INFO3333
Semester 1, 2019

Module 5 Lecture:

Time and Cost Management (introduction)

based on slides by Dr Rabiul Hasan and Prof Alan Fekete, using content in "Information Technology Project Management (9th ed)" by K. Schwalbe, pub Cengage

Reminder: progress oral presentations

In lab on Monday April (Module 5, week 6)

Duration: 4 minutes per group

Weight in assessment: ZERO (just “successful” or “unsuccessful” like record of meeting etc)

But also get feedback from tutor as a “mark” using a rubric (this is crucial practice for the week 10 oral presentations which are worth 5%)

progress oral presentations

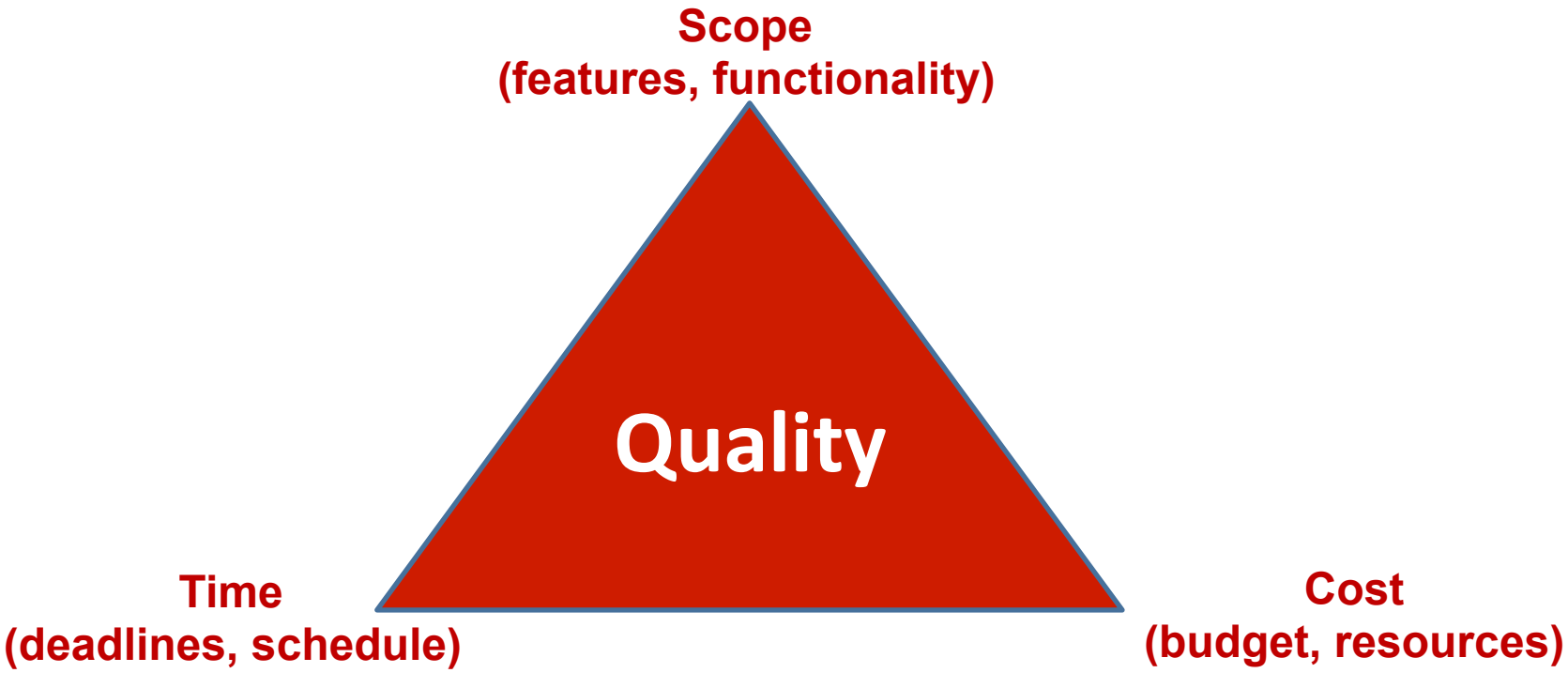
- Describe your work up to scope and requirements (not including risk register)
  - it's not about the process you have followed in doing the work on the info3333 group project, but instead it's about your current understanding of the Colesworth project you chose
- Communicate (tone, use of language, level of detail, focus of discussion) as if you are presenting to Colesworth CIO
- Every group member to speak
- Tutor will expect to see that your understanding of the project has improved from initial attempts, by making changes based on their feedback in earlier tutor meetings

Learning objectives

- Terminology
- overall PMBOK approach to time management
- overall PMBOK approach to cost management
- Agile approach to time and cost management
- Comparing PMBOK and Agile approaches

Recall: What makes projects hard?

- "Triple constraint"



Importance of Time Management

- It’s especially challenging: many (most) IT projects run late
- Time passes constantly; no way to adjust this rate!
- Schedule issues are a major cause of conflicts on projects

Importance of Cost Management

- It's especially challenging: many (most) IT projects run over budget
- In most organizations, money is the dominant focus (managers performance measured this way)
  - in some organizations eg non-profits, money may be less dominant for managers, but also, usually, it is rather scarce in these organizations

Activity list

- An activity is a task to be done (from WBS) with associated information ("activity attributes") about expected duration, dependencies, constraints, cost, resource requirements, etc
- Activity list includes the activities, each with identifier and name as well as attributes

Milestone

- A *significant event* that is expected to occur in the project
  - eg when a whole component is ready, or when a review has been passed, or a key document has been signed-off
- Typically, have no duration; either it has happened, or not
  - it is important to define milestone so one can judge objectively whether it was reached successfully
- Typically, one milestone requires outcomes of multiple activities

Project schedule

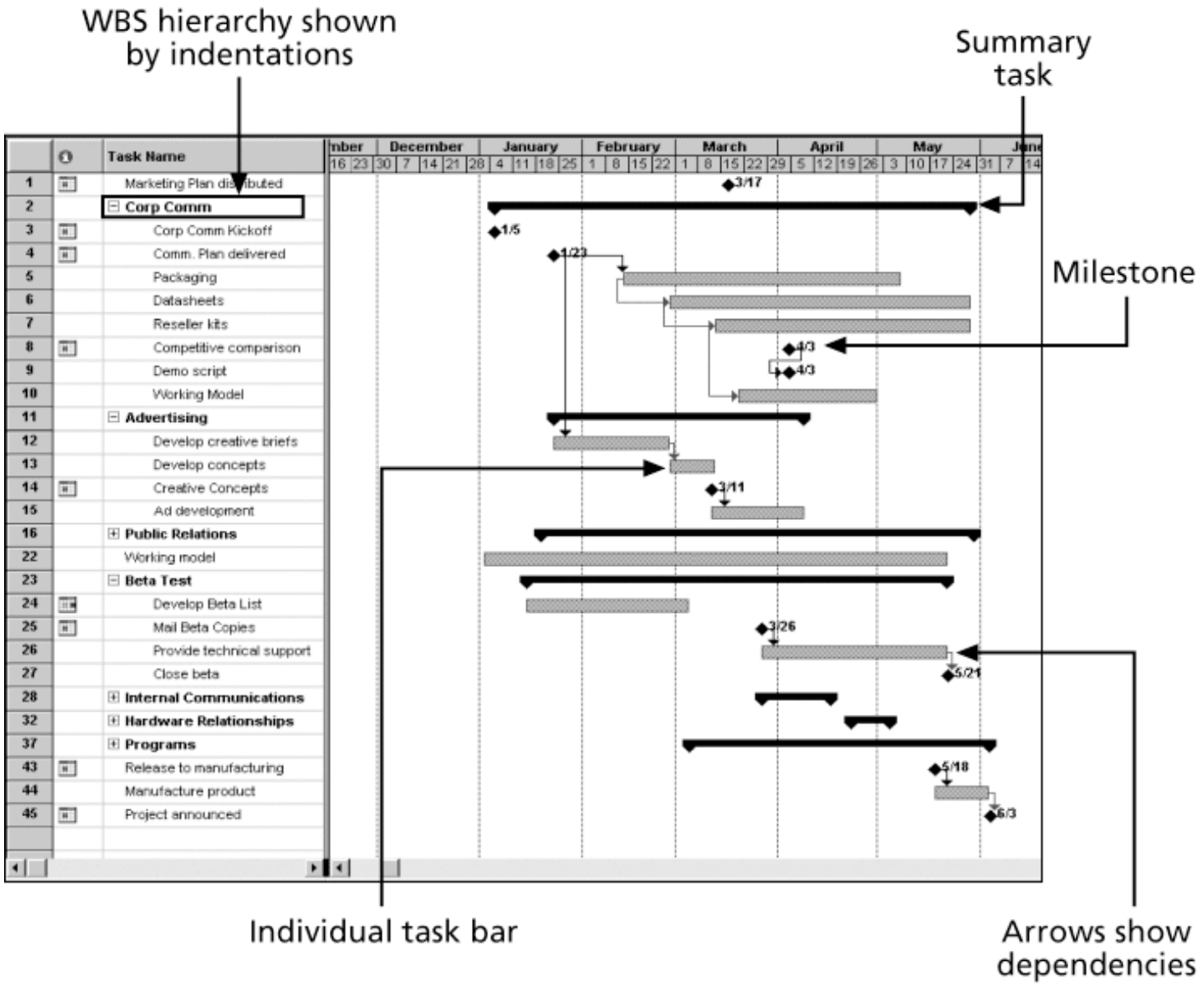
- Shows project activities and milestones with intended dates (intended start and finish, for each activity; date for each milestone to be reached)

Gantt Charts

- **Gantt charts** provide a standard format for displaying project schedule information by listing project activities and their corresponding start and finish dates in a calendar format
  - plenty of tools to support this format (eg Microsoft Project)

- Symbols include:
  - A black diamond: a milestone
  - Thick black bars: summary tasks
  - Lighter horizontal bars: durations of tasks
  - Arrows: dependencies between tasks

Gantt Chart for Software Launch Project



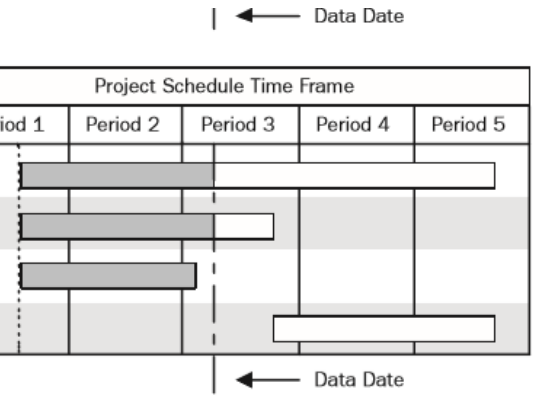
Summary Schedule

&

Detailed Schedule

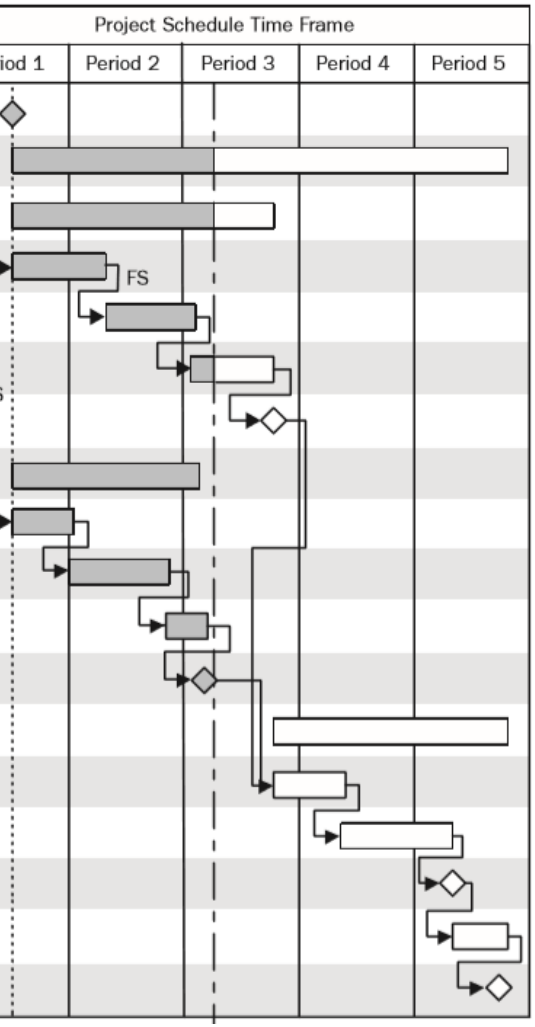
Summary Schedule

Activity Identifier	Activity Description	Calendar units
1.1	Develop and Deliver New Product Z	120
1.1.1	Work Package 1: Component 1	67
1.1.2	Work Package 2: Component 2	53
1.1.3	Work Package 3: Integrated Components 1 and 2	53



Detailed Schedule

Activity Identifier	Activity Description	Calendar units
1.1.MB	Begin New Product Z	0
1.1	Develop and Deliver Product Z	120
1.1.1	Work Package 1: Component 1	67
1.1.1.D	Design Component 1	20
1.1.1.B	Build Component 1	33
1.1.1.T	Test Component 1	14
1.1.1.M1	Complete Component 1	0
1.1.2	Work Package 2: Component 2	53
1.1.2.D	Design Component 2	14
1.1.2.B	Build Component 2	28
1.1.2.T	Test Component 2	11
1.1.2.M1	Complete Component 2	0
1.1.3	Work Package 3: Integrated Components 1 and 2	53
1.1.3.G	Integrate Components 1 and 2 as Product Z	14
1.1.3.T	Complete Integration of Components 1 and 2	32
1.1.3.M1	Test Integrated Components as Product Z	0
1.1.3.P	Deliver Product Z	7
1.1.3.MF	Finish New Product Z	0



Source: A Guide to the Project Management Body of Knowledge, Fifth Edition (PMBOK® Guide) © 2013 Project Management Institute

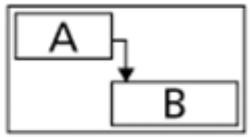
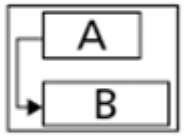
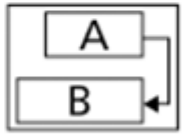
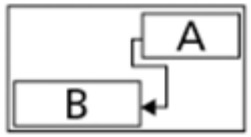
Project Time Management processes

- **Plan schedule management:** determining the policies, procedures, and documentation that will be used for planning, executing, and controlling the project schedule
- **Define activities:** identifying the specific activities that the project team members and stakeholders must perform to produce the project deliverables
- **Sequence activities:** identifying and documenting the relationships between project activities
- **Estimate activity durations:** estimating the number of work periods that are needed to complete individual activities
- **Develop the schedule:** analyzing activity sequences, activity resource estimates, and activity duration estimates to create the project schedule
- **Control the schedule:** controlling and managing changes to the project schedule

Sequence activities

- Identify dependencies between activities
  - situations where the timing of work is not completely independent
  - eg if the output of taks1 is used as an input in task2, that means we can't start task2 until after task1 is finished
    - there is a finish-to-start dependency of task2 on task1
- Example: you can't start run-tests until all of write-code AND write-tests AND install-test-framework do-training-in-test-framework are finished
- Example: you can't start write-code-to-store-cart-contents-in-database until choose-database is finished
  - But, by coding with APIs, one might write the code that uses database before the database is installed

Task Dependency Types

Task dependency	Example	Description
Finish-to-start (FS)		Task (B) cannot start until task (A) finishes.
Start-to-start (SS)		Task (B) cannot start until task (A) starts.
Finish-to-finish (FF)		Task (B) cannot finish until task (A) finishes.
Start-to-finish (SF)		Task (B) cannot finish until task (A) starts.

How to identify dependency

- This involves a lot of domain knowledge and technology knowledge
  - eg for a given activity: what data will be used, what tools will be used, how the components will interact
    - especially, for code, whether interface or implementation is needed from another component
- Involve stakeholders in the discussions

Estimate durations

- This is really hard to do well: discussed in Module 6 next week
- For the moment, just do coarse qualitative estimates (eg a little work, medium work, a lot of work)

Develop schedule

- Systematic approach, once activities durations are known
- Discussed in module 6 (next week)

Techniques to Control Schedule

- Continually monitor progress, and adjust schedule to respond
  - eg one activity is delayed, then the dependent ones need to move also
  - eg one activity finishes early, look for others than can be moved up
  - recognize potential for difference between the views of project team on status, and reality
    - have ways to check independently (eg look at repo commits)
- Schedule should allow for contingencies and so have some slack
  - But project manager needs to recognize when this isn't enough, and so milestones or overall schedule end-date will need to be adjusted
- Hold progress meetings with stakeholders, and be clear and honest in communicating schedule issues: "avoid surprises", "manage expectations"
  - organization may be able to deal with delays

Reality Checks on Scheduling

- First review the draft schedule or estimated completion date in the project charter
- Prepare a more detailed schedule with the project team
- Make sure the schedule is realistic and followed
- Alert top management well in advance if there are schedule problems

Learn from experience

- Keep careful records of all slippages
  - "Tracking Gantt chart" shows original planned schedule and adjusted actual work
- Look for patterns
  - eg particular people who regularly underestimate or overestimate time required
  - eg particular types of activity where estimates are commonly found to be wrong
  - eg particular types of events that often cause delay
- Feed into future planning
  - also incorporate into risk management!

Project Cost Management processes

- **Planning cost management**: determining the policies, procedures, and documentation that will be used for planning, executing, and controlling project cost.
- **Estimating costs:** developing an approximation or estimate of the costs of the resources needed to complete a project
- **Determining the budget:** allocating the overall cost estimate to individual work items to establish a baseline for measuring performance
- **Controlling costs:** controlling changes to the project budget

Financial Terms To Use

- Most members of an executive board better understand and are more interested in financial terms than IT terms, so IT project managers must speak their language (financial terms)
  - **Revenue** money that is received
  - **Expenditure** money that is spent
  - **Profits** are revenues minus expenditures
  - **Profit margin** is the ratio of revenues to profits
  - **Life cycle costing** considers the total cost of ownership, or development plus support costs, for a project
  - **Cash flow analysis** determines when money arrives and leaves
    - even a profitable project may have difficulty if spending happens early, but revenue arrives late

Costs and Benefits

- **Tangible costs** or **benefits** are those costs or benefits that an organization can easily measure in dollars
- **Intangible costs** or **benefits** are costs or benefits that are difficult to measure in monetary terms (eg reputation, voluntary work)

- **Direct costs** are costs that can be directly related to producing the products and services of the project
- **Indirect costs** are costs that are not directly related to the products or services of the project, but are indirectly related to performing the project
  - often estimated as a given percentage of direct costs

- **Sunk cost** is money that has been spent in the past; when deciding what projects to invest in or continue, you should *not* include sunk costs

Reserves

- **Reserves** are dollars included in a cost estimate to mitigate cost risk by allowing for future situations that are difficult to predict
  - **Contingency reserves** allow for future situations that may be partially planned for (sometimes called **known unknowns**) and are included in the project cost baseline
  - **Management reserves** allow for future situations that are unpredictable (sometimes called **unknown unknowns**

Estimating Costs -- Tools and Techniques

- Basic tools and techniques for cost estimates:
  - **Analogous** or **top-down estimates:** use the actual cost of a previous, similar project as the basis for estimating the cost of the current project
  - **Bottom-up estimates:** involve estimating individual work items or activities and summing them to get a project total
  - **Parametric modeling** uses project characteristics (parameters) in a mathematical model to estimate project costs

Evolution of cost estimates

- Very early in project, aim for rough **order-of-magnitude estimate**
  - used to give go-ahead for further work that will develop more detailed plans, with better understanding of scope etc, allowing more detailed budget
- **Budgetary estimate** used to get money allocated for the project, typically companies have budgets set year or more in advance
  - it's understood that this will allow some variation during execution eg 10%
- **Definitive estimate**, with details per task, used in purchasing and then in project execution

Estimating Costs -- Issues with IT Project

- Estimates are done too quickly
  - not enough time and staff provided for doing the estimate
- People lack estimating experience
  - not enough *experienced* staff provided for doing the estimates
  - feedback to estimators is often lacking
- Human cognitive biases: want to look good to self and others, so don't think enough about what could go wrong (what has gone wrong)
- Management pushes for impossible and unnecessary accuracy
- Sales or managers make promises before getting real estimates, then pressure estimates to match promises!

Sample Cost Estimate

Surveyor Pro Project Cost Estimate Created October 5

	# Units/Hrs.	Cost/Unit/Hr.	Subtotals	WBS Level 2 Totals	% of Total
WBS Items					
1. Project Management				**$306,300**	**20%**
Project manager	960	$100	$96,000		
Project team members	1920	$75	$144,000		
Contractors (10% of software development and testing)			$66,300		
2. Hardware				**$76,000**	**5%**
2.1 Handheld devices	100	$600	$60,000		
2.2 Servers	4	$4,000	$16,000		
3. Software				**$614,000**	**40%**
3.1 Licensed software	100	$200	$20,000		
3.2 Software development*			$594,000		
4. Testing (10% of total hardware and software costs)			$69,000	**$69,000**	**5%**
5. Training and Support				**$202,400**	**13%**
Trainee cost	100	$500	$50,000		
Travel cost	12	$700	$8,400		
Project team members	1920	$75	$144,000		
6. Reserves (20% of total estimate)			$253,540	**$253,540**	**17%**
Total project cost estimate				**$1,521,240**	

*See software development estimate.

source: K. Schwalbe, IT Project Management (9th ed)

Determining the Budget

- Cost budgeting involves allocating the project cost estimate to individual work items over time
- The WBS is a required input to the cost budgeting process since it defines the work items

- Important goal is to produce a **cost baseline**
  - a time-phased budget that project managers use to measure and monitor cost performance

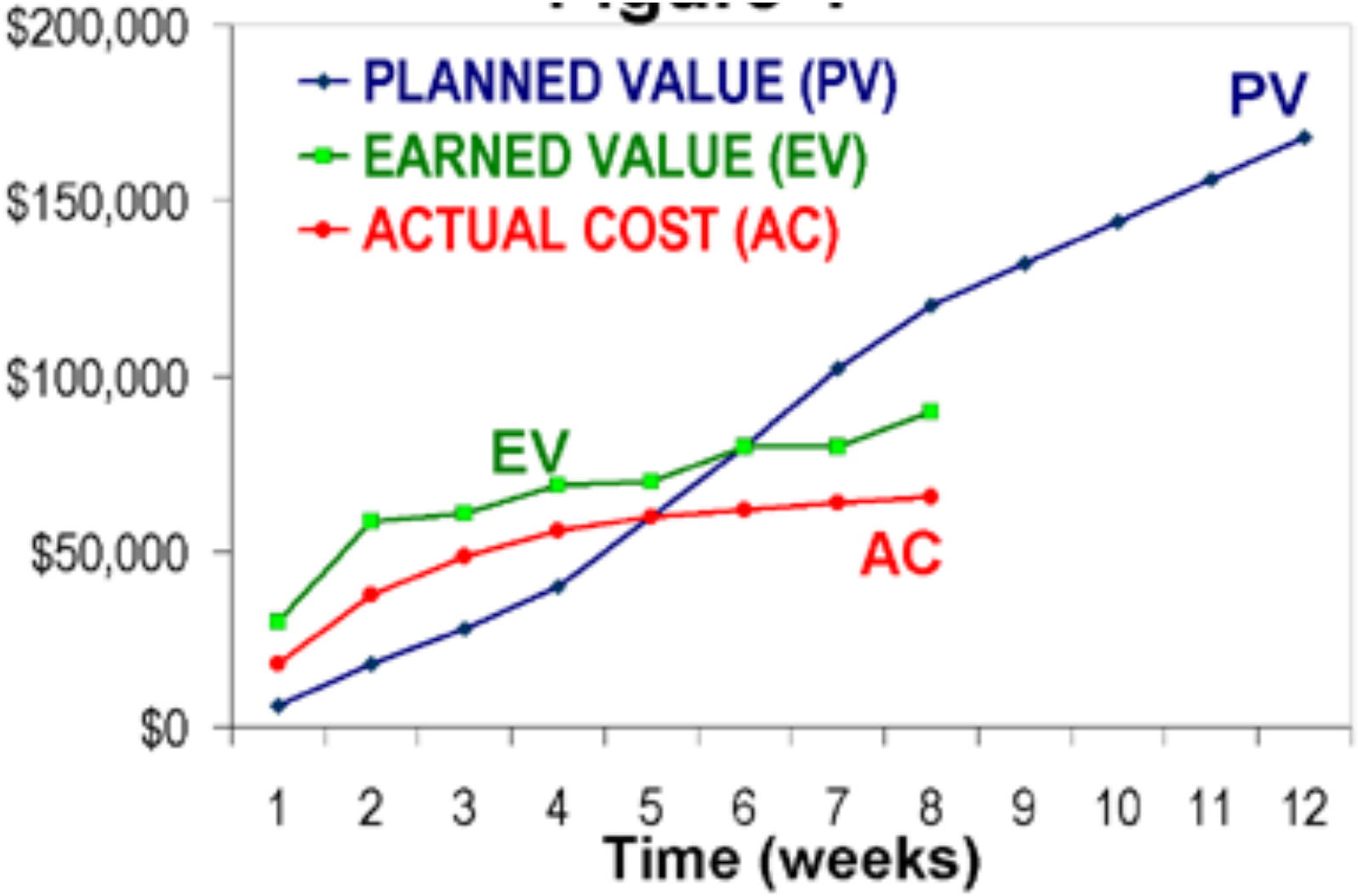
Earned Value Management

- Cost management technique introduced in US government in 1960s
- Key idea: compared money actually spent at a certain point, with money that was planned to spend for the work that has actually been completed
- Separate schedule slippage issues from cost over-run issues
- See https://en.wikipedia.org/wiki/Earned_value_management

Measures in EVM

- Planned Value (PV): budget that was allocated to be spent up to a time point
- Actual Cost (AC): money that was spent up to a time point
- Earned Value (EV): budget that was allocated to the work actually completed up to a time point

- Note: these are all cumulative (they grow as time advances)



source: G. Booker, public domain from Wikipedia

Calculations in EVM

- Cost variance (CV) = EV-AC
  - positive is good (project spent less than planned for that work)
- Cost performance index (CPI) = EV/AC
  - greater than 1 is good
- Schedule variance = EV – PV
- Budget at completion (BAC): total planned cost, placed to scheduled project end date
- Estimate at completion = BAC/CPI
  - adjust planned estimates, based on performance so far

Communications about schedule and budget

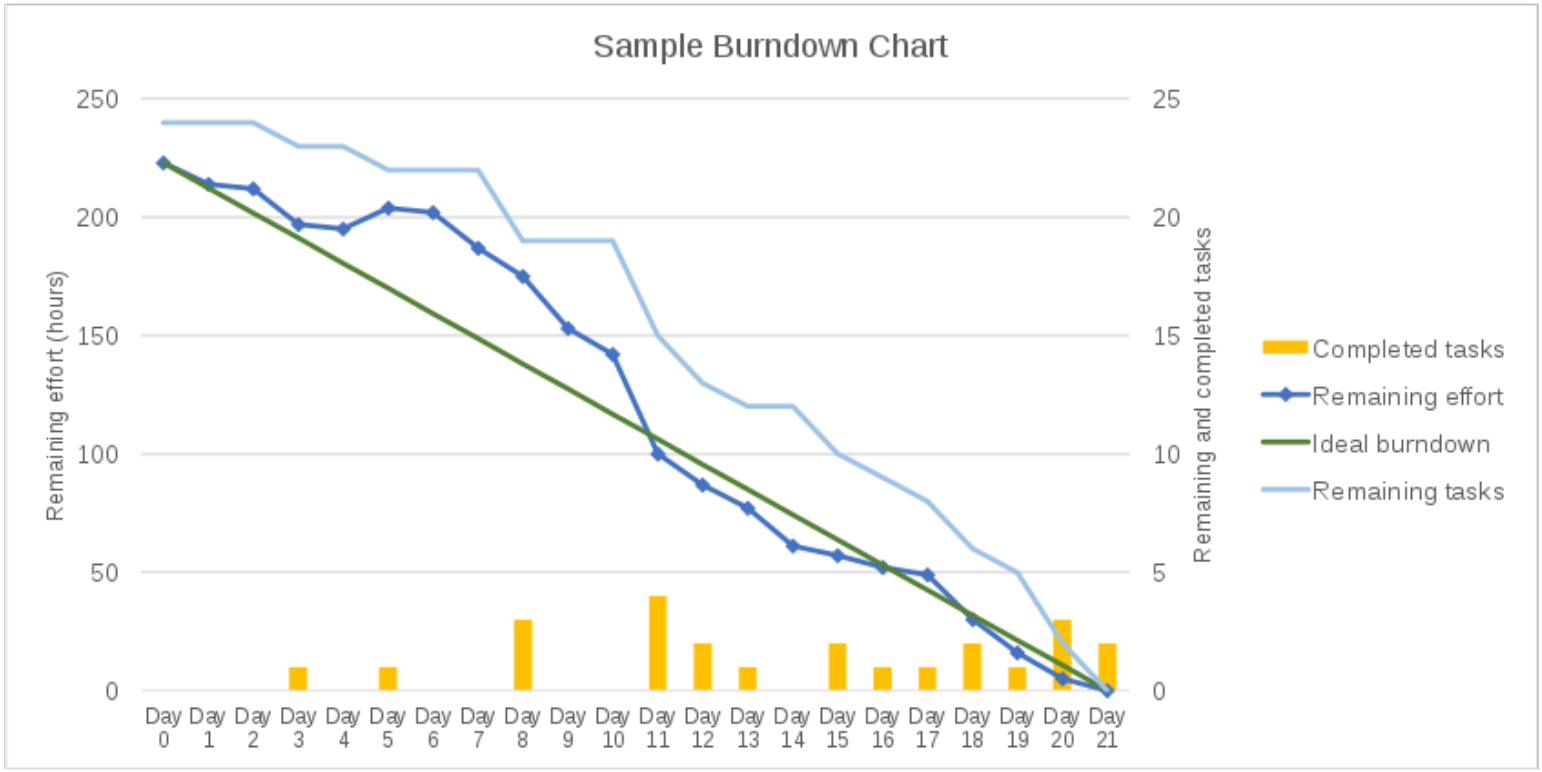
- Keep project upper managers well informed
- What to tell internal customer?
  - don't reveal contingency reserves, schedule slack etc
    - they may pressure to reallocate this
  - but do keep them informed of risks, likely slippage of milestones
- What about external customer?
  - keep informed of possible need to vary agreed budget, risks, likely slippage of milestones,

Agile approach

- Agile projects use time-boxed iterations (in Scrum, called sprints)
  - typically short (a few weeks)
- The schedule cannot slip
- Budget could need adjusting a bit eg if extra tools need to be bought, but people are the main cost, so budget also has very little variation
- Agile adjusts the scope: project can change which user stories get delivered by an iteration
  - while in an iteration, only change is if some chosen stories are not delivered, or if some extra ones are
  - from each iteration to the next, priorities on remaining stories are reconsidered with stakeholder involvement

Burn-down chart

source:
P. Straub,
CC licence
from
wikpedia



- A diagram showing progress on the project
  - typically show actual and ideal, usually for work in a single iteration
- X-axis is elapsed calendar time
- y-axis can be amount of work remaining
  - or, estimated time for doing the remaining work
- Kept to help improve estimating for future iterations
- See https://en.wikipedia.org/wiki/Burn_down_chart

Comparison agile and PMBOK

- PMBOK keeps scope, but schedule and budget may (often do) slip
  - unless project fails, eventually customer gets what they expected
  - this approach fits well with other large-organizational processes
- Agile keeps schedule but scope may (usually does) adjust
  - one way agile can adjust schedule is by number of iterations
  - eg when customer decides to halt the project
  - this approach is especially suited to IT, where customers idea of requirements is often unclear and rapidly changing
  - organization can get value from whatever is working, as quickly as possible
    - provided priorities on work have been sensibly set

Key knowledge (quiz, exam!)

- Importance of schedule (time) and budget (cost) in project management
- Terminology
- PMBOK time and cost documents
- PMBOK time and cost processes
- Agile approach to time and cost
- Comparison of PMBOK and agile approaches