

Project Finance & Control — Complete Study Guide

Prepared for Liam Smith · Version 1.1 · 5 October 2026

Instructor: Robert Caldwell

Coverage: all five supplied lectures, 16, 21, 23, 28 and 30 September 2026, plus *Project Finance and Control*, workbook version 8.0, 247 PDF pages, and the supplied Modules 1/2, 3 and 4 review documents.

This guide follows the course from project selection through estimating, budgeting, earned value, project control and procurement. It combines repeated explanations, resolves numerical mistakes, and labels differences between the workbook and lectures. References use **PDF-viewer page numbers**, counting the cover as page 1. Lecture times are positions within each recording, not clock times.

Use this guide for learning, the separate **Quick Review** for recall, and the **Practice Questions** for checking your understanding. The **Source and Review Index** maps lessons and records corrections. The practice set contains 60 original study exercises plus four adapted from the new review documents. Instructor predictions about exam topics are emphasis signals, not an exam blueprint or a guarantee of question counts.

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1. Course map and study priorities

Session	Main learning	Workbook locations
September 16	Financial purpose, strategy, funding, WACC, NPV, CBA, financial planning	Introduction pp. 7–16; Module 2 pp. 17–52; start of Module 3
September 21	Cost metrics, estimating, quality costs, reserves, cost aggregation and time-phased budgets	Module 3 pp. 53–86
September 23	Earned value, forecasting, status interpretation and corrective action	Module 4 pp. 87–124; exercise scenarios pp. 208–214
September 28	Performance controls, change control, requirements and trade-offs	Modules 5–6 pp. 125–166; exercises pp. 215–220
September 30	Procurement, contract risk, solicitations, negotiation and closeout	Appendix A pp. 167–198

Appendix B contains exercises on pp. 199–222; Appendix D is the glossary on pp. 227–236; Appendix E has sample solutions on pp. 237–247. Modules 2–6 are the workbook's numbered instructional modules following its introduction. Procurement is an appendix but remains part of this course.

First recall priorities: ROM ranges, PERT, the distinction between earned and expected value, the six EVM formulas, interpreting SPI/CPI, reserves, measurable control factors and thresholds, change control, contract types and buyer/seller cost risk. Caldwell repeatedly emphasized these. WACC and NPV calculations received less exam emphasis, but their concepts matter for understanding project value. Negotiation tactics received less lecture emphasis, yet the workbook still includes BATNA in its self-test. Study it rather than assuming it is excluded. (Sep 16, 02:08:11–02:09:04; segments 153–159.) (Sep 23, 00:43:01–01:54:05; segments 79–99.) (Sep 30, 00:34:19–01:14:52; segments 49–65.) (Workbook, PDF p. 197.)

2. Financial management and organizational value

The course organizes financial work into four processes: **plan financial management → estimate costs → develop the budget → monitor and control finances**. Planning defines how money will be estimated, authorized, tracked and reported; estimating develops expected costs; budgeting aggregates and approves a baseline; control compares performance with that baseline and supports decisions. (Workbook, PDF p. 19.)

The sponsor supports funding and authorization. The project manager leads estimation, budgeting and ongoing control within delegated authority. Accounting, finance and procurement specialists support areas requiring their expertise. A PM does not need to personally perform every specialist calculation, but must understand what its result means and when a decision needs authorization. (Sep 16, 00:16:24–00:23:23; segments 20–37.)

Project costs extend beyond purchased materials. Include labor, equipment, facilities, training, transition effort, contractor charges and other relevant resources. A short meeting consumes paid time even when it produces no invoice. Cost management begins with sound scope, reasonable resource estimates, risk awareness and agreed controls. (Sep 16, 00:28:38–01:03:52; segments 58–74.) (Workbook, PDF p. 20.)

Module-review recall: benefits and implementation costs

The review asks for five benefits of project cost management. Recall **expectations, resources, profit, capacity and learning**:

Benefit	What it means
Manage stakeholder expectations	Agree on spending limits and communicate performance
Use resources efficiently	Connect expenditure to necessary work and value
Support organizational profit	Control relevant costs while protecting required outcomes
Create capacity for further projects	Cost efficiency may release limited funds/resources
Improve future plans	Apply lessons and actual-cost information to later estimates

Implementing cost management also consumes **infrastructure, training and time**. These benefits are goals, not guaranteed results; cost performance is one dimension of project success. (Module review: Finance M1 M2 Review MASTER.docx, body blocks 44–54.)

Align projects with strategy

The workbook's strategy cycle moves through vision/mission, objectives, strategy, implementation, and monitoring or adjustment. A **vision** describes a desired future; a **mission** describes organizational purpose and scope. A strategy is the broad approach; a tactic is a specific shorter-term action supporting it. A project should explain how its outcomes support the organization, not merely describe an activity. (Workbook, PDF pp. 21–26, 234–235.)

Objective type	Focus	Illustrative measure
Financial	Financial performance	Revenue growth, profit, return on investment
Strategic	Future position and organizational capability	Customer reach, product innovation, market position, operational capability

Numbers alone do not make an objective financial: a target for the share of sales generated by newly developed products can express an innovation strategy. Likewise, an objective can combine financial and strategic elements. The class discussed financial measures as often lagging and strategic measures as often leading; **leading/lagging describes the measure's relationship to an outcome**, so do not mechanically classify every measure by its label. Use both kinds to judge progress. (Sep 16, 01:06:04–01:28:32; segments 90–106.) (Workbook, PDF pp. 36–41.)

The class's SMART wording was **specific, measurable, actionable, realistic and timely**. Other versions exist; the useful test is whether the objective identifies a clear result, a way to measure it, feasibility and a deadline. The workbook also discusses benefits extending through the project outcome lifecycle, beyond delivery and closure. Delivery of an asset and realization of benefits are related but different milestones. (Sep 16, 00:54:12–01:03:52; segments 72–74.) (Workbook, PDF p. 27.)

3. Funding, cost of capital and WACC

The course contrasts debt, equity, public appropriations, grants and partnerships. Debt involves financing obligations; equity provides ownership capital whose investors still require a return. A grant's conditions and funding limits must be understood; the lecture's broad description of grants is not a rule that every grant has no repayment or compliance obligations. The funding source affects constraints, reporting and affordability. (Sep 16, 00:19:15–00:23:23; segments 22–37.) (Workbook, PDF p. 27.)

Weighted average cost of capital (WACC) represents the combined cost or required return of the financing sources in this simplified debt/equity model:

$$WACC = w_D k_D (1 - T) + w_E k_E$$

Here, w_D , w_E are financing proportions totaling 1, k_D is debt cost, k_E is equity cost, and T is the tax rate under the model's assumed interest tax treatment. Enter percentages as decimals. The model's tax adjustment is an assumption, not a tax rule for every organization.

$$\text{Capital charge for a period} = \text{Capital employed} \times WACC$$

WACC is a required return/capital cost, not the project's actual ROI. Equity does not become costless just because there is no loan interest. Economic value added, discussed in the workbook, compares returns with the capital charge. Do not confuse **economic value added** with **earned value analysis**; the same letters EVA can appear in different contexts. (Sep 16, 01:17:11–01:46:33; segments 106–116.) (Workbook, PDF pp. 28, 43–47.)

Checked course calculations

Inputs	Calculation	Result
30% debt at 10%; 70% equity at 15%; tax 50%	$0.30(0.10)(0.50) + 0.70(0.15)$	12.00% ; \$12,000 charge on \$100,000

Inputs	Calculation	Result
\$100m refinery; 40% debt at 6%; 60% equity at 9%; tax 35%	$0.40(0.06)(0.65) + 0.60(0.09)$	6.96%; \$6.96m charge
Same refinery; debt cost rises to 12%	$0.40(0.12)(0.65) + 0.60(0.09)$	8.52%; \$8.52m charge

The workbook rounds the second case to 7% and the third to 8.5%. Keep intermediate precision and round the final answer. Principal plus a period's capital charge is a simple illustration of capital recovery plus return; calling that sum **NPV** is incorrect. (*Workbook, PDF pp. 44–47.*) (*Sep 16, 01:30:35–01:48:53; segments 112–134.*)

4. Time value, NPV and cost-benefit analysis

Money received later is discounted to compare it with money today. For a future amount F , rate r , and t periods:

$$PV_{financial} = \frac{F}{(1+r)^t}$$

With a time-zero investment C_0 and subsequent net cash flows C_t :

$$NPV = -C_0 + \sum_{t=1}^n \frac{C_t}{(1+r)^t}$$

Positive NPV means the modeled cash flows exceed the required return embodied in the discount rate. Zero NPV meets it exactly. Negative NPV falls short under those assumptions. This evaluation depends on the amounts, timing and rate; it is not a guarantee of actual performance. The workbook gives the correct definition/formula on PDF p. 29 even though some later slides misuse the label. (*Workbook, PDF pp. 29, 48–49.*)

Avoid an abbreviation collision: financial present value and EVM planned value both use PV. In an investment-selection problem, PV discounts cash. In an earned-value problem, PV is the budget for scheduled work.

Example A: \$100,000 today versus \$110,000 in a year

At 10%, \$100,000 grows to \$110,000. Discounting the \$110,000 gives **\$100,000 present value**. If the project required \$100,000 at time zero, its **NPV is \$0**. The \$100,000 discounted receipt alone is not the net result after the investment. (*Sep 16, 02:02:15–02:08:04; segments 143–149.*) (*Workbook, PDF p. 48.*)

Example B: refinery cash inflows

Assume a \$100m time-zero outflow, \$53.5m at the end of year 1, \$54m at the end of year 2, and 10% discounting:

$$PV_{inflows} = 53.5/1.1 + 54/1.1^2 = \$93.2644628m$$

$$NPV = 93.2644628 - 100 = -\$6.7355372\text{m}$$

The workbook's approximately \$93.3m is the present value of the future inflows, not the NPV after the initial \$100m investment. In Excel, `=NPV(10%,53500000,54000000)-100000000` accounts for the time-zero outflow separately; the built-in function discounts its listed flows as end-of-period flows. See [Microsoft's NPV documentation](#). (Workbook, PDF p. 49.) (Sep 16, 02:02:15–02:08:04; segments 143–149.)

Cost-benefit analysis (CBA)

The course's CBA approach identifies costs and benefits, monetizes them where defensible, discounts future amounts as appropriate, and compares alternatives. Document the perspective, time horizon, assumptions and nonmonetized benefits. Avoid double counting. A favorable score supports judgment; it does not override mandatory requirements, affordability or organizational priorities. (Workbook, PDF pp. 30, 50.) (Sep 16, 02:18:35–03:05:02; segments 181–187.)

For the workbook's three-project sample, the following arithmetic uses **its illustrative cost/benefit totals**, not independently estimated project economics:

Sample project	Costs	Benefits	Net benefit	Benefit/cost ratio
Computer upgrade	\$1.44m	\$2.00m	\$0.56m	1.39
County MIS	\$3.00m	\$6.50m	\$3.50m	2.17
School, local funding perspective	\$5.36m	\$18.50m	\$13.14m	3.45

The school sample counts a \$2.5m local capital contribution after a stated 90% federal grant on the \$25m construction project, plus reserve and capital-charge entries. This does **not** make the full project's resource cost \$2.5m. Its ratio of 3.45 means approximately **\$3.45 benefits per \$1 cost**, not \$3.45 net profit; net benefit per \$1 cost is approximately \$2.45. These are different denominators and perspectives. (Workbook, PDF pp. 200–203, 238–240.)

The workbook adds separate capital charges to some costs after using discounted benefits. Reproduce that only as the workbook's stipulated illustration. When a discount rate already captures financing/opportunity cost, adding an overlapping capital charge can double count it. Use a consistent model with finance support before treating such a result as an investment decision.

Module-review recall: CBA and ROI

Recall the review's five-step CBA sequence: **identify costs/benefits → monetize costs → monetize benefits → discount future values as appropriate → evaluate and decide**. Record assumptions, use a consistent perspective and avoid double counting. (Module review: Finance M1 M2 Review MASTER.docx, body blocks 151–162.)

The review also asks about **return on investment (ROI)**. In a simple, undiscounted comparison, $\text{ROI} = (\text{benefits} - \text{costs}) / \text{costs} \times 100\%$. Benefits of \$12,000 against \$10,000 cost give **20% ROI**; the benefit/cost ratio is **1.20**. State the period and method; this simple ratio does not account for cash-flow timing. WACC remains the

cost/required return of capital. (Module review: Finance M1 M2 Review MASTER.docx, body blocks 10–11.) [PMI: Measuring project management ROI.](#)

5. Financial management planning

A financial management plan explains **how** costs will be handled. It is not just the approved dollar total. Include:

- Units: dollars, hours, quantities, currency and exchange assumptions.
- Precision: rounding or display detail, such as nearest dollar or thousand dollars.
- Accuracy: the uncertainty range around an estimate.
- Control factors, thresholds and the action/escalation expected when exceeded.
- EVM measurement rules: how completed work earns budgeted value.
- Actual-cost collection: source, owner, frequency and cutoff date.
- Reports: audience, frequency, format and accountability.
- Estimate, budget, reserve and change approval responsibilities.

An estimate displayed as \$4,832.17 can still be highly uncertain. Extra decimal places do not improve accuracy. The lecture emphasized defining who collects actuals, using time records, purchase records and accounting support, and communicating the process before execution. (Workbook, PDF pp. 54, 68–72.) (Sep 16, 02:51:12–03:05:02; segment 187.)

6. Estimating costs and uncertainty

Start with the work: define the activity, its assumptions, required resources and costing criteria. Use historical information and specialist input, estimate individual costs, aggregate them, and document the result. Update estimates as information improves. (Workbook, PDF pp. 59, 74–75.)

Technique	How it works	Useful distinction
Analogous	Expert comparison with similar previous work	Fast and inexpensive; quality depends on similarity and judgment
Parametric	Quantity × calibrated rate, or a historical statistical model	Requires relevant data and a valid relationship
Bottom-up	Estimate detailed work components and aggregate upward	More effort and detail; completeness matters
Modified Delphi	Independent initial expert estimates, discussion and revision toward consensus	A structured consensus method, not merely a casual conversation
Single point	One estimate, often most likely in the course example	Does not show uncertainty by itself

Technique	How it works	Useful distinction
Three point	Use optimistic, most likely and pessimistic values	Makes the range explicit

The lecture's typical speed/accuracy ranking helps compare techniques, but no method automatically produces an accurate result if its input assumptions are poor. (*Workbook, PDF pp. 60–61, 76–77.*) (Sep 21, 02:00:31–02:24:23; segments 173–192.)

Three-point formulas

Let O = optimistic, M = most likely, and P = pessimistic:

$$\text{Triangular mean} = (O + M + P)/3$$

$$\text{PERT weighted mean} = (O + 4M + P)/6$$

The workbook also gives the conventional PERT spread approximation $SD = (P - O)/6$. It uses the same units as the estimate. The class breakfast-cost example has $O=\$4$, $M=\$20$, $P=\$30$: triangular mean **\$18**, PERT mean **\$19**, approximate SD **\$4.33**. PERT weights the most likely value four times; dividing a plain sum by six is not PERT. (*Workbook, PDF pp. 61, 76.*) (Sep 21, 02:04:12–02:24:23; segments 175–192.)

Estimate classifications used in this workbook

Class	Workbook range around the base estimate	\$5,000 example
Rough order of magnitude (ROM)	–50% / +100%	\$2,500–\$10,000
Budgetary	–10% / +25%	\$4,500–\$6,250
Definitive	–5% / +10%	\$4,750–\$5,500

For a \$7,000 ROM base, the range is \$3,500–\$14,000. These are the **course's ranges**, not universal accuracy promises. An estimate class describes maturity/uncertainty; it is different from a calculation technique. A PERT calculation does not automatically convert an estimate to a particular class. (*Workbook, PDF p. 77.*) (Sep 21, 01:03:56–03:00:51; segments 65–78, 203.)

Module-review practice: \$100,000 estimate and gym frequency

For a **\$100,000** base estimate, apply the course percentages to the base:

Class	Lower calculation	Upper calculation	Range
ROM	$\$100,000 \times 0.50$	$\$100,000 \times 2.00$	\$50,000–\$200,000

Class	Lower calculation	Upper calculation	Range
Budgetary	$\$100,000 \times 0.90$	$\$100,000 \times 1.25$	\$90,000–\$125,000
Definitive	$\$100,000 \times 0.95$	$\$100,000 \times 1.10$	\$95,000–\$110,000

The review's definitive estimate remains a forecast, not actual incurred cost. The budgetary lower bound is **–10%**; a minus sign is missing in one review answer. (*Module review: Finance M3 Review MASTER.docx, body blocks 17–18, 38–54.*) (*Workbook, PDF p. 77.*)

The gym case gives **minimum 2, most likely 3, maximum 5 visits/week**. Triangular mean = $(2 + 3 + 5) / 3 = \mathbf{3.33 \text{ visits/week}}$. PERT weighted mean = $(2 + 4 \times 3 + 5) / 6 = \mathbf{3.17 \text{ visits/week}}$. Here a favorable week has more visits, so label the endpoints minimum/maximum rather than automatically treating the lower number as the favorable outcome. The means are expected frequencies, not a requirement for fractional visits in a particular week. (*Module review: Finance M3 Review MASTER.docx, body blocks 58.*)

7. Cost of quality and cost categories

Cost of quality includes spending to achieve quality and the consequences of failure:

Group	Category	Examples
Conformance	Prevention	Training, planning, process improvements
Conformance	Appraisal	Inspection, audit, testing
Nonconformance	Internal failure	Scrap or rework discovered before delivery
Nonconformance	External failure	Returns, warranty work or complaints after delivery

Paying for prevention and appraisal can reduce later failure costs. It does not mean every additional inspection is worthwhile or that every defect can be eliminated. In a situation question, ask **what the money is spent on** and **when the defect is discovered**. Caldwell strongly emphasized this distinction. (*Sep 21, 02:07:07–03:00:51; segments 192–203.*)

For activity costing, distinguish direct labor/materials/contract charges from allocated indirect costs. The workbook's patio example uses prime costs, overhead, general and administrative costs and fee entries. Confirm each rate's cost base and whether a quoted rate already includes it; do not apply an overhead rate twice. The lecture did not establish what its "COM" column meant, so this guide does not invent an expansion. (*Workbook, PDF pp. 64, 75.*) (*Sep 21, 01:13:49–01:56:51; segments 128–150.*)

Direct costs can be attributed to the specified work; **indirect** costs are allocated support/shared costs.

Opportunity cost is the benefit forgone by choosing one option over another. Inflation, currency movements and resource availability can affect estimates. These are considerations to model explicitly, not automatic percentage additions. (*Workbook, PDF pp. 61, 78.*)

8. Contingency and management reserve

Budget layer	Purpose	Course treatment
Work budget	Estimated cost of planned work	Aggregated activity/work-package costs
Contingency reserve	Identified residual uncertainty after planned responses	Added to form the cost baseline; use governed by the plan
Cost baseline	Approved work budget plus contingency	Comparison basis; time phased
Management reserve	Unforeseen work/uncertainty outside the baseline	Added to obtain the total project budget; access requires appropriate authorization

$$\text{Cost baseline} = \text{Work budget} + \text{Contingency}$$

$$\text{Total project budget} = \text{Cost baseline} + \text{Management reserve}$$

For the course model, management reserve is outside the baseline. The PM's ability to use contingency and request management reserve depends on agreed authority; "the program manager always owns it" is too narrow as a universal rule. Avoid adding a project reserve after contingency has already been embedded in the same line items. (*Workbook, PDF pp. 62–63, 79.*) (*Sep 21, 01:55:29–03:00:51; segments 143–150, 203.*)

Expected-value method for residual risks

For each residual risk, convert probability to a decimal and multiply by its monetary impact:

$$\text{Risk expected value} = \text{Probability} \times \text{Impact}$$

The class exercise sums these expected values as its project cost contingency. This gives an expected amount across the modeled risks, not a guaranteed maximum loss or a confidence-level funding amount. (*Workbook, PDF pp. 63, 80–81, 206.*) (*Sep 23, 00:08:07–00:09:37; segments 21–31.*)

Refinery residual risk	Probability	Impact	Expected cost
1	10%	\$50m	\$5.00m
2	2%	\$15m	\$0.30m
3	15%	\$1m	\$0.15m
4	25%	\$5m	\$1.25m

Refinery residual risk	Probability	Impact	Expected cost
5	5%	\$25m	\$1.25m
Total reserve			\$7.95m

The garden-shed example instead gives $\$150 + \$20 + \$25 = \textbf{\$195}$. Its \$1,780 planned work cost plus \$195 contingency produces a **\$1,975 baseline**, assuming that reserve has not already been counted. No management reserve amount is specified. (*Workbook, PDF pp. 244–245.*)

The workbook gives historical reserve heuristics of **8–20%** in prose and **8–15%** on its slide. Those are different illustrative ranges, not risk-probability limits, not mandatory reserve rules, and not substitutes for project-specific analysis. (*Workbook, PDF pp. 63, 79.*)

Module-review practice: headquarters contingency

The headquarters case has **\$200m planned work** and the following residual risks. Monetary amounts in this table are millions of dollars:

Risk	Probability	Impact (\$m)	Expected cost (\$m)
1	10%	100	10.00
2	2%	30	0.60
3	15%	2	0.30
4	25%	10	2.50
5	5%	50	2.50
Total			15.90

Under the course's expected-value method, contingency is **\$15.9m**. If the \$200m work estimate excludes this reserve, the baseline is **\$215.9m**. No management reserve is given. These impacts differ from the earlier refinery case; do not reuse its \$7.95m reserve. (*Module review: Finance M3 Review MASTER.docx, body blocks 62–72.*)

Module-review practice: three-risk contingency

Risk	Probability	Monetary impact	Expected cost
A	10%	\$200,000	\$20,000
B	20%	\$100,000	\$20,000
C	35%	\$40,000	\$14,000
Total			\$54,000

Use dollars consistently when summing a monetary reserve. A probability-times-days calculation is a schedule quantity and cannot be added directly to dollars. (*Module review: Finance M3 Review MASTER.docx, body blocks 20, 76–81.*)

9. Building and phasing the cost baseline

Use the WBS to ensure the work is covered. Aggregate lower-level estimates into work packages, deliverables and the project total; then place costs in the periods when the work and spending are planned. A **cost breakdown structure** organizes cost totals; its relationship to the WBS helps prevent omissions and double counting. Confirm what each total includes. (*Workbook, PDF pp. 64–65, 82–84.*) (*Sep 21, 03:02:54–03:13:33; segment 215.*)

The five-month course example, in thousands of dollars:

Category	Month 1	Month 2	Month 3	Month 4	Month 5
Labor	5.0	5.0	6.0	7.0	4.0
Materials	2.0	2.0	2.0	3.0	2.0
Supplies	0.5	0.5	0.5	1.0	1.0
Period cost	7.5	7.5	8.5	11.0	7.0
Cumulative planned cost	7.5	15.0	23.5	34.5	41.5

The cumulative planned-cost curve is often called an **S-curve**, although its actual shape depends on spending. It depicts the plan, not proof of actual expenditures or completed work. Funding availability and the performance baseline also need to be distinguished: receiving cash is not the same as earning value. (*Workbook, PDF p. 84.*) (*Sep 21, 03:02:54–03:13:33; segment 215.*)

A baseline is an approved comparison point, not any latest estimate. Forecasting a higher cost does not itself change the baseline. Approved changes must follow the project's process; retain a record so performance problems are not hidden by silently replacing the original plan. (*Workbook, PDF pp. 227, 130, 144.*)

10. Earned value: terms and six formulas

Earned value integrates scope, schedule and cost. At a common status date, compare **what was planned**, **what was achieved**, and **what it actually cost**. Completion measurement must be defined; unsupported guesses about percent complete undermine every result. (*Workbook, PDF pp. 89–91.*) (*Sep 23, 00:10:35–00:46:03; segments 41–79.*)

Term	Meaning	Older label
PV — planned value	Approved budget for work scheduled by the status date	BCWS

Term	Meaning	Older label
EV — earned value	Approved budget value of work actually performed by that date	BCWP
AC — actual cost	Actual cost incurred for that performed work	ACWP
BAC — budget at completion	Total approved baseline budget for the measured project/work	—
BD — baseline duration	Planned total duration	—

EV is budgeted value, **not actual spending, revenue, profit or risk expected value**. In EVM, “earned” is the E. In risk analysis, “expected” value is probability × impact. Both meanings occur in this course, and Caldwell explicitly clarified the difference. (Sep 23, 01:13:50–01:22:00; segments 90–97.) (Workbook, PDF pp. 91, 229.)

Six course formulas

Measure	Formula	Units	Interpretation
Schedule variance, SV	EV – PV	Budget currency	Positive ahead; negative behind
Schedule performance index, SPI	EV / PV	Ratio	>1 ahead; <1 behind
Revised total duration, RTD	BD / SPI	Time	Simplified total-duration forecast
Cost variance, CV	EV – AC	Budget currency	Positive under; negative over
Cost performance index, CPI	EV / AC	Ratio	>1 favorable; <1 unfavorable cost efficiency
Estimate at completion, EAC	BAC / CPI	Currency	Total-cost forecast if efficiency persists

Memory cue: EV starts the two variances and the two indices. Schedule compares EV with **PV**; cost compares EV with **AC**. The two forecasts then divide the baseline by the relevant index. SV is not a number of days, even though it describes schedule performance. (Workbook, PDF pp. 111–113.) (Sep 23, 00:43:01–01:10:22; segments 79–89.)

Module-review answers to correct

Review question	Correct answer
Budgeted cost of work performed	EV
Actual cost of work performed	AC
Budgeted cost of work scheduled	PV
Total approved budget at completion	BAC
EAC when current cost efficiency continues	BAC / CPI

The Module 4 review swaps several term answers and prints "EAC = EAC / AC." Use the definitions and forecast above. EVM expands to **Earned Value Management**; risk expected value is a separate concept. (*Module review: Finance M4 Review MASTER.docx, body blocks 20–22, 29.*) (*Module review: Finance M3 Review MASTER.docx, body blocks 5.*) (*Workbook, PDF pp. 98–111.*)

11. Worked EVM examples and graph interpretation

Ten-widget example

Baseline: 10 widgets, \$1,000 budget each, one widget per week, total BAC=\$10,000 and BD=10 weeks. At the end of week 5, five widgets were planned, only three are complete, and AC=\$7,000. Therefore **PV=\$5,000; EV=\$3,000; AC=\$7,000.**

Result	Calculation	Answer
SV	$\$3,000 - \$5,000$	-\$2,000
SPI	$3,000 / 5,000$	0.60
CV	$\$3,000 - \$7,000$	-\$4,000
CPI	$3,000 / 7,000$	0.428571...
RTD	$10 / 0.60$	16.67 weeks total
EAC	$10,000 / (3/7)$	\$23,333.33 total

The project is behind and cost inefficient. Three completed widgets earn \$3,000 because of their budget, regardless of whether they actually cost \$3,000 or \$7,000. Keep the full CPI for forecasting: substituting rounded 0.43 produces a different approximate EAC. (*Sep 23, 00:10:35–01:10:22; segments 41–89.*) (*Workbook, PDF pp. 98–104.*)

Percentage traps in the same example

Question	Correct calculation	Result
What fraction of planned budgeted work is achieved?	EV/PV	60%
How much budgeted work is missing relative to plan?	$(PV - EV) / PV$	40%
How much longer is the simplified total-duration forecast than baseline?	$(RTD - BD) / BD$	66.67%
What fraction of AC is the adverse cost variance?	$(AC - EV) / AC$	57.14%
How much does spending exceed the budgeted value of completed work?	$(AC - EV) / EV$	133.33%

These are different percentages. The lecture's shorthand "40% behind" is a work-progress gap, not automatically 40% more duration. Calling $1 - CPI$ "percent over budget" obscures its denominator; the actual overspend relative to earned budget is $1/CPI - 1$. State the basis whenever interpreting a percentage.

Corrected refinery practice problems

Both have BAC=\$100m and BD=100 weeks. All currency figures below are millions.

Common inputs — money in \$m:

Workbook case	EV	PV	AC	BAC	BD (weeks)
Practice 5, PDF p. 105	65	50	45	100	100
Practice 6, PDF p. 106	45	50	55	100	100

Schedule results:

Workbook case	SV (\$m)	SPI	RTD (weeks)
Practice 5	+15	1.30	76.92
Practice 6	−5	0.90	111.11

Cost results:

Workbook case	CV (\$m)	CPI	EAC (\$m)
Practice 5	+20	1.444444...	69.23
Practice 6	−10	0.818181...	122.22

Practice 5 contains a real answer-key error: the printed SPI calculation uses 65/40 even though the stated PV is 50. Its 1.63 SPI and 61.3-week RTD are incorrect for the inputs. EAC also differs slightly when calculated with unrounded CPI. Practice 6's printed EAC is approximate because CPI was rounded to .82. (*Workbook, PDF pp. 105–106.*) (*Sep 23, 00:51:51–01:10:22; segment 89.*)

Read EVM curves at the same status date

Position of EV	Schedule meaning	Cost meaning
Above PV and above AC	Ahead	Under budget for work performed
Below PV but above AC	Behind	Under budget for work performed
Above PV but below AC	Ahead	Over budget for work performed
Below PV and below AC	Behind	Over budget for work performed

Equal EV/PV means SPI=1; equal EV/AC means CPI=1. For example, SPI=.95 and CPI=1.10 means behind schedule but favorable cost efficiency; SPI=1 and CPI=.93 means on schedule but unfavorable cost efficiency. Compare EV with each other curve separately. **AC versus PV alone cannot establish earned-value status.** (*Workbook, PDF pp. 107–113.*) (Sep 23, 01:22:07–02:06:39; segments 99–111.)

12. Forecast assumptions and control thresholds

The course's **EAC=BAC/CPI** assumes remaining work continues at the cumulative cost efficiency measured so far. It predicts total cost, not the amount left to spend. As an arithmetic extension, **remaining forecast cost = EAC–AC**. The widget case gives \$16,333.33 remaining under that assumption.

Similarly, **RTD=BD/SPI** is a simplified projection that assumes the measured progress rate is useful for predicting total duration. The widget forecast is 16.67 weeks total; after five elapsed weeks, that implies 11.67 weeks remaining. These predictions do not replace analysis of the critical path, resource constraints, changes and remaining work. One derived limitation is visible in the formula: after all baseline work is complete and its scheduled finish has passed, EV=PV=BAC and SPI=1, even if completion was late. Treat the duration formula as a course heuristic, not an exact finish-date rule. (*Workbook, PDF pp. 111–112.*) (Sep 23, 00:46:19–01:10:22; segments 83–89.)

If PV or AC is zero, the corresponding index is undefined. If the relevant index is zero or undefined, do not blindly divide to create a forecast. Investigate the status data and the work instead.

The workbook discusses CPI below .85 after approximately 20% completion and control thresholds around .90–.95. It does not identify the underlying study sufficiently to make a universal rule. A low CPI calls for investigation and recovery analysis; it does not establish that every project is irrecoverable. Define actual thresholds in the management plan according to project needs. (*Workbook, PDF pp. 92, 114.*) (Sep 23, 02:02:46–02:06:39; segment 111.)

Finishing well below budget also deserves analysis. It may reflect genuine efficiency, overestimation, omitted work, poor quality, incomplete actual-cost capture or changes. Check scope, acceptance and benefits; neither force unnecessary spending nor automatically declare success. (*Workbook, PDF pp. 93, 115.*) (Sep 23, 02:07:28–02:21:21; segments 119–131.)

13. Reading status and recommending action

A useful status report states the status date, baseline, actuals, forecasts, variances, causes, risks, recommendations and decisions required. Traffic-light colors summarize agreed criteria; accompany them with numbers and a narrative. A green schedule indicator does not imply green scope, quality or cost. (*Workbook, PDF pp. 94, 115, 159.*) (Sep 23, 02:11:32–02:21:21; segment 131.)

For corrective-action questions:

1. Establish what the supplied evidence actually proves.
2. Identify priorities and constraints agreed with stakeholders.
3. Determine cause, critical-path impact, resource suitability and missing information.

4. Compare feasible options, including schedule, cost, quality, scope and risk effects.
5. Recommend an option and explain its trade-off.
6. Obtain required approval, implement and check results.

Six workbook status scenarios

Scenario	What the evidence supports	Appropriate reasoning
1: SPI=.98, CPI=.92	Slightly behind; unfavorable cost efficiency	Time is high priority. Investigate delays and compatible resource movement; do not sacrifice critical work to improve cost alone.
2: SPI=1.04, CPI=.92	Ahead; unfavorable cost efficiency	Protect the schedule while testing whether extra cost/resources can be reduced safely.
3: SPI=.87, CPI=.92	Behind and unfavorable cost efficiency	Quality is high priority. Assess recovery without trading away essential quality.
4: SPI=1.10, CPI=.90	Ahead and unfavorable cost efficiency	Assess whether excess staffing is buying unnecessary schedule acceleration; preserve the required finish date.
5: planned and actual spending only	\$145,000 actual vs \$143,000 planned through month 4	\$2,000, or 1.40% , above the spending plan. Without EV, neither CPI nor SPI can be computed.
6: schedule/resource/cost charts	Qualitative schedule and spending signals	Read symbols at the status line. Confirm incomplete activity finishes and the critical path; do not invent an exact CPI or SPI from a cost sketch.

Scenario 5's dollar difference is a **spending-plan variance**, not EVM CV. Scenario 6 prioritizes time over cost; a faster alternative still needs resource, quality and risk analysis. The graphs provide limited evidence, so additional information is part of a good answer. (*Workbook, PDF pp. 116–122, 209–214.*) (Sep 23, 02:11:32–03:29:49; segments 131–233.)

14. Establishing effective project control

Establish controls **during planning**, then use them during execution. The workbook's five setup steps are: identify factors and thresholds, establish actual-data collection, establish change control, assign responsibilities, and document/communicate. (*Workbook, PDF p. 139.*) (Sep 28, 00:07:08–01:09:56; segments 1–41.)

A **control factor** is the metric you measure. Its **threshold** defines acceptable deviation and the trigger for review/action. "Budget" is a category or amount, not a sufficient metric. "Actual cumulative spending versus cumulative planned spending, investigate above +5% at each weekly review" defines the factor, comparator, threshold and cadence.

If the threshold is $\pm 5\%$ and spending is $+7\%$, it is outside by **2 percentage points**. If the plan is \$1,000, the allowed band is \$950–\$1,050; \$1,070 exceeds the upper bound by \$20. A variance inside the threshold still merits trend monitoring. (Sep 21, 01:07:40–01:11:38; segments 89–106.) (Sep 28, 00:18:09–00:34:43; segment 37.)

Measurable effort means a discrete work increment with a scheduled completion and tangible result. **Levels of control** mean tracking across activities/work, interim deliverables, major deliverables, milestones and phases. They are not merely “level 1 warning” and “level 2 critical” severity labels. Severity rules can be useful, but they do not fulfill the course's request for controls at different project levels. (Workbook, PDF pp. 128–130, 140.) (Sep 28, 00:18:09–01:16:58; segments 37–77.)

Illustrative eight-factor control register

These are authored examples, not mandatory standards or a record of Liam's actual project.

Category / level	Metric and measurement point	Example threshold	Response
Cost / project	Weekly AC versus cumulative spending plan	$\pm 10\%$	Validate actuals; investigate cause
Cost / forecast	EAC versus BAC at weekly review	Above $+5\%$	Assess recovery and funding need
Schedule / activity	Forecast completion against activity baseline	More than 1 day late	Review dependencies and owner actions
Schedule / milestone	Forecast commissioning date	More than 2 days late	Analyze critical path and escalate
Work / activity	Installation labor hours versus estimate	Above $+10\%$	Check productivity and scope
Deliverable / interim	Accepted rooms installed by day 2	Fewer than 3 of 4 planned	Reassess remaining throughput
Quality / acceptance	Critical defects at handover	More than 0	Correct before acceptance
Phase / progress	Verified preparation-phase completion by day 1	Below 35% when plan is 40%	Investigate a >5 percentage-point gap

The register needs owners, actual-data sources and reporting cadence in a real plan. For proportional comparisons state whether the tolerance is relative percent or percentage points. “40% complete ± 5 percentage points” means 35–45%; a relative $\pm 5\%$ band would mean 38–42%. (Workbook, PDF pp. 142, 215, 246.) (Sep 28, 01:14:24–01:16:58; segments 74–77.)

Use interviews, owner updates, time logs, accounting records, review meetings and tools as appropriate. Define cutoff dates and avoid combining costs through Friday with progress through Monday. Reviews can be informal or formal phase gates, with designated approvers. (Workbook, PDF pp. 129–130, 141.)

15. Change and configuration control

Change can originate from business conditions, regulations, revised needs, misunderstood requirements, technologies, realized risks or learning after implementation. Change is expected; **uncontrolled change** creates avoidable problems. Scope creep is expansion outside the agreed change process. Gold plating adds unrequested features, often without authorization or clear value. (*Workbook, PDF pp. 131–134, 143–146.*) (Sep 28, 01:17:29–01:55:16; segments 81–87.)

The workbook groups its change-control principles into five main headings, with three system components:

- Establish clear baseline requirements with stakeholder participation and approval.
- Route change through a single agreed channel.
- Size the process to the project.
- Implement configuration management, grouped releases and a feature-freeze policy where appropriate.
- Build disciplined adherence to the process.

Configuration management identifies the product's controlled characteristics, records approved changes and checks conformance. Change approval and product-version traceability must remain connected. Grouping releases is a scheduling choice, not permission to skip individual evaluation. A feature freeze needs a stated policy and exception authority; the lecture's 60% timing was an illustration, not a universal requirement. (*Workbook, PDF pp. 132, 144–145.*) (Sep 28, 01:19:31–01:55:16; segments 85–87.)

Change request workflow

1. Document and log the request.
2. Evaluate whether it is needed and appropriate.
3. Analyze effects across scope, schedule, cost, quality, resources, risk and benefits.
4. Have the authorized decision maker accept, reject or defer it.
5. Notify affected parties, including the requester.
6. Integrate approved changes into plans and controlled records.
7. Implement, verify and close the change; track its status.

The workbook's statuses include submitted, evaluated, rejected, deferred, approved, made, verified and closed. **Deferred means postponed**, such as to a future iteration; escalation to a higher authority is a separate action. The lecture sometimes used these ideas together, but they are not synonyms. (*Workbook, PDF pp. 144–145.*) (Sep 28, 01:28:05–01:55:16; segment 87.)

A **change control board (CCB)** is the person or group assigned authority to decide relevant changes. A small project can have a small decision structure; a large one may have multiple levels. The PM can approve only within delegated authority. Not every change needs a large committee, and being the PM does not automatically authorize baseline changes. (*Workbook, PDF pp. 134–135, 145.*) (Sep 28, 01:28:05–01:55:16; segment 87.)

Symptoms of weak performance control include missed deadlines, cost problems, low morale and stakeholder dissatisfaction. Weak change control appears as scope/feature creep and records or versions that no longer match the actual product. Completing scheduled activities alone does not establish project success. (*Workbook, PDF pp. 134–135, 146.*)

16. Executing, monitoring and controlling

Function	Central question	Typical activity
Executing	Are we doing the planned work?	Coordinate people/resources and produce deliverables
Monitoring	What is happening?	Collect data, measure performance, report and distribute information
Controlling	What does it mean and what should change?	Compare against plan, analyze causes/trends, evaluate options and take authorized action

These functions interact throughout delivery. Reporting a variance is monitoring; deciding its response is control; implementing the authorized work requires execution. (*Workbook, PDF pp. 150, 157.*) (Sep 28, 01:55:39–02:11:11; segments 89–97.)

The control cycle can be written as six steps: collect actuals/forecasts; compare with plan; determine causes/impact; take action; make authorized plan revisions; report status/revisions. Some workbook diagrams combine comparison and analysis into one step, giving five boxes rather than six. They describe the same logic. (*Workbook, PDF pp. 130, 141.*)

A status worksheet distinguishes planned, actual and forecast start, finish, effort and cost. A milestone review plan records dates, deliverables, risks, scope changes and their effects. **Actual versus forecast:** a finish forecast is not evidence the activity is already complete. On the workbook's milestone table, the concept-set milestone planned June 30 completed July 8: **8 calendar days late**, not early; the lecture appears to say "June 8." (*Workbook, PDF pp. 151–152, 157–158.*) (Sep 28, 01:59:07–02:11:11; segment 97.)

17. Emerging requirements and project trade-offs

A requirement expresses a needed condition or capability of the product/service/result; it is not simply an activity dependency. The course examples include availability, receipts, appearance and user access. Clarify the need before deciding how to build it. (Sep 28, 02:11:11–02:18:10; segments 98–99.) (*Workbook, PDF pp. 232–234.*)

For a new requirement, determine why it is needed, assess impacts, follow change control and update the requirements record. Assess alternatives by matching features to reprioritized requirements, making design trade-offs, analyzing whole-project impact and verifying decisions with stakeholders. A sponsor's idea is still a proposed change requiring analysis and appropriate authorization. (*Workbook, PDF pp. 153, 159–160.*)

Trade-off scenario 1: lost specialist resources

The project baseline is \$750,000 and 8.5 months. At month 6, actual spending is \$650,000 versus \$625,000 planned. Two resources intended for H were reassigned. Internal substitutes take longer; contracting adds \$50,000. Time has high priority and cost low priority. The workbook is inconsistent about the internal option: its

slide says **50% longer**, while the appendix exercise says **100% longer**. The lecture uses the twice-as-long version. State which assumption you use. (*Workbook, PDF pp. 161–162, 217–218.*) (Sep 28, 02:56:38–02:58:34; segments 127–128.)

Compare internal staffing with outside specialists. If qualified outside resources restore the needed finish and are feasible, recommend the additional expenditure for stakeholder authorization because it protects the higher-priority schedule. \$50,000 is **6.67%** of the \$750,000 baseline; a one-month delay is **11.76%** of 8.5 months. The sample solution's "about 11%" is loose rounding, not precise arithmetic. Those percentages inform the case but are not automatically equivalent measures of business value. (*Workbook, PDF p. 247.*)

The \$25,000 spending difference does not alone prove EVM cost inefficiency: no EV is given. The proposal must consider remaining funding, contractor availability, competence and the true critical-path benefit.

Trade-off scenario 2: pressure to skip UAT

A poorly performing project has \$750,000 actual spending against \$625,000 planned. A sponsor proposes eliminating user acceptance testing (UAT) to gain time. Time and quality are high priorities, but the workbook warns that the earlier survey did not establish sound stakeholder consensus. Its sample solution calls for an urgent stakeholder review of current needs, risks and priorities. (*Workbook, PDF pp. 163–164, 219–220, 247.*)

Preserve essential acceptance validation while evaluating recovery options: qualified extra resources, feasible overlap, genuine scope reprioritization and schedule revision. Crashing requires resources that can actually shorten critical work; adding unsuitable staff is not a solution. Fast tracking adds overlap risk and is only feasible where dependencies allow it. Do not remove acceptance work merely to make the dates look favorable or to satisfy personal career pressure. Caldwell challenged the proposal to cancel tests and emphasized quality and suitable resources. (Sep 28, 02:58:38–03:05:09; segments 130–157.)

A strong recommendation explains benefits, consequences, assumptions and the decision needed. Reconfirm priorities when evidence is stale or stakeholders disagree, then record and communicate the authorized decision.

18. Procurement planning and contract types

Procurement acquires goods or services from outside the performing organization. The two parties are **buyer** (purchaser/customer/client) and **seller** (vendor/supplier/contractor). A team can act as a buyer in one relationship and a seller in another. (*Workbook, PDF pp. 168, 178–180.*) (Sep 30, 00:06:49–00:20:23; segments 5–29.)

The three course processes are **plan procurement management, conduct procurements and control procurements**. Planning decides approach and documents it; conducting obtains responses, selects a seller and awards a contract; controlling manages performance, changes and closure. (*Workbook, PDF pp. 168, 179, 194.*)

Make or buy

Compare in-house delivery with outsourcing. Consider costs, capabilities, availability, time, quality, control, risk and dependencies; use CBA to support the choice. A low quoted price does not establish a lower whole-life cost. Options include buying a large portion from one seller, multiple sellers, a minor portion, or nothing. (*Workbook, PDF pp. 169, 183.*) (Sep 30, 00:23:28–00:29:18; segments 39–41.)

Procurement planning covers the objective, a clear SOW, roles, market/qualified sellers, constraints, contract type, solicitation documents, evaluation criteria and the management plan. A **statement of work (SOW)** specifies the procured work and measurable expectations, with specifications, drawings and acceptance criteria as appropriate. It can be part of a contract; it is not automatically a complete, legally enforceable contract by itself. (Workbook, PDF pp. 170, 173, 181.) (Sep 30, 00:17:43–00:23:11; segments 29–35.)

Contract categories and cost risk

Family	Payment basis	Most useful course condition	Main cost-overrun exposure
Fixed price	Agreed price for defined scope	Clear scope and relatively low uncertainty	More on the seller for the agreed scope
Cost reimbursable	Allowable costs plus agreed fee arrangement	Uncertainty makes reliable fixed pricing difficult	More on the buyer, subject to terms and limits
Time and materials (T&M)	Agreed labor rates × hours, plus materials	Extent/duration hard to estimate; flexible services	Buyer bears quantity/duration exposure; monitoring and ceilings limit it

Risk labels are comparative, not a promise that either party has **all** or **no** risk. Fixed price does not authorize unlimited additional scope at the original price. T&M fixes unit rates, not necessarily the total bill; it is not identical to every type of unit-price contract. The workbook describes T&M as controllable medium buyer risk, while the lecture uses stronger language; retain the payment structure and controls rather than an absolute risk ranking. (Workbook, PDF pp. 171, 185.) (Sep 30, 00:34:19–00:56:25; segments 49–59.)

Contract variants to recognize

Abbreviation	Meaning	Distinction
FFP	Firm fixed price	Defined scope for a fixed agreed price
FPIF	Fixed price incentive fee	Incentive structure changes final compensation according to agreed performance/cost provisions
FP-EPA	Fixed price with economic price adjustment	Defined adjustments for specified economic changes; workbook addition not developed in the lecture
CPFF	Cost plus fixed fee	Allowable costs reimbursed; fee fixed at inception, rather than a constant percentage of actual costs
CPIF	Cost plus incentive fee	Fee varies under agreed objective/formula incentives
CPAF	Cost plus award fee	Award reflects evaluated performance under stated criteria; not simply winning a design competition

Abbreviation	Meaning	Distinction
CPP / CPPC	Cost plus percentage of cost	Fee increases as reimbursed costs increase; weak cost-control incentive

The class's \$50,000 price/fee and \$5,000 early-finish bonuses illustrate incentive concepts. For US federal contracting, FPIF and CPIF have more specific target/formula structures; CPAF uses an award-fee evaluation framework. See [FAR 16.403-1](#), [16.405-1](#), and [16.401\(e\)](#). (*Workbook, PDF pp. 172, 185–186.*) (*Sep 30, 00:34:19–00:56:25; segments 49–59.*)

The US federal FAR prohibits cost-plus-a-percentage-of-cost contracting. **This does not prohibit every cost-reimbursement form:** CPFF is a recognized form, with restrictions. See [FAR 16.102\(c\)](#) and [16.306](#). For T&M, FAR 16.601 also describes fixed labor rates, oversight and a ceiling. The study point is to distinguish payment mechanisms; actual procurement must follow the governing policy and contract. (*Sep 30, 01:17:51–01:20:18; segments 82–89.*)

Classroom selection examples

- Completed website design/specification package: fixed price can fit because scope is defined.
- Novel work whose effort cannot yet be established: consider cost reimbursable with clear controls.
- Plumbing diagnosis/repair with uncertain extent: T&M can fit, with rates and limits.

Caldwell endorsed these examples, including Liam's website and plumbing suggestions. They illustrate reasoning, not rules that every website or repair must use that form. (*Sep 30, 01:14:57–01:45:49; segments 68–92.*)

Contract essentials

The workbook asks about offer/acceptance, consideration, legal purpose, capacity, consent and authorized parties. It also discusses the intention and mutual obligations of the agreement. Know those course concepts and ensure authorized procurement/legal review. The lecture's suggestion that oral agreements generally cannot bind is too broad: enforceability depends on law and the agreement; some must be written. See [Cornell LII's oral-contract overview](#). Use clear written documentation for project procurement and distinguish the SOW, contract and signature authority. (*Workbook, PDF pp. 170, 184.*) (*Sep 30, 00:29:21–00:34:16; segments 42–47.*)

19. Solicitation, selection and negotiation

Document	Purpose	Course emphasis
IFB — invitation for bid	Bids for clearly specified comparable work	Commonly price driven; assess responsive, qualified offers
RFP — request for proposal	Compare proposed solutions/approaches	Technical, management and cost criteria; innovation can matter

Document	Purpose	Course emphasis
RFQ — request for quotation	Obtain prices for specified requirements	Clarify whether research or purchasing under the relevant procedure
RFI — request for information	Learn market capabilities/options	Helps refine the approach before formal selection

The workbook associates IFB with fixed price and RFP with cost reimbursement. These are course associations, not universal pairings. RFQ is not a mandatory preliminary step before every IFB. Evaluate the actual solicitation and governing process. (*Workbook, PDF pp. 173, 187–190.*) (*Sep 30, 01:20:42–02:10:38; segments 92–96.*)

Develop criteria **before** evaluation. Define dimensions, scale, weights, required qualifications and a consistent scoring method. Management capability, technical performance and cost are common dimensions. For an authored example with weights .30 cost, .50 technical and .20 management, scores 4, 5 and 3 produce $.30(4) + .50(5) + .20(3) = 4.30$ out of 5. Scores guide the documented decision; do not silently rewrite criteria to favor a preferred seller. (*Workbook, PDF pp. 173, 189–191.*)

The conduct-procurement sequence is advertise, conduct a bidder conference as appropriate, receive responses, validate bids, evaluate proposals, and negotiate/complete the contract. Validate unusually low prices for omissions or misunderstanding as well as legitimate efficiency. Use any required qualified-seller list. (*Workbook, PDF pp. 174, 190.*)

Bidder conference: a buyer-led clarification meeting before bids are submitted. Give potential sellers consistent information. It is not a series of seller sales pitches. Clarifications should be available fairly under the solicitation rules; private favoritism undermines the process. (*Sep 30, 01:46:19–02:10:38; segment 96.*) (*Workbook, PDF p. 190.*)

Negotiation

Seek a fair price and workable relationship. A win-win outcome meets important interests on both sides and supports future performance; a short-term one-sided victory can damage trust. Liam's experience in the final class illustrated the long-term cost of a win-lose relationship. (*Sep 30, 02:29:07–02:44:49; segments 103–129.*) (*Workbook, PDF pp. 191–193.*)

BATNA = best alternative to a negotiated agreement: the best available course of action if this negotiation produces no agreement. Improving your alternative strengthens your ability to decline a poor deal. Concessions and reservation limits are related preparation topics, but they are not BATNA itself. The workbook uses the correct expansion; the lecture describes bargaining flexibility more loosely. See [Harvard Program on Negotiation](#). (*Workbook, PDF pp. 192, 197.*) (*Sep 30, 01:46:19–02:10:38; segment 96.*)

Know the tactics so you can recognize pressure: attacks, surprise, delay, deadline, good-guy/bad-guy, limited authority, missing decision maker and lying. The workbook lists them for recognition, not as a recommendation to mislead. Prepare interests, evidence, limits, decision authority and alternatives; preserve respectful communication. The classroom discussion favored more definite questions in one sales context; **do not turn that into a rule to avoid all open questions**. Use questions suited to understanding needs and confirming commitments. (*Workbook, PDF pp. 175, 192–193.*) (*Sep 30, 01:46:19–02:44:49; segments 96, 103–129.*)

Contract privity concerns who has a direct contractual relationship. Know which parties are actually bound and who has authority to give directions, approve amendments or resolve disputes. A subcontractor relationship is not automatically identical to the buyer's prime contract relationship. (*Workbook, PDF pp. 174, 190, 197.*)

20. Procurement control and closure

Procurement control includes performance tracking, relationship management, authorized changes and closeout. Use the SOW and contract to define acceptable results, measures, reports, review dates and payment conditions. Observe work, meet with the seller and check reports; the frequency should fit the work. Integrate contract change control with project change control, while retaining actual contract-amendment authority. (*Workbook, PDF pp. 176, 194–196.*) (*Sep 30, 02:33:18–02:44:49; segment 129.*)

For a possible dispute, preserve facts and records, identify the authorized commercial/legal decision makers, and escalate appropriately. The workbook emphasizes that one breach is not an automatic remedy for another. A PM should not invent a legal remedy or direct an unauthorized contract change. Treat the contract's terms and the applicable law as the basis for specialist review.

Contract closure checks that goods/services meet requirements; settles legitimate payments and obligations; completes performance reports and contract records; holds a post-contract review as appropriate; and archives lessons learned. A seller's statement that work is finished is not a substitute for verification. Closing an individual contract and closing the whole project are distinct events. (*Workbook, PDF pp. 176, 195–196.*) (*Sep 30, 02:33:18–02:44:49; segment 129.*)

21. Integrated application and final recall checklist

One connected example: commercial dishwasher installation

This is an **authored study example inspired by Liam's classroom project**, not a reconstruction of his submitted estimates.

1. **Define scope and acceptance:** install and commission the specified machine; verify electrical/plumbing compatibility, operating performance and staff handover. State exclusions and approvals.
2. **Estimate planned work:** \$2,000 installation labor + \$3,000 machine/materials + \$500 commissioning/training = **\$5,500 work budget**.
3. **Assess residual cost risk:** a 10% chance of a \$1,000 delivery issue gives \$100; a 20% chance of a \$500 compatibility correction gives \$100; a 5% chance of \$2,000 emergency labor gives \$100. Sum **\$300 contingency**.
4. **Authorize the baseline:** \$5,500 + \$300 = **\$5,800**. If an additional \$200 management reserve is separately authorized, the total project budget is **\$6,000**; do not put that \$200 into BAC without an approved baseline transfer.
5. **Phase the plan:** assign work and reserve treatment to the schedule, establish measurement rules and maintain sufficient funding. Do not assume all cash is spent on the first day.

6. **Set controls:** milestone finish deviation, actual labor hours, verified progress, cost forecast and acceptance defects. Assign owners, cadence and numeric thresholds.
7. **Select procurement:** a clearly specified machine can support fixed pricing; uncertain site repair may require separately controlled T&M. Define acceptance and amendment authority.
8. **Track a status point:** if $PV=\$2,900$, $EV=\$2,320$ and $AC=\$2,600$, $SPI=.80$, $CPI=.892307\dots$, $SV=-\$580$ and $CV=-\$280$. Under constant efficiency, $EAC=\$6,500$ using $BAC=\$5,800$. The EAC exceeds the baseline and the example's total budget, so evaluate causes, remaining work, recovery options and authorization.
9. **Handle new scope:** assess and log requests; approve before changing plans/contracts. Corrective action and authorized baseline change are distinct decisions.
10. **Verify and close:** confirm safe functioning and agreed acceptance, settle records/payments and retain lessons.

This ties together the course's recurring lesson: approved expectations, measurable results, reliable actuals, analysis and authorized response must remain connected. (*Sep 21, 01:55:29–03:01:54; segments 143–150, 206–211.*) (*Workbook, PDF pp. 68–84, 112, 139–145, 196.*)

Can you explain these without looking?

- Strategic versus financial objectives; project delivery versus benefit realization.
- Cost of capital versus actual return; present value versus NPV.
- Plan financial management, estimate costs, develop budget, control finances.
- Analogous, parametric, bottom-up, modified Delphi and three-point estimating.
- ROM/budgetary/definitive course ranges; PERT versus triangular mean.
- Prevention/appraisal versus internal/external failure costs.
- Contingency versus management reserve; work budget, baseline and total budget.
- Risk expected value versus EVM earned value.
- $PV/EV/AC/BAC/BD$; $SV/SPI/RTD/CV/CPI/EAC$ and each unit.
- Progress shortfall versus duration extension; CPI versus overrun percentages.
- Why AC/PV alone cannot establish earned-value status.
- Factor versus threshold; measurable effort; multiple levels of control.
- Execute versus monitor versus control; report, analyze and act.
- CCB, scope creep, gold plating, configuration control and deferred changes.
- Priority-based trade-offs and the value of stakeholder agreement.
- Buyer/seller, make/buy, SOW and the three procurement processes.
- FFP/FPIF/FP-EPA/CPFF/CPIF/CPAF/PPP/T&M payment and risk distinctions.
- IFB/RFP/RFQ/RFI, bidder conference, selection criteria, BATNA and privity.
- Contract performance control, acceptance, financial closure and lessons.

Use the separate practice set next. When an answer is wrong, revisit the concept and its source rather than memorizing the answer alone.