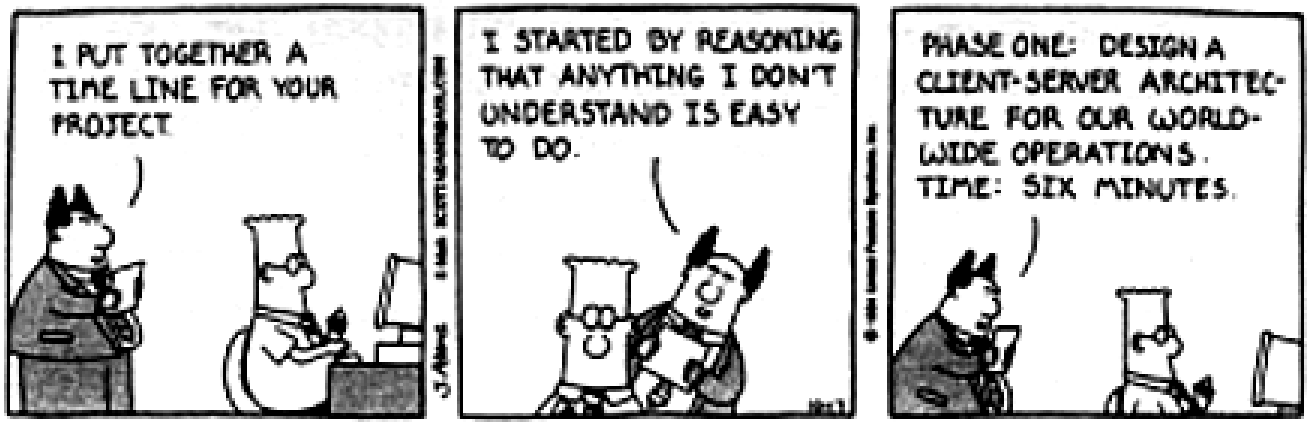
Info6007
Project Management in IT

Lecture 5 – Money
Dr Steven Sommer



Lecture Resources

- Bring to class
  - Calculator
- Required Readings
  - Schwalbe 7e and 8e: Chapter 7.
- Practice Questions (7e and 8e)
  - Quick Quiz Q9 & Q10, Exercises 1 and 5.
- References
  - Schwalbe, K. 2015, Information Technology Project Management (8e) Cengage Learning

Learning Objectives

- Construct and Evaluate a project budget
- Create and review a cost baseline for a project
- Calculate, Apply, Interpret, and explain the standard financial metrics for a project (AC, PV, EV, CV, SV, CPI, SPI, ETC, EAC)

Agenda

- Cost Estimating
- Cost Budgeting
- Cost Control
- (Exam Brief)
- Tutorial Questions

Agenda - Project Cost Management Processes

- Planning Cost Management
  - Determining the policies, procedures, and documentation that will be used for planning, executing, and controlling project cost.
- Cost Estimating
  - Developing an estimate of the costs and resources needed to complete a project
- Cost Budgeting
  - Allocating the overall cost estimate to individual work items to establish a baseline for measuring performance
- Cost Control
  - Monitoring and Controlling changes to the project budget
- Senior Managers must be at one with money

Estimating Types (from PMBOK)

- PMBOK

Type of Estimate	When Done	Why Done	How Accurate
Rough Order of Magnitude (ROM)	Very early in the project life cycle, often 3–5 years before project completion	Provides estimate of cost for selection decisions	–25% to +75%
Budgetary	Early, 1–2 years out	Puts dollars in the budget plans	–10% to +25%
Definitive	Later in the project, less than 1 year out	Provides details for purchases, estimates actual costs	–5% to +10%

Schwalbe 2015, Table 7-1

Quiz

- Give some examples of project costs.

Common Sources of Project Cost

- Labor
- Materials
- Subcontractors
- Equipment & facilities
- Travel

Types of Costs and Benefits

- **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.
- **Fixed costs** are costs that do not vary with usage.
- **Variable costs** change with usage.
- **Recurring costs** repeat and continue to occur during parts of the project life cycle.
- **Nonrecurring costs** generally occur once.
- Quiz: Give examples of each!

Cost Estimation Techniques and Tools

- Analogous or top-down estimates:
  - Uses actual cost of a previous, similar project as base
- Bottom-up estimates:
  - Estimating individual work item/activities and adding them
- Calculations
- Combinations of the above

Calculations cont.

- Historical data classifying tasks
  - Size (s/m/l) & Complexity (s/m/c) to give estimate

	S	M	L
S	1	5	10
M	2	10	20
C	3	15	30

- Formulas & Computations
  - Multiplication Method
    - Factor x Productivity Rate (e.g. No. Reports x Effort per Report)
  - Percentage Method
    - Function of another task (e.g. Supervision)
  - Fixed effort
    - Not dependent on any other factor or task
  - Parametric Modelling …

Calculations - Parametric modeling

- Parametric modeling:
  - Uses project characteristics (parameters) in a mathematical model
- One example:
  - Barry Boehm helped develop the Constructive Cost Model COCOMO model for estimating software development costs. Parameters include:
    - Function points: Technology-independent assessments of the functions involved in developing a system.
- Parametric models do not suffer from the limits of human decision-making.

Sample - Surveyor Pro Project 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.

Sample - Surveyor Pro Project Cost Estimate

Surveyor Pro Software Development Estimate Created October 5

1. Labor Estimate	# Units/Hrs.	Cost/Unit/Hr.	Subtotals	**Calculations**
Contractor labor estimate	3000	$150	$450,000	3000 * 150
Project team member estimate	1920	$75	$144,000	1920 * 75
Total labor estimate			**$594,000**	Sum above two values
2. Function point estimate**	Quantity	Conversion Factor	Function Points	**Calculations**
External inputs	10	4	40	10 * 4
External interface files	3	7	21	3 * 7
External outputs	4	5	20	4 * 5
External queries	6	4	24	6 * 4
Logical internal tables	7	10	70	7 * 10
Total function points			**175**	Sum above function point values
Java 2 languange equivalency value			46	Assumed value from reference
Source lines of code (SLOC) estimate			8,050	175 * 46
Productivity×KSLOC^Penalty (in months)			29.28	3.13 * 8.05^1.072 (see reference)
Total labor hours (160 hours/month)			4,684.65	29.28 * 160
Cost/labor hour ($120/hour)			$120	Assumed value from budget expert
Total function point estimate			**$562,158**	4684.65 * 120

**Approach based on paper by William Roetzheim, "Estimating Software Costs," Cost Xpert Group, Inc. (2003) using the COCOMO II default linear productivity factor (3.13) and penalty factor (1.072).

Schwalbe 2015, Fig 7-3

Plan for Contingencies

- Most projects are allocated an overall percentage of costs to cover contingency. This is meant to include
  - Allowance for unexpected work that is in scope
  - Estimating variances
- The project manager might need approval to start spending their contingency budget.
- Known or likely ‘contingencies’ should be explicitly catered for in the budget. E.g..,
  - New hire and training due to attrition
  - Sick leave

Common Problems with IT Cost Estimates

- Developing an estimate for a large software project is a complex task requiring a significant amount of effort.
- Many people doing estimates have little experience doing them.
- People have biases toward underestimation
- Some stakeholders (sales, management) often want a low estimate to ensure an attractive bid.
  - Project managers must maintain realistic cost estimates as they will be held accountable to deliver to them

Exercise 1

- In week 10, you may be presenting a 30 minute professional video (with actors) on you group assignment results. You will be also be providing food.
- In groups, prepare a cost estimate for your video presentation project
- One team to present
- See next slide for ideas

- 15 minutes

Ideas

- Script
- Story Board
- Costume
- Sets
- Casting
- Crew (a day filming) – Director, Cinematographer, Camera operator, Sound man, hair and make-up artist, Script supervisor, Cast
- Editing – Film editor, sound editor, music, title and credit sequences, DVD version
- Catering

Agenda

- Cost Estimating
- **Cost Budgeting**
- Cost Control

Cost Budgeting

- Cost budgeting involves allocating the project cost estimate to individual work items over time.
- The WBS is a required input for the cost budgeting process because 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.

Surveyor Pro Project Cost Baseline

Surveyor Pro Project Cost Baseline Created October 10*

WBS Items	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1. Project Management													
1.1 Project manager	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	96,000
1.2 Project team members	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	144,000
1.3 Contractors		6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	66,300
2. Hardware													
2.1 Handheld devices				30,000	30,000								60,000
2.2 Servers				8,000	8,000								16,000
3. Software													
3.1 Licensed software				10,000	10,000								20,000
3.2 Software development		60,000	60,000	80,000	127,000	127,000	90,000	50,000					594,000
4. Testing			6,000	8,000	12,000	15,000	15,000	13,000					69,000
5. Training and Support													
5.1 Trainee cost									50,000				50,000
5.2 Travel cost									8,400				8,400
5.3 Project team members							24,000	24,000	24,000	24,000	24,000	24,000	144,000
6. Reserves				10,000	10,000	30,000	30,000	60,000	40,000	40,000	30,000	3,540	253,540
Totals	20,000	86,027	92,027	172,027	223,027	198,027	185,027	173,027	148,427	90,027	80,027	53,567	1,521,240

Schwalbe 2015, Fig. 7-4

Exercise 2

- Prepare a weekly cost baseline for your presentation
- One team to present
- 20 mins

Intermission

Agenda

- Cost Estimating
- Cost Budgeting
- **Cost Control**

Cost Monitoring / Control

- Non IT people will evaluate the project purely on costs
- Projects have limited budgets, PMs need to monitor and report on costs & schedule
- Need the baseline

Financial Metrics

- "Value"
  - Actual Cost (to date) (AC)
  - Planned Value (PV)
  - Earned Value (EV)
- Variance
  - Cost Variance (CV)
  - Schedule Variance (SV)
- Ratios
  - Cost Performance Index (CPI)
  - Schedule Performance Index (SPI)
- Projected outcome
  - Estimated Completion Time
  - Estimate at Completion (of cost)

Earned Value Terms

- **Actual cost (AC)** or Actual Cost of Work Performed (ACWP), is the total of direct and indirect costs incurred in accomplishing work on an activity during a given period

  AC = actual $ spent

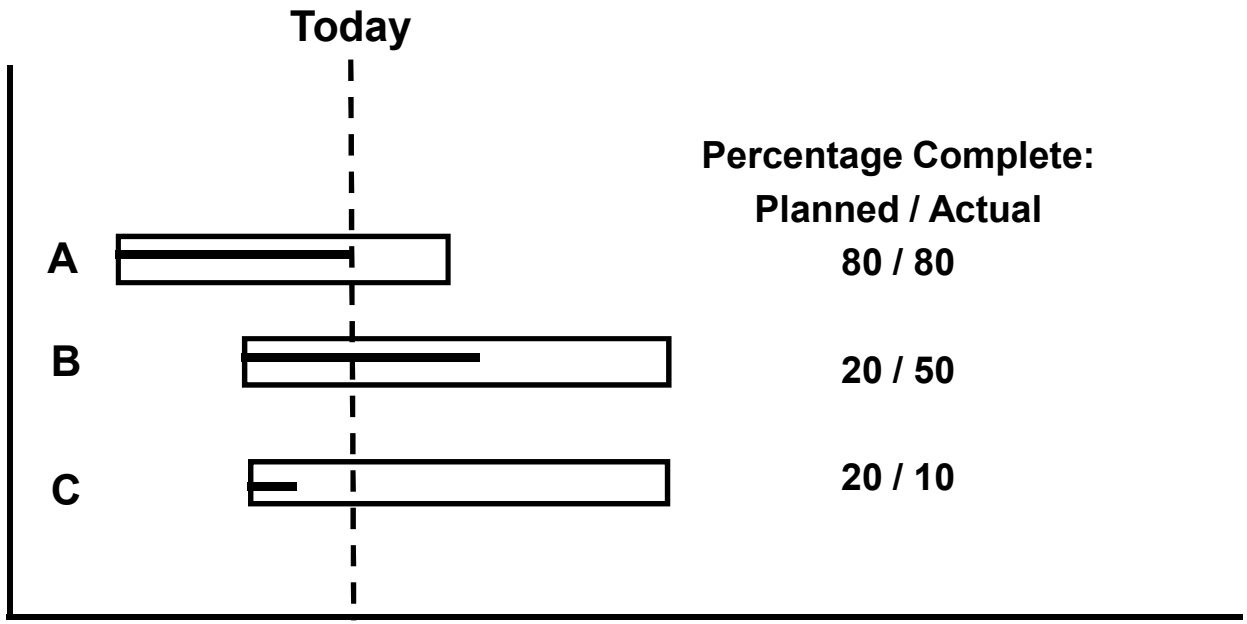
- **Planned value (PV)** or Budgeted Cost of Work Scheduled (BCWS), also called the budget, is that portion of the approved total cost estimate planned to be spent on an activity during a given period

  PV = planned % to complete x planned $ estimate of whole activity

- **Earned value (EV)** or Budgeted Cost of Work Performed (BCWP), is an estimate of the value of the work that has actually been completed

  EV = actual % complete x planned $ estimate of whole activity

Planned Value and Earned Value



	Percentage Complete: Planned / Actual	If Budget is $200 PV / EV
A	80 / 80	$160 / $160
B	20 / 50	$40 / $100
C	20 / 10	$40 / $20

Baseline schedule

Actual performance

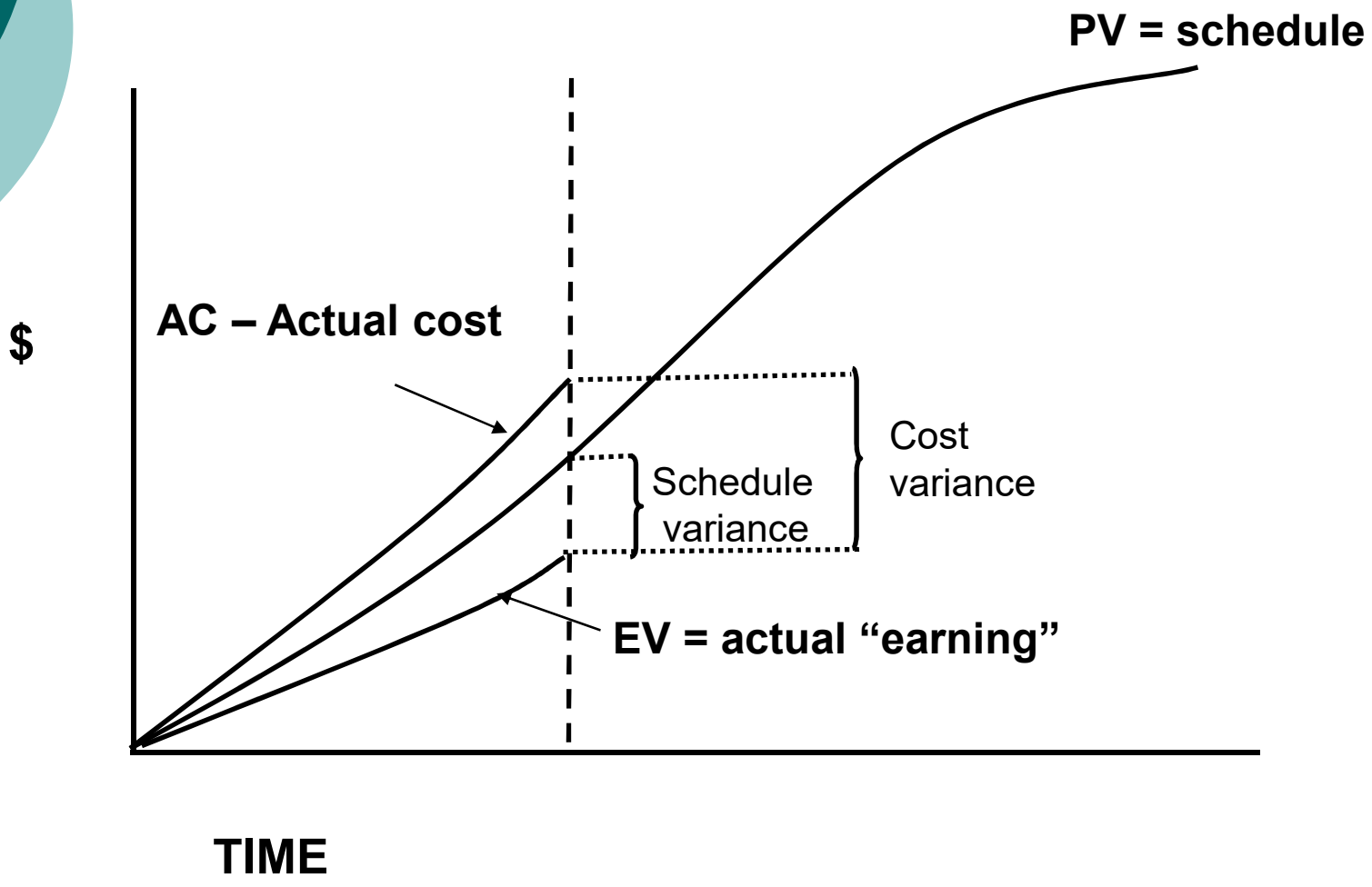
Quiz: Which is worst / best?

Variances

- Schedule Variance (SV)
  = EV – PV
- Cost Variance (CV)
  = EV – AC
- Negative is bad!

- If SV is positive, the project has delivered more value than had been predicted. Perhaps:
  - Resources are available earlier or at higher availability
  - Project team experienced improved efficiency
- If SV is negative, the project is behind schedule. Perhaps:
  - there are less resources available than planned
    - more vacation than planned
    - more illness / absence than planned
    - late arrival of resources
  - project team is inefficient
  - Quiz: How will the CV help distinguish between the above 2 possibilities?

Variances


PV = schedule
$
AC – Actual cost
Cost
variance
Schedule
variance
EV = actual “earning”
TIME

Exercise

1. You are sitting a 2 hour exam. There are 40 questions in the exam. Each question has an equal value. You must answer every question. Your hourly rate is $60/hour ($1/min)
   - What is your budget for each question? (assuming no contingency – BAD!)
- 20 minutes has passed, and you have just completed the 7th question. Intuitively (without the formula)
  - What is your Earned Value?
  - What was the Planned Value?
  - What is your Schedule Variance?

Variance indexes or ratios

- Schedule performance index (SPI)
  = EV / PV
- Cost performance index (CPI)
  = EV / AC
- Less than 100% indicates a problem
- Needed to understand scale of an issue
- Quiz:
  - How bad is a CV of -$10,000?
  - If, at the same time, the CPI is 99%, how bad is the -$10000 now?

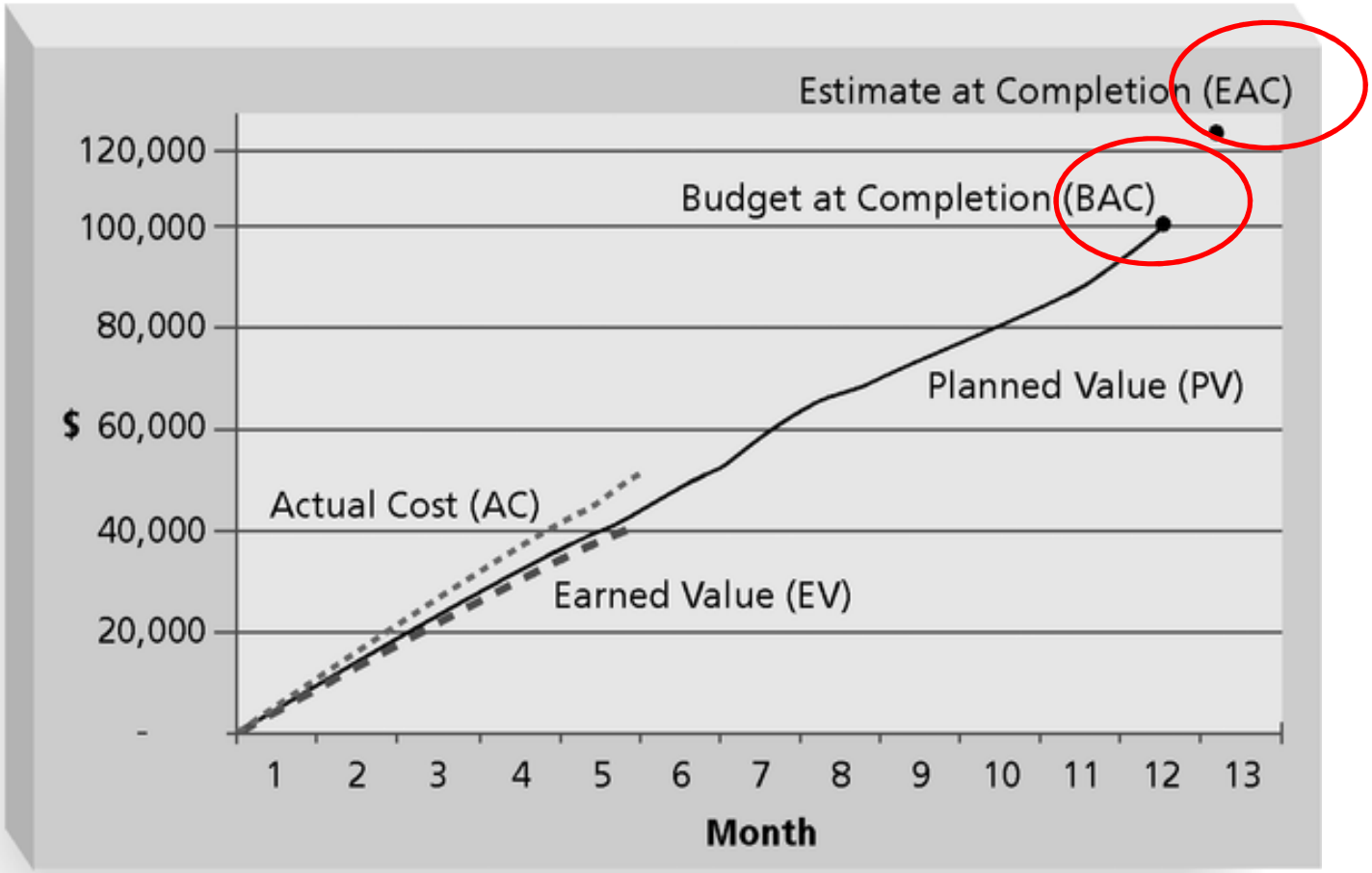
Estimated Completion time

- Estimated Time to Complete (ETC)
  = original time/SPI

- Estimate at Completion (EAC)
  = BAC / CPI

  BAC = Budget at Completion

Earned Value Chart



Schwalbe 2015, Fig. 7-5

Sample

EV Calculations for a One-Year Project After Five Months

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	**Activity**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**PV**	**% Complete**	**EV**
2	Plan and staff project	4,000	4,000											8,000	100	8,000
3	Analyze requirements		6,000	6,000										12,000	100	12,000
4	Develop ERDs			4,000	4,000									8,000	100	8,000
5	Design database tables				6,000	4,000								10,000	100	10,000
6	Design forms, reports, and queries					8,000	4,000							12,000	50	6,000
7	Construct working prototype						10,000							10,000	-	-
8	Test/evaluate prototype						2,000	6,000						8,000	-	-
9	Incorporate user feedback							4,000	6,000	4,000				14,000	-	-
10	Test system									4,000	4,000	2,000		10,000	-	-
11	Document system											3,000	1,000	4,000	-	-
12	Train users												4,000	4,000	-	-
13	Monthly Planned Value (PV)	4,000	10,000	10,000	10,000	12,000	16,000	10,000	6,000	8,000	4,000	5,000	5,000	100,000		44,000
14	Cumulative Planned Value (PV)	4,000	14,000	24,000	34,000	46,000	62,000	72,000	78,000	86,000	90,000	95,000	100,000			
15	Monthly Actual Cost (AC)	4,000	11,000	11,000	12,000	15,000										
16	Cumulative Actual Cost (AC)	4,000	15,000	26,000	38,000	53,000										
17	Monthly Earned Value (EV)	4,000	10,000	10,000	10,000	10,000										
18	Cumulative Earned Value (EV)	4,000	14,000	24,000	34,000	44,000										
19	Project EV as of May 31	44,000														
20	Project PV as of May 31	46,000														
21	Project AC as of May 31	$ 53,000														
22	**CV=EV-AC**	**$ (9,000)**														
23	**SV=EV-PV**	**$ (2,000)**														
24	**CPI=EV/AC**	**83%**														
25	**SPI=EV/PV**	**96%**														
26	**Estimate at Completion (EAC)**	**$120,455**	(original plan of $100,000 divided by CPI of 83%)													
27	**Estimated time to complete**	**12.55**	(original plan of 12 months divided by SPI of 96%)													

Schwalbe, Fig. 7-5

Exam Exercise Continued

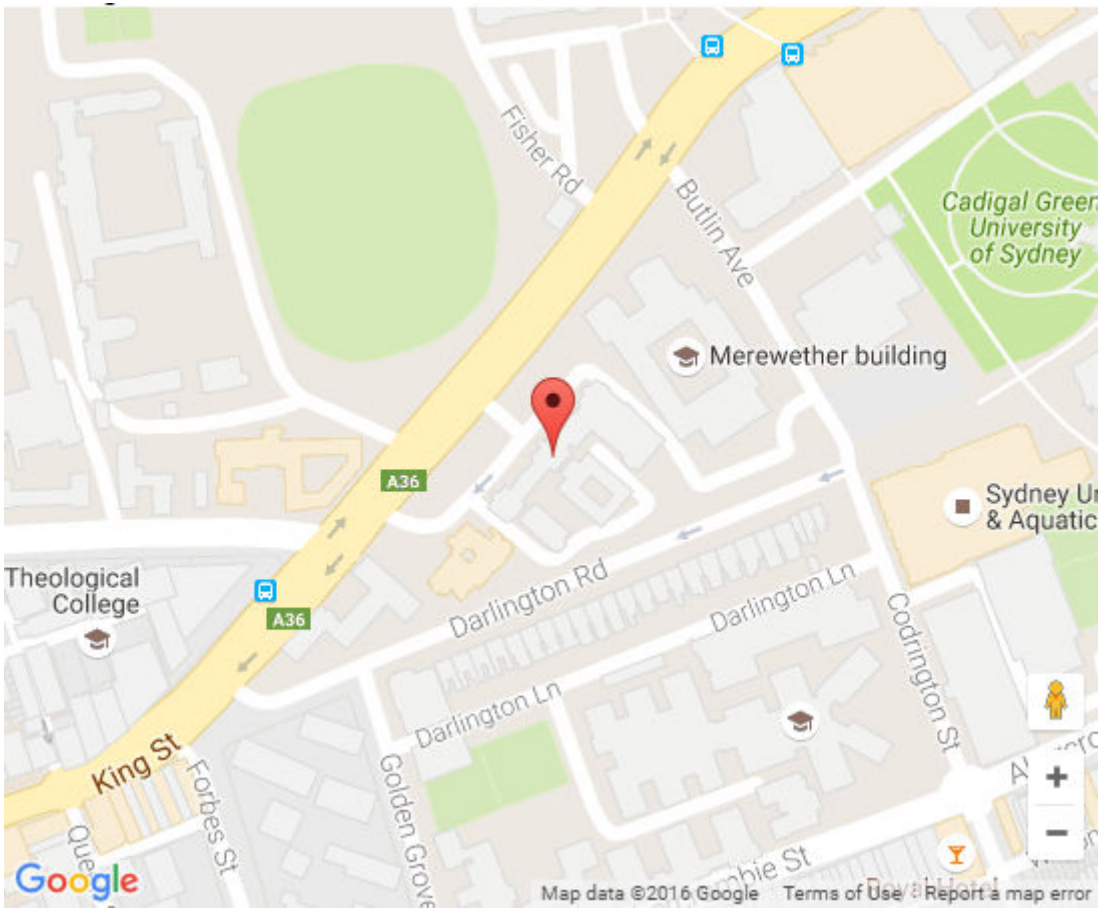
- 20 minutes has passed, and you have completed 7 questions.
  - How much faster are you completing the exam relative to finishing exactly on time (i.e. what is the SPI)?
  - When do you think you will finish? (i.e., what is the *Estimated Time to Complete*)

Summary / Agenda

- Cost Estimating
- Cost Budgeting
- Cost Control
- **Exam Brief (10 mins)**
  - **Location**
  - **Cover**
  - **Format**
  - **Topics**
  - **Advice**
- Tutorial Questions

Exam Location and time

- You MUST attend the right exam (or you will receive 0 for the exam)
- Location: Institute Lecture Room 2



Stream 1 (Wednesday) Exam Cover Sheet

CONFIDENTIAL EXAM PAPER

This paper is not to be removed from the examination room

School of IT

INFO6007 - Project Management in IT

Stream 1, Mid-Term Examination, Semester 2 – 2016

Total Duration: 1 hours and 40 minutes
Writing Time: 1 hours and 30 minutes
Reading Time: 10 minutes

INSTRUCTIONS TO CANDIDATES

1. Please read each question carefully. The value of each question has been written next to the question. All questions must be answered.
2. That questions are of unequal value. The total of marks of this exam paper is 90.
3. You have 90 minutes to answer questions worth 90 marks of value. You may wish to allocate your time based on 1 minute per mark.
4. Write your response to questions in the answer booklets provided.
5. Please ensure that your Name and Student Number are written on each booklet you use.
6. Please indicate the Question number/s on the front of each booklet you use.
7. This question paper must be returned with the answer booklets
8. Every attempt has been made to make the questions unambiguous. However, if you are not sure what a question is asking, make a reasonable assumption and state it at the beginning of your answer.

Materials Permitted:

You may bring into the exam a single handwritten sheet of A4 paper. Both sides of the sheet may be written on. ***You must submit this sheet of paper with your answer booklet***.
Translation Dictionaries are permitted.
Non programmable calculators are permitted.

Please check your examination paper is complete (**4 pages including cover sheet**) and indicate you have done this by signing below.

Exam – Format (Stream 1)

- 4 questions, many with a number of subparts
  - Identify, List, Describe, Explain, Create, Calculate Show, Draw, Compare, ...
  - Worth 20% of your final mark for the unit
  - No multiple choice questions
  - A mini-case (~½ page) will be in the exam.

Exam Topics

- Topics – any topic or concept covered up to (and including) week 5, supported by the text and additional readings.
- No detailed case knowledge

Study Sources

- Lecture slides annotated with your personal notes
- The text
  - Very high correlation with getting a F or bare P
- Additional Readings on eReserve
- Practice Questions at the end of each week
- Your friends to set you random questions on any topic/slide

- Consults
  - Steve on Wed 4:30-5:30; Srini on Friday 4:30 to 5:30.

Exam Advice

- Know the rules (It is your responsibility to know and observe the university regulations for exams, special consideration and appeals)
- Do not do the questions in order. Do the easier ones first. Use the reading time to decide the order you will do them in.
- Plan and monitor your time
  - 1 min per mark
  - Move on if you are stuck
- Plan your answers for longer questions.
  - Structure your answer before you start writing it.
- Write clearly expressed, to-the-point, legible answers
  - Quality over quantity.
  - Write sentences where sentences are required!
- Be kind to the marker!

Quiz 1

- A construction project at day 70 exhibits an actual cost of $78K, and a scheduled cost of $84K. The foreman estimates that $81K of value has completed.

  a) Calculate the Cost variance
  b) Calculate the Schedule variance
  c) How can you explain this?

Quiz 2

- Summary activity 16 in an advertising project had a planned cost of $12,000 with costs to date of $10,000. It is 70% complete but should have completed yesterday evening on its 30th day. For this task:
  a) Calculate the cost variance
  b) Calculate the schedule variance
  c) Will the client be pleased?
  d) Calculate SPI and CPI
  e) Calculate ETC and expected days remaining
  f) Calculate EAC and expected cost overrun