sponsor/customer/key-stakeholder approvals.
3. **Archive in a repository:** securely preserve the approved version where it can be found.
4. **Communicate:** provide it to relevant stakeholders using the communication plan.

Preserve the baseline's role as a comparison point. Do not quietly reset it merely to conceal a variance. If objectives/constraints/status change enough to require a new authorized plan, use the change procedure. (*Workbook v8.1, printed pp. 164–165 [PDF 170–171]; 174 [PDF 180]; 207 [PDF 213]*) (Sep 14 · 00:51:37 · segments 148–177)

---

# 15. Execution and team development

**Workbook lookup:** (*Workbook v8.1, printed pp. 177–178 [PDF 183–184]; 185 [PDF 191]; 232 [PDF 238]*)

Execution means directing, coordinating, and performing the work to achieve deliverables. The teaching spends much of its time on planning techniques; that does not mean real projects spend the same proportion of their duration planning. Caldwell stresses that work must actually begin and that execution and control proceed together. (Sep 14 · 01:54:41 · segments 220–260)

Key responsibilities discussed:

- **Team development:** coach, mentor, train, onboard people, equip them with information/tools, and address conflict fairly.
- **Quality:** check work against agreed standards using appropriate metrics, observations, or checklists.
- **Communication:** support the team and report outward to relevant stakeholders.
- **Contract administration:** help select/obtain contracts and monitor delivery of the agreed goods/services.

Detailed procurement methods are deferred to the next course. The workbook likewise lists quality assurance and mentions QA/QC checklists but does not explain their full distinction, so that formal terminology remains unresolved here. (*Workbook v8.1, printed pp. 177 [PDF 183]; 185–186 [PDF 191–192]*) (Sep 14 · 02:06:20 ·

## Tuckman's team formation model

| Stage      | Course description                                          | PM implication                                        |
|------------|-------------------------------------------------------------|-------------------------------------------------------|
| Forming    | People meet, learn roles, and exchange initial pleasantries | Establish direction, roles, support, and expectations |
| Storming   | Working-style differences, tension, or conflict emerge      | Anticipate friction and handle it constructively      |
| Norming    | Members accept differences and coordinate more effectively  | Reinforce workable norms and communication            |
| Performing | Team operates cohesively and effectively toward goals       | Support the conditions that sustain performance       |
| Adjourning | Work ends and people transition to other assignments        | Recognize contribution and manage transition          |

Caldwell emphasizes that performing is not guaranteed; talent, time working together, and retention matter. The model helps anticipate team dynamics rather than proving every team will move through a fixed timetable. A new member or turnover can require renewed integration. The workbook's explanatory text and study checklist list four stages through performing; Caldwell adds **adjourning**. Learn the four-stage workbook list plus the lecture's fifth, end-of-team stage rather than treating the omission as a contradiction. (*Workbook v8.1, printed pp. 178 [PDF 184]; 185 [PDF 191]; 232 [PDF 238]*) (Sep 14 · 02:12:30 · segments 275–301)

## 16. Reporting, monitoring, and controlling

**Workbook lookup:** (*Workbook v8.1, printed pp. 178–179 [PDF 184–185]; 181 [PDF 187]; 184 [PDF 190]; 186 [PDF 192]; 188 [PDF 194]*)

### Three performance perspectives

| Item            | Main perspective            | Course usage                                                                               |
|-----------------|-----------------------------|--------------------------------------------------------------------------------------------|
| Progress report | Movement over an interval   | What has changed since the last report; usually tactical/internal in Caldwell's comparison |
| Status report   | Snapshot at a point in time | Current condition; useful for outward stakeholder communication and also internally        |
| Forecast        | Future performance          | Predict likely results using information available now                                     |

The difference between change over time and a snapshot is central. Audience distinctions are Caldwell's teaching comparison, not a rule forbidding stakeholders from receiving progress information. Quarterly status reporting is an example cadence, not a requirement. *(Sep 14 · 02:24:22 · segments 302–326)*

## Monitoring versus controlling

**Monitoring** collects, measures, and reports data against benchmarks. **Controlling** analyzes what that information means and takes appropriate corrective action. "Take corrective action" is Caldwell's recognition cue for controlling. Execution is doing the work; checking and correcting performance are different functions that accompany it. *(Sep 14 · 02:00:36 · segments 244–257)*

**Collecting actuals** means gathering evidence of what really happened: receipts, timecards, purchase records, invoices/statements, and other relevant records. Compare actual cost or progress with the plan, then decide whether action is needed. Keep pending commitments and what has actually occurred clear so totals are not confused or duplicated. *(Sep 14 · 02:44:04 · segments 363–375)*

**Illustrative study example:** the budget plans \$2,670 through day 2; reliable records show \$2,900 actually incurred. Actual minus planned = \$230 above plan at that point. Gathering the records is monitoring; analyzing the cause and proposing corrective action is controlling. This is a simple cost comparison, **not an earned-value calculation**: spend alone does not tell you how much work was completed.

Caldwell's desire to spend a grant allocation is specific to his grant experience. Being under budget does not generally mean a PM should spend money merely to exhaust it. Work objectives, funding terms, and authorization govern the decision. *(Sep 14 · 02:47:07 · segments 372–375)*

## Workbook addition: complete performance-control cycle

1. Collect actuals **and forecasts**.
2. Compare actuals with the plan.
3. Determine variance causes and analyze their impact.
4. Take appropriate corrective action.
5. Make authorized revisions to the plan.
6. Report status and revisions.

The workbook also discusses **reviews/approvals**, including a **phase gate** where approval is needed to proceed. An **issues log** and resolution process document and address problems needing decisions or action; do not merely record them without assigning a path to resolution. *(Workbook v8.1, printed pp. 179 [PDF 185]; 181 [PDF 187]; 188 [PDF 194])*

---

# 17. Change control

**Workbook lookup:** *(Workbook v8.1, printed pp. 76 [PDF 82]; 85 [PDF 91]; 179–180 [PDF 185–186]; 187–188 [PDF 193–194])*

A change control system governs changes to baselines such as **scope, schedule, and budget**. **Scope creep** is a scope change that bypasses the proper change process. The control system limits it and puts decisions with the appropriate authority. A PM should not simply reduce scope or change a baseline unilaterally because doing so

makes the plan easier. (Sep 14 · 02:37:10 · segments 342–348) (Sep 9 · 01:05:23 · segments 146; 01:08:45 · segments 162)

The lecture process, completed with the workbook flowchart:

1. Submit a **formal change request** with the proposed change, reason, and justification.
2. **Log** the request so it can be traced.
3. Route it to the **Change Control Board (CCB)** or designated decision authority.
4. Evaluate whether it has a benefit/need and its impact on time, cost, resources, and risk.
5. **Accept, reject, or defer** based on that assessment and authority.
6. Notify the requester; if accepted, integrate the approved change into the plan.

Steps 5–6 reflect the actual flowchart in the supplied workbook, adding **deferral** and the explicit notification/integration endpoint to the lecture summary. (Workbook v8.1, printed pp. 180 [PDF 186]; 187 [PDF 193])

A CCB can be a committee or designated person. Participants might include the sponsor, customer, senior leaders, or qualified experts. Approval is not automatic just because a feature sounds useful: it may create unacceptable cost or risk. (Sep 14 · 02:38:23 · segments 345–360)

**Study application:** if a customer requests another feature, identify the added work and its time/cost/risk consequences, record the decision, and maintain a consistent authorized plan. Implementing the feature before evaluation would bypass the control system. This applies the lecture's principles rather than claiming a specific unseen form or software workflow.

---

## 18. Closing and lessons learned

**Workbook lookup:** (Workbook v8.1, printed pp. 191–196 [PDF 197–202]; 228 [PDF 234])

Closing follows delivery in Caldwell's walkthrough, but the workbook definition also covers closing a **phase or contract** and **terminating a project before completion**. It is not limited to successful finished delivery. Closing completes the remaining administrative work: final actuals and reports, accounting/documentation, and archiving. The team may be shrinking or transitioning to other assignments. Do not confuse the last physical work activity with completion of every project obligation. Workbook review meetings should objectively evaluate successes, improvement opportunities, both product and project processes, and variances/corrective actions. Follow retention policies, index/catalogue the records, and tell relevant people where to find them. (Workbook v8.1, printed pp. 191–193 [PDF 197–199]; 196 [PDF 202]) (Sep 14 · 02:18:44 · segments 287–290; 02:48:27 · segments 376–383)

**Lessons learned** document both what worked and what could be improved. A retrospective can occur at a phase/milestone or at project end. Capture enough context that future teams can use the lesson as an input, rather than merely recording "communication was bad." (Sep 14 · 02:32:32 · segments 330–336)

**Illustrative useful lesson:** "Assign a minutes-taker and record decisions in the shared folder after each meeting; this prevented contradictory task instructions." A corresponding improvement might be: "Validate the entire charter scope before creating the WBS; an omitted component later forced revisions to the schedule and cost

estimates." These study examples apply the meeting-policy and full-scope lessons. (Aug 26 · 03:15:04 · segments 537–541) (Aug 31 · 03:02:58 · segments 428–438)

**Workbook's four closing steps:** collect final actuals; conduct post-project review meetings; document/archive project history; celebrate success. Know this sequence for the workbook study checklist. Celebration is its recommended closeout practice; neither the list nor the lecture establishes a universally required party. (Workbook v8.1, printed pp. 191–193 [PDF 197–199]; 196 [PDF 202]; 232 [PDF 238])

Caldwell recommends a closeout meeting with retrospective, recognition, and celebration, potentially involving the customer. He explicitly presents celebration as good practice rather than establishing a compulsory event. (Sep 14 · 02:49:37 · segments 379–382)

**Workbook software appendix: implementing the plan**

Appendix E translates the planning work into ten Microsoft Project steps: set project information; enter lowest-level work activities/durations; insert milestones; add necessary constraints; create dependency relationships; add summary tasks; add resources; assign resources; address overloads; review/validate/save the baseline. It explicitly defines milestones as **zero-duration activities**. (Workbook v8.1, printed pp. 233–235 [PDF 239–241])

Understand the scheduling logic before using software. The appendix recommends letting dependencies calculate dates, applying genuine constraints cautiously, checking resource calendars/capacity and task types, and validating the complete plan before saving a baseline. Its assignment relationship is  $\text{work} = \text{duration} \times \text{commitment rate}$ , using consistent units and availability assumptions. This complements the effort/duration distinction in §8. Automatically changing a schedule does not establish that the result is feasible or authorized. The PDF's menu paths and automatic-leveling description are edition-specific instructions, not checked against a current software release. (Workbook v8.1, printed pp. 233–235 [PDF 239–241])

19. Instructor emphasis: study priorities

**Workbook lookup:** (Workbook v8.1, printed pp. 229–232 [PDF 235–238])

**Workbook review coverage:** Appendix D supplies topic lists for Modules 2–10. Work through those alongside the 42 prompts in §20. Its list includes the 8–80-hour WBS best practice that Caldwell downplays for exam memorization, four team stages versus his five, and a third duration type (level of effort) whose definition is not supplied. The review index maps each module and flags these differences. (Workbook v8.1, printed pp. 229–232 [PDF 235–238])

The signals below are attached to named material, not inferred from every mention of "exam," "circle," or "star." A circle around a team in an explanatory diagram is not an exam mark. General instructions about his marking convention and navigation stars are recorded separately in the review index.

| Material                                   | Actual signal                       | What to practice                          | Source                                                                                   |
|--------------------------------------------|-------------------------------------|-------------------------------------------|------------------------------------------------------------------------------------------|
| Matrix; functional/projectized comparisons | Circle and explicit exam references | Authority and dual reporting in scenarios | (Aug 24 · 02:10:39 · segments 353–355; 02:19:03 · segments 381; 02:24:59 · segments 398) |

| Material                       | Actual signal                                        | What to practice                                  | Source                                                                               |
|--------------------------------|------------------------------------------------------|---------------------------------------------------|--------------------------------------------------------------------------------------|
| PMO types                      | Explicit exam reference                              | Supportive vs controlling vs directive            | (Aug 24 · 02:26:45 · segments 402; 02:30:36 · segments 410)                          |
| Competencies / Talent Triangle | Starred page; important to know                      | Ways of working, power skills, business acumen    | (Aug 24 · 02:55:40 · segments 495; 02:57:46 · segments 504; 03:03:52 · segments 519) |
| Six constraints                | Circle                                               | Recognize and distinguish all six                 | (Aug 24 · 03:04:51 · segments 522; 03:15:01 · segments 568)                          |
| ROM                            | Explicit exam reference                              | Workbook-confirmed course range and arithmetic    | (Aug 26 · 01:40:11 · segments 297)                                                   |
| Sponsor vs PM                  | Explicit exam distinction                            | Authorization/support vs day-to-day management    | (Aug 26 · 01:26:50 · segments 253; 01:29:09 · segments 260)                          |
| Team membership                | Possible exam questions                              | Team vs sponsor/stakeholder; contractor context   | (Aug 26 · 02:58:14 · segments 471)                                                   |
| Communication plan             | Possible question                                    | Who, what, when, how                              | (Aug 26 · 03:12:56 · segments 531)                                                   |
| Glossary                       | Explicit exam reference                              | Definitions/acronyms/formulas                     | (Aug 26 · 03:19:49 · segments 549)                                                   |
| Kickoff                        | Explicit exam reference                              | Shared understanding, roles, goals, communication | (Aug 26 · 03:28:49 · segments 584)                                                   |
| Deliverable and work package   | Says both should be circled, especially work package | Verifiable result; lowest WBS level               | (Aug 31 · 00:44:32 · segments 119)                                                   |
| Code of accounts               | “Write that down”                                    | Unique WBS identifiers                            | (Aug 31 · 00:46:46 · segments 125)                                                   |
| RAM and RACI                   | Exam reference; RACI should be circled               | Matrix purpose and course role labels             | (Aug 31 · 01:27:27 · segments 170; 01:28:47 · segments 175)                          |
| Effort and duration            | Says circles should be added                         | Labor units vs work periods                       | (Aug 31 · 02:29:07 · segments 293)                                                   |
| PERT beta                      | Circle; repeated exam emphasis                       | $(O + 4M + P) / 6$                                | (Aug 31 · 02:38:29 · segments 328–329; 03:07:11 · segments 463)                      |
| Four dependency types          | Starred page; test abbreviations                     | FS, SS, FF, SF                                    | (Sep 2 · 00:09:49 · segments 24–25)                                                  |

| Material                             | Actual signal                                    | What to practice                                  | Source                                                                              |
|--------------------------------------|--------------------------------------------------|---------------------------------------------------|-------------------------------------------------------------------------------------|
| Critical path / total float          | Explicit likely question / PMI-question guidance | Longest duration, ES/EF/LS/LF, shared float       | (Sep 2 · 00:40:35 · segments 130; 00:48:00 · segments 167; 02:09:19 · segments 329) |
| Schedule compression                 | Explicit likely questions                        | Crashing vs fast tracking, cost vs rework risk    | (Sep 2 · 03:11:33 · segments 470; 03:20:09 · segments 503)                          |
| Histogram; loading and leveling      | Exam recollection; circle/should circle          | Capacity threshold and overload remedies          | (Sep 9 · 01:02:27 · segments 133–135; 01:09:27 · segments 165–167)                  |
| Expected value                       | Circle and calculation-on-exam statement         | Probability as decimal × impact                   | (Sep 14 · 00:26:26 · segments 67; 00:30:28 · segments 74)                           |
| Qualitative then quantitative        | Explicit exam order                              | Prioritize, then quantify                         | (Sep 14 · 00:31:12 · segments 76)                                                   |
| Risk responses                       | Explicit likely questions                        | Especially avoid vs mitigate                      | (Sep 14 · 00:53:10 · segments 152–153)                                              |
| Executing / monitoring / controlling | Says page should have circle                     | Doing, collecting/reporting, analyzing/correcting | (Sep 14 · 02:05:21 · segments 257)                                                  |
| Tuckman model                        | Explicit questions; write-down instruction       | Stage order and scenario recognition              | (Sep 14 · 02:12:30 · segments 275; 02:23:46 · segments 301)                         |
| Progress vs status reports           | Write-down instruction; circle discussed         | Change over time vs snapshot                      | (Sep 14 · 02:26:41 · segments 312; 02:29:51 · segments 321)                         |
| Lessons learned                      | Explicit exam reference                          | Good and bad lessons as future inputs             | (Sep 14 · 02:34:12 · segments 335)                                                  |

**Additional important teaching:** strategic alignment is explicitly called important; charter priorities and change control are also emphasized. Importance is not automatically a circle/star signal. These statements express Caldwell's guidance; they do not guarantee questions on a current exam. (Aug 24 · 01:37:47 · segments 299) (Aug 26 · 01:36:30 · segments 288) (Sep 14 · 02:39:45 · segments 349–352)

## 20. Practice questions and answer key

**Workbook lookup:** (Workbook v8.1, printed pp. 229–232 [PDF 235–238])

These are original study prompts based on the lectures and workbook, not recalled certification questions. Questions 1–32 cover the six sessions; 33–42 cover workbook additions. Try them without the guide, then identify the relevant section and revisit its cited recording if needed.

## Questions

1. A business produces the same item every day, then runs a one-time effort to redesign its production process. Which activity is operations and which is a project? Why?
2. What distinguishes a program from simply listing several projects together?
3. A marketing employee supports a project but must follow the marketing manager's priority when the managers disagree. What matrix type does Caldwell's comparison suggest?
4. An office offers optional templates; a second mandates templates and audits compliance; a third directly supervises PMs. Identify their PMO types.
5. Name the six constraints and give one reason a scope change could affect more than one.
6. A team gets along well, but the customer rejects its deliverable. Has team cohesion established overall project success?
7. What belongs in a high-level charter, and how do sponsor and PM responsibilities differ?
8. Use the course ROM rule for a \$12,000 estimate and a six-day estimate. What source now confirms the course range, and what remains unverified?
9. Why is a priority matrix with every constraint marked "highest" unhelpful?
10. Give the four basic communication-plan questions and the purpose of a kickoff.
11. Is "eight windows" product scope or project scope? What about purchasing and installing them?
12. What does hierarchical decomposition indicate? What is the lowest official WBS level in the course, and what is the code of accounts?
13. Expand RAM and the course's RACI labels. Why can the R differ from the person performing most of the labor?
14. Under the class's eight-hour workday rule, convert 12 and 18 effort-hours to duration. Why should you not assume this is every project's staffing formula?
15.  $O = 4$ ,  $M = 7$ ,  $P = 16$  hours. Calculate triangular and PERT estimates.
16. Name the relationships: baking before frosting; frosting preparation after baking starts; music continuing until the bride finishes; refrigeration continuing until pickup begins.
17. Can a dependency be both external and mandatory? Explain the two classifications.
18. In the 58-day example, identify the critical path. How much float is available on the design/build branch? Can you add design's six and build's six to obtain 12?
19. If design starts at day 23 instead of day 17, what happens to its finish and the project finish under the example's assumptions?
20. Compare fast tracking and crashing. What charter information helps choose?
21. A person has two evenly distributed commitments: 80 hours over four weeks and 30 over 1.5 weeks. Is the combined weekly load above a 40-hour threshold? What if the first commitment is 100 hours instead?
22. What is the difference between resource loading and addressing an overload? Why check float first?
23. Recognize the cost-estimating methods: prior similar-project total; rate per unit based on historical data; detailed estimates added upward.
24. In the five-day budget, what are day 3's labor, daily total, and cumulative total? Which series goes into the S-curve?

25. A risk has a 20% probability of a \$15,000 impact; another a 5% probability of a 40-day delay. Compute their expected values. Can they be added into one unitless total?
26. What is qualitative risk analysis for, and what order does Caldwell teach for qualitative and quantitative analysis?
27. Identify the response: buy insurance; eliminate the threat by changing the plan; reduce its likelihood; send a risk beyond your authority to the appropriate manager; retain a risk with a backup plan.
28. Distinguish a residual risk, contingency plan, trigger, owner, and contingency reserve.
29. Put Tuckman's stages in order. Is performing guaranteed?
30. Distinguish a progress report, status report, and forecast; monitoring, controlling, and executing.
31. What should happen when a requested feature changes scope, cost, and schedule? Who decides?
32. Why is closing more than completing the final construction task? What should a useful lessons-learned record contain?
33. What is the workbook's value-centered project definition, and how does it relate to delivering a product/service/result?
34. Name the seven domains and the six delivery principles. How do principles differ from domains/focus areas?
35. What are business value realization and tailoring? Does using every available technique demonstrate good tailoring?
36. Distinguish progressive elaboration from rolling wave planning and state the five workbook RAM-development steps.
37. At a \$10,000 base, calculate the workbook's ROM, budgetary, and definitive ranges. Explain fixed vs variable duration and name its third listed type.
38. In the 58-day network, what are design's and build's free float? Why can design have six days total float but zero free float?
39. What do O, A, and I mean in the garden-shed sample RAM, and why would treating its I as "informed" be wrong?
40. What four steps finalize the baseline? List the six steps in the workbook's performance-control cycle.
41. Calculate the garden-shed sample's residual expected delay:  $5\% \times 20$  days;  $0\% \times 2$  days;  $25\% \times 1$  day.
42. What outcome besides acceptance or rejection appears in the change flowchart, and can closing occur on an unfinished project?

## Answers

1. Routine repeated production is operations; the temporary redesign effort with a defined result is a project. See §1.
2. Coordinated related work yields benefits unavailable from managing each separately. See §1.
3. Weak matrix: functional-manager authority predominates. See §2.
4. Supportive; controlling; directive. See §2.
5. Scope, schedule, quality, budget, resources, risk. Added scope may require labor, time, money, or additional risk/quality work. See §3.
6. No. Cohesion is one success measure; acceptance and other objectives still matter. See §3.

7. Need/solution, objectives, alignment, high-level scope/priorities/assumptions and early estimates. Sponsor authorizes/supports/funds; PM manages day-to-day work. See §4.
8. \$6,000–\$24,000; 3–12 days. The workbook confirms this course range; independent certification alignment remains unverified. See §4.
9. It does not identify which constraint can move when tradeoffs are unavoidable. See §4.
10. Who, what, when, how. Kickoff establishes shared goals, roles, expectations, and communication. See §5.
11. Feature: product scope. Required work: project scope. See §6.
12. WBS; work package; unique component-identification system. See §6.
13. Responsibility Assignment Matrix; Responsible, Approver/Authority, Contributor, Informed in this course variant. R ensures completion and may coordinate contributors. The embedded workbook image confirms these course A/C labels. See §7.
14. Two and three whole workdays. Resource availability, staffing, calendar, and wait time can alter the relationship. See §8.
15. Triangular =  $27/3 = 9$  **hours**. PERT =  $(4 + 28 + 16)/6 = 8$  **hours**. See §8.
16. FS; SS; FF; SF. See §9.
17. Yes. External describes control/boundary; mandatory describes whether the logic is required. See §9.
18. Requirements → test procedures → test = 58 days. Six days on the other branch; shared allowance, not 12. See §10.
19. Design finishes day 38; build can finish day 46; test still finishes day 58. All six available days are consumed. See §10.
20. Overlap with rework risk versus added resources/cost. Constraint priorities and actual dependencies help select a feasible option. See §11.
21.  $20 + 20 = 40$  **hours/week**, at threshold. With  $100/4 = 25$ , total = **45**, five hours above capacity. See §12.
22. Loading reveals assigned demand. Leveling/remedies address excess demand. Available float may shift noncritical work without extending the finish. See §12.
23. Analogous; parametric; bottom-up. See §13.
24. Labor \$560; day total \$2,560; cumulative \$5,230. Plot cumulative planned cost against time. See §13.
25. **\$3,000** and **2 days**. Retain separate units. See §14.
26. Rank/prioritize probability and impact. Qualitative before quantitative in the course sequence. See §14.
27. Transfer; avoid; mitigate; escalate; active acceptance with contingency. See §14.
28. Remaining risk; backup action; observable signal; assigned watcher/responsible person; retained-risk capacity/funds. See §14.
29. Forming, storming, norming, performing, adjourning. No; talent, cohesion, time, and retention matter. See §15.
30. Change over an interval; current snapshot; future projection. Collect/report; analyze/correct; do the work. See §16.
31. Formal request, log, authorized review of benefit/impacts, accept/reject/defer, notify the requester, and integrate accepted changes. CCB or designated authority decides. See §17.
32. Final reporting, actuals, documentation and archiving remain. Capture good practices and improvements with enough context for future use. See §18.

33. A temporary initiative in a unique context undertaken to create value. Outputs are a way to produce value; acceptance alone need not prove benefits were realized. See §1.
34. Domains: governance, scope, schedule, finance, stakeholders, resources, risk. Principles: holistic view; value; embedded quality; accountable leadership; sustainability; empowered culture. Principles guide behavior; domains group activities; focus areas organize major functions. See §1.
35. Realize the intended benefit after delivery; deliberately adapt approach/governance/processes to the work. No—choose what fits. See §1.
36. Refine as information improves; detail the near phase while later work remains broad. RAM: list skills, select people, discuss roles, gain commitments, document. See §§1,7.
37. \$5,000–\$20,000; \$9,000–\$12,500; \$9,500–\$11,000. Fixed does not shorten with added people; variable may. Level of effort is listed but not explained in this workbook. See §8.
38. Design 0; build 6. Delaying design delays build's early start while six shared days still protect project finish. See §10.
39. Owner, Approval, Implementer. It is a different letter model whose legend defines I as doing work. See §7.
40. Validate, approvals, archive, communicate. Control: collect actuals/forecasts; compare; analyze cause/impact; correct; revise as authorized; report. See §§14,16.
41.  $1 + 0 + 0.25 = 1.25$  **days**, the sample's schedule contingency. See §14.
42. Defer; accepted changes are notified and integrated. Yes—closing can terminate a project before completion, or close a phase/contract. See §§17–18.

---

## Module-review checkpoint

The Module 2 review repeats §§1–4. Check that you can define a project and program, compare organizational structures and PMO control levels, recall six constraints and three competency areas, and distinguish delivery approaches. **PMO = Project Management Office**. A program is defined by coordinated related work and benefits; a department analogy alone is insufficient. Iteration can be used in Agile, but an iterative approach alone does not establish Agile. (*Module review: Foundations M2 Review MASTER.docx, body blocks 5–17, 43–50, 78–93.*)

The file named Module 5 Review contains only a Module 5/6 scope question, already answered in §6: **project scope = the work; product scope = features/functions**. It adds no further Module 5/6 coverage. (*Module review: Foundations M5 Review MASTER.docx, body blocks 1–5.*)

**Edition 1.2 changes:** compared both supplied Foundations review documents, retained existing chapter coverage, and added the checkpoint and review-source provenance. The broader Edition 1.1 workbook integration remains. Current certification alignment and terminology differences are separately identified in the review index.