

# Earned Value

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## Project Background

To maintain their competitive position in the robotics market, STUMP Corp need to develop a new generation robot. They have initiated a project to achieve this goal. The project starts on 1<sup>st</sup> January 2000.

The project is comprised of the tasks listed in Table One below. Predecessors, task duration and the number of personnel required to achieve the task in that duration are also provided.

## Part 1: Requirements

Construct a Bar chart for the project and determine the Budget At Completion (BAC) for the project.

Assume that STUMP have access to unlimited resource; that personnel cost \$10,000 per month per person, and that there are no project costs other than personnel costs.

A task cannot commence until all its predecessors have been completed.

ID	Job Description	Immediate Predecessors	Planned Duration (Months)	Staff
A	Electrical Design	Start	4	6
B	Assemble Boards	A	4	3
C	Test Boards	B	2	2
D	Software Design	Start	4	1
E	Programming	D	2	2
F	Software Testing	E	2	2
G	Robot Body Design	A	4	2
H	Robot Construction	G	2	2
I	Final Assembly	C,F,H	2	2

**Table One: Original Task List and Budgeted Effort**

## Model Answer For Part 1

Task	Month														
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
Electrical Design	■	■	■	■											
Assemble Boards					■	■	■	■	■						
Test Boards									■	■	■				
Software Design	■	■	■	■											
Programming					■	■									
Software Testing					■		■	■							
Robot Body Design					■	■	■	■							
Robot Construction									■	■	■				
Final Assembly											■	■	■		

**Table Two: Original Gantt Chart**

BAC = \$680,000

i.e.  $\sum(\text{duration}(i) \times \text{staff}(i))$  for all  $i$ , where  $i$  = a project task.

## Part 2: Earned Value Calculations

After 8 months project progress is detailed in Table Three. Predecessors remain the same.

ID	Job Description	Effort to Date (Person Months)	Outstanding Duration (Months)	Staff
A	Electrical Design	30	0	0
B	Assemble Boards	9	1	3
C	Test Boards	0	2	2
D	Software Design	4	0	0
E	Programming	8	1	2
F	Software Testing	0	4	2
G	Robot Body Design	6	1	2
H	Robot Construction	0	2	2
I	Final Assembly	0	2	2

**Table Three: Progress as at the End of Month 8**

Using the information in the table above, and the original details, create a Gantt Chart showing just the remaining work, and estimate the PV, AC and EV for each task as at the end of Month 8. For the project, what is the Cost Variance? Schedule Variance? Cost Performance Index (CPI)? Schedule Performance Index (SPI)? Estimate At Completion (EAC)? The next section provides details about calculating these values.

## Important Definitions and Formulae

Data Date	Current reporting date. Date against which project progress is measured. Usually set to end of latest reporting period.
PV	<b>P</b> lanned <b>V</b> alue of the work that was scheduled to be performed to the Data Date (originally: <i>Budgeted Cost of Work Scheduled</i> )
EV	<b>E</b> arned <b>V</b> alue of the work actually performed. I.e. Based on the baseline schedule, how much was budgeted to perform the work that has been accomplished? (originally: <i>Budgeted Cost of Work Performed</i> )
AC	Actual costs incurred as at the Data Date ( <i>Actual Cost of Work Performed</i> )
SV	<i>Schedule Variance = EV - PV</i>
CV	<i>Cost Variance = EV - AC</i>
SPI	<i>Schedule performance index = EV/PV</i> (efficiency factor relating to schedule)
CPI	<i>Cost Performance Index = EV/AC</i> (efficiency factor relating to cost)
BAC	<i>Budget At Completion</i> . Budgeted cost of completing the project.
EAC	<i>Estimate At Completion = BAC/CPI</i> . This is also known as the Estimated Cost at Completion (ECAC)

## Model Answer For Part 2

Task	Month														
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
Electrical Design															
Assemble Boards									■						
Test Boards									■	■	■				
Software Design															
Programming									■						
Software Testing									■	■	■	■	■		
Robot Body Design									■	■	■	■			
Robot Construction										■	■	■			
Final Assembly														■	■

**Table Four: Gantt Chart of the Remaining Work**

## Project Estimates at End of Month 8

### Budgeted Cost of Work Scheduled (PV)

This is the original budgeted cost of the work that was scheduled to be completed at this point. From the original Gantt, this comprises all work in the following tasks: A B D E F G.

**The PV at this point is \$560,000.**

For Task<sub>i</sub>:  $EV_i = \text{Original Budget}_i * \%Complete_i$

		AC	EV
A	Completed	\$300,000	\$240,000
B	75% complete	\$90,000	\$90,000
C	Not started	\$0	\$0
D	Completed	\$40,000	\$40,000
E	Budget \$40,000, \$20,000 o/s	\$80,000	\$32,000
F	Not Started	\$0	\$0
G	75% complete	\$60,000	\$60,000
H	Not Started	\$0	\$0
I	Not Started	\$0	\$0
	<b>TOTAL</b>	<b>\$570,000</b>	<b>\$462,000</b>

**Table Five: AC and EV as at End of Month 8**

### Cost Variance (CV)

$$CV = EV - AC = (\$108,000)$$

The project is \$108,000 over budget for the work that has been done.

### Schedule Variance (SV)

$$SV = EV - PV = (\$98,000)$$

The project is currently \$98,000 worth of effort behind schedule.

### **Cost Performance Index (CPI)**

$$\text{CPI} = \text{EV} / \text{AC} = \$462,000 / \$570,000 = 0.811$$

For every dollar spent we get \$0.81 of planned result

### **Schedule Performance Index (SPI)**

$$\text{SPI} = \text{EV} / \text{PV} = \$462,000 / \$560,000 = 0.825$$

For every dollar spent on scheduled effort we get \$0.82 worth of schedule progress.

### **Estimate At Completion (EAC)**

$$\text{EAC} = \text{BAC} / \text{CPI} = \$680,000 / 0.811 = \$838,471$$