

Calculation of ES,LS,EF,LF, Critical path in Excel

Dymanic version of the Activity Schedule Chart

The calculations for scheduling (ES, LS, slack, etc.) can be set up in Excel—they require use of the “min” and “max” functions and (to identify the critical path) the “if” function. The setup is slightly easier (but takes a bit more space) with an alteration in the text’s layout. There is a modified (I will claim “improved”) model in the workbook PERT_CPMtemplates.xls on the Blackboard site.

Set up columns for:

Description

Node label/name (A, B, C, etc.)

The immediate predecessors

Duration

ES, EF, LS, LF (column for each)

Slack

Critical (entries will be “Y” — for Yes – or blank).

There is a row for each activity

If there are two (or more) activities with no successors, it helps (for the setup) to add a “Finish” activity (all activities with no successors are predecessors, duration is 0) but this is not required.

Similarly, if there are two or more activities with no predecessors, it helps to add a “Start” activity (all activities without predecessors are successors of “Start”, duration is 0).

Create (below the table—label in the next cell over) a cell for Finish time

Filling in the columns

1. First four columns just put in the information on the activities

2. *Forward* pass for “Early” times (*ES, EF*):

In the column for *ES* the entry is always “=max(*the EF entries for the immediate predecessors – separated by commas*)” . The immediate predecessors are the nodes listed in the “Predecessors” column [the cells will all be in column *G* in my template]

In the *EF* column all entries are “= cell with *ES* + cell with *duration*”. With my template *ES* is the entry in column *F*, “duration” in column *E*,

For the “finish” node (if there is one) *ES* is “=max(*all EF entries*)” This is also the max of all the entries in column *G* “Finish time” is calculated as the max of entries in the *EF* column, unless there is a preset finish time.

3. *Backward* pass for “Late” times (*LS, LF*):

In the *LS* column, the entry is “= cell containing *LF* – cell containing *duration*” In my setup, ‘*LF* is in column *I*, “duration” is in column *E*.

In the *LF* column, the entry is “= min(*the LS entries for all the immediate successors – separated by commas*)” In my setup the *LS* entries are in column *H* The immediate successors of an activity are all the activities that have the activity in their “predecessors” list) [If you dont have a “Finish” node you need to remember that for an activity that has no successors, the *LF* entry is “=max(*all EF entries*)”]

4. Slack is = cell for *LF* – cell for *EF*” (or = cell for *LS* – cell for *ES*”.

5. Critical is =IF(*slack=0*,”Y”,”)’ . “slack is the slack for the activity. This will put “Y” in the cell if “*slack* = 0” is true and leave the space blank if it is not. Finish time is ’“= *EF of the “Finish” node*” if there is a finish node, or “= max(*all EF entries*)” Use the mouse to select the range of all *EF* entries from column *G*.

This layout will be useful [though the columns will be moved over wont be “F, G, H, I” necessarily] when we want to look at probabilistic layouts, at “crashing” (speeding up a project by increasing the effort on some activities) and simply for finding the critical path.