Microsoft Project 2019 (and 2016)

Practical Exercises

Contents

Practical 1

Getting Started – Create a Folder Structure for Storage

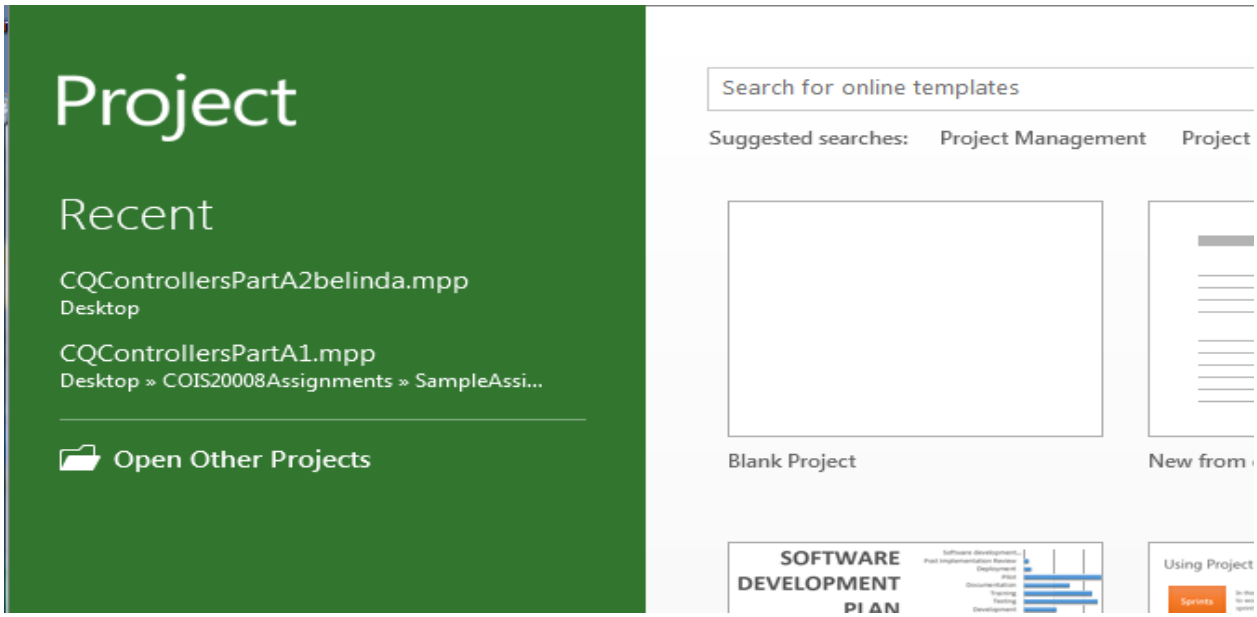
- If you have not done so already, create a folder for the unit you are studying (e.g. PPMP20007) and then create a subfolder within this unit folder called ProjectPracticals. You will save the work that you do in practical 1 in the ProjectPracticals folder in a file called practical1.mpp.

Introduction to Microsoft Project

- Microsoft Project is a software program designed to assist project managers. It is a powerful tool with many options and features to help a project manager to develop schedules, track project progress, manage resource assignment, produce reports etc. These practicals are only an introduction to Microsoft Project to give you an appreciation of some of the features you can expect from project management software. If you plan to use a tool like Microsoft Project in the workplace you should study the capabilities of the software in more depth so that you are aware of the various options available to you (and have an understanding of the subtleties associated with some of those options). If you wish to learn more about Microsoft Project 2016, there are excellent books available on the as well as videos and tutorials that can be found online.

- Open Microsoft Project.

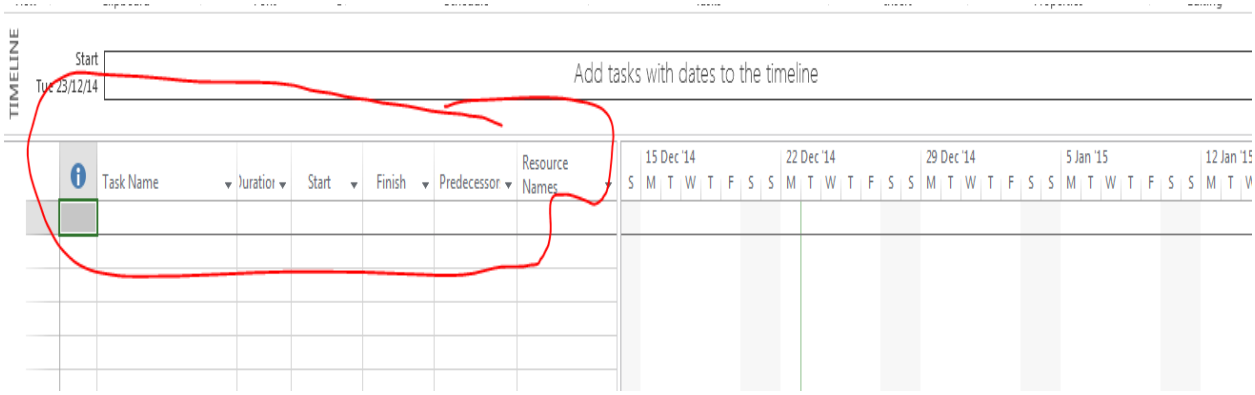
- Select “blank Project”



Microsoft Project opens with a Gantt Chart view (see below).

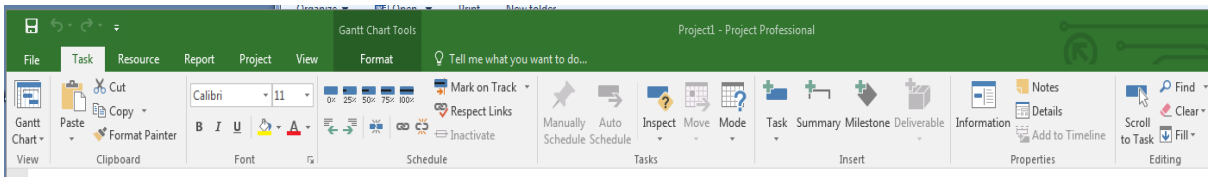
In the first window on the left hand side you will see the task and duration columns.

If necessary, expand this window (using the “split bar”) to view the start, finish, predecessor and resource columns.

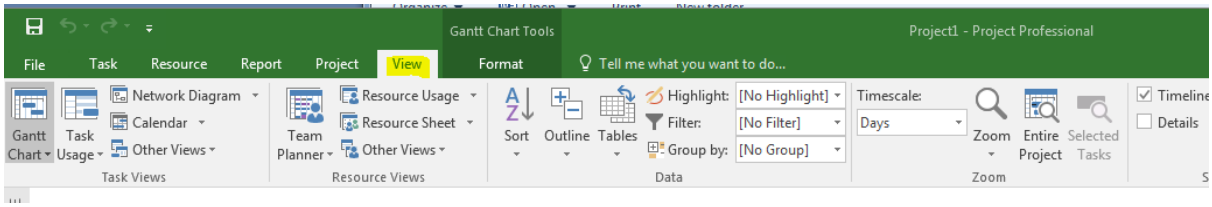


The window on the right hand side is a calendar that will display a Gantt chart view of your project.

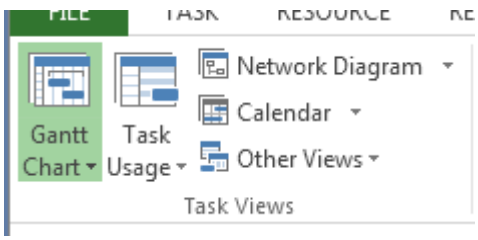
Along the top you will see the options available on the “ribbon” for the task “tab”. You will also see various other tabs - file, resource, project, view and format.



- Take **a couple of minutes** to explore the various options available under the different tabs (e.g. if you click on the File tab you will see New, Save, Print, Help options etc.).
- Click on the View tab and view the drop down options under “Gantt chart”.

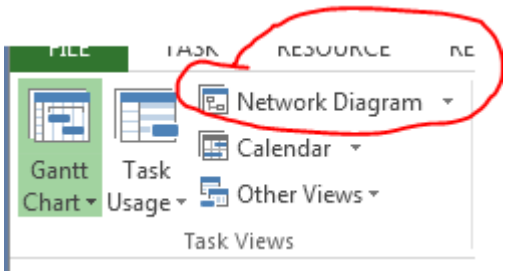


Observe that the Gantt chart option has been selected.



- Note that there are various options if you click on the down arrow on the Gantt chart - there are more views available. When you have developed your first schedule (at the end of practical 2), you can try out some of the alternative views (e.g. network diagram).

- Hover over an icon or option in the ribbon. You should see a pop-up window telling you the function of the icon. (e.g. if you hover over the Network Diagram option the pop-up window will explain the purpose of the Network Diagram view - "display tasks represented as boxes ….").



As you can see Microsoft Project provides you with a large number of options and functions. These lab exercises will introduce the basic steps to allow you to develop a schedule, add resource information and track the progress of a project.

You may like to spend some time becoming familiar with the various ribbons and options available when you have completed this practical.

Creating a New Microsoft Project File

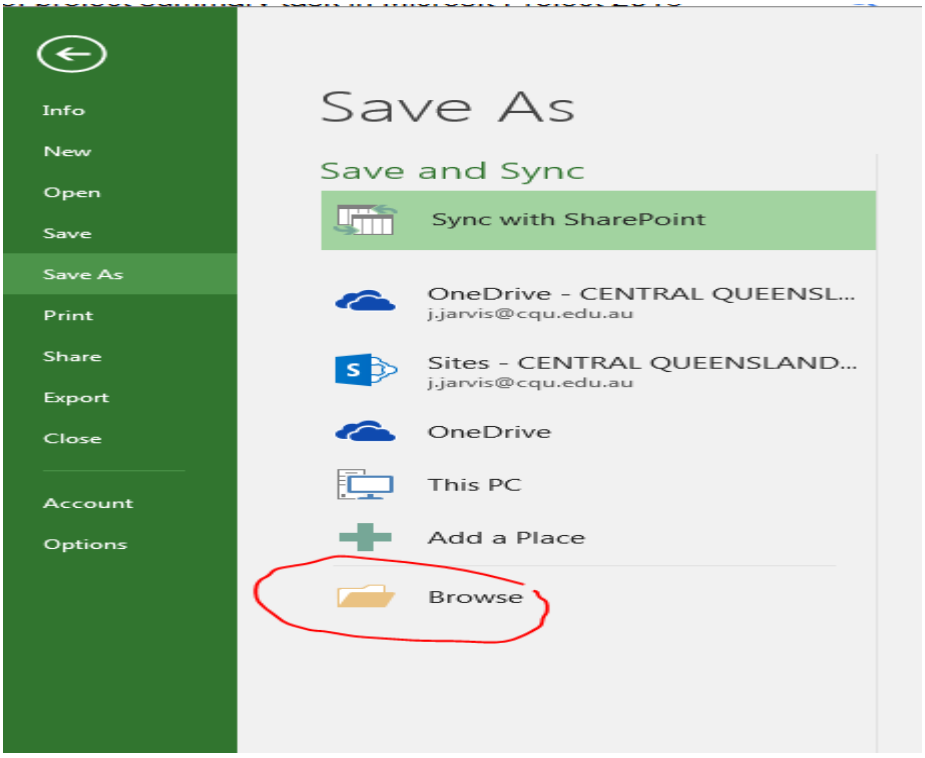
Create a blank Project

- You created a blank project when you clicked on "blank project" at the beginning of this practical.

- You will shortly begin entering information about your project. Before we do that, we begin by saving the project file in the appropriate folder.

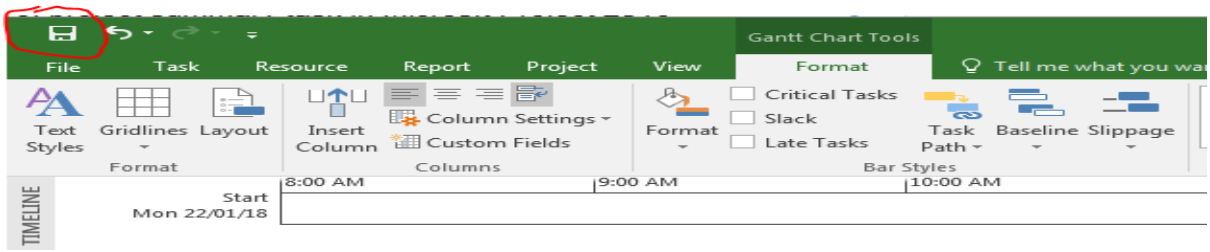
Saving Project Files

- Microsoft Project files can be saved with or without a baseline. The baseline allows you to track performance. However, as we are still developing our project file, we are not yet ready to save with a baseline. The default is to save the file without a baseline.
- Save your file (without a baseline) by selecting "Save As" from the File menu and saving your file as practical1 in the folder you created earlier called ProjectPracticals. You do this by selecting the File tab, followed by the "Save As" option.
- Click on the Browse icon to browse to the ProjectPracticals folder to save your file. (Note that one of the other options such as a "recent folder" may be appropriate in future.)



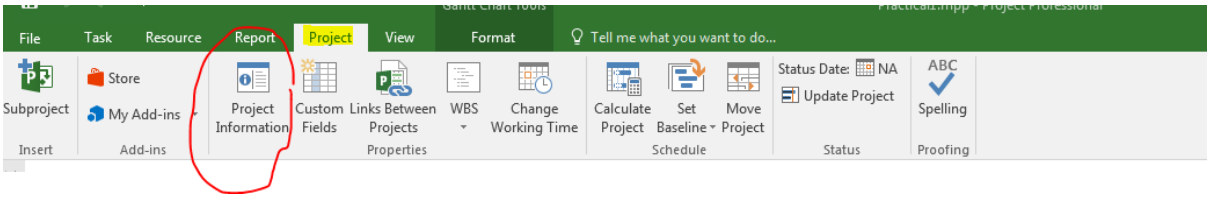
- When you have used the Browse option to browse to the appropriate folder, change the default file name to Practical1.mpp and click the save button.

- As you enter information about your project it is a good idea to save your work regularly. You can now save your work easily by clicking on the save icon on the top left hand corner of the screen:



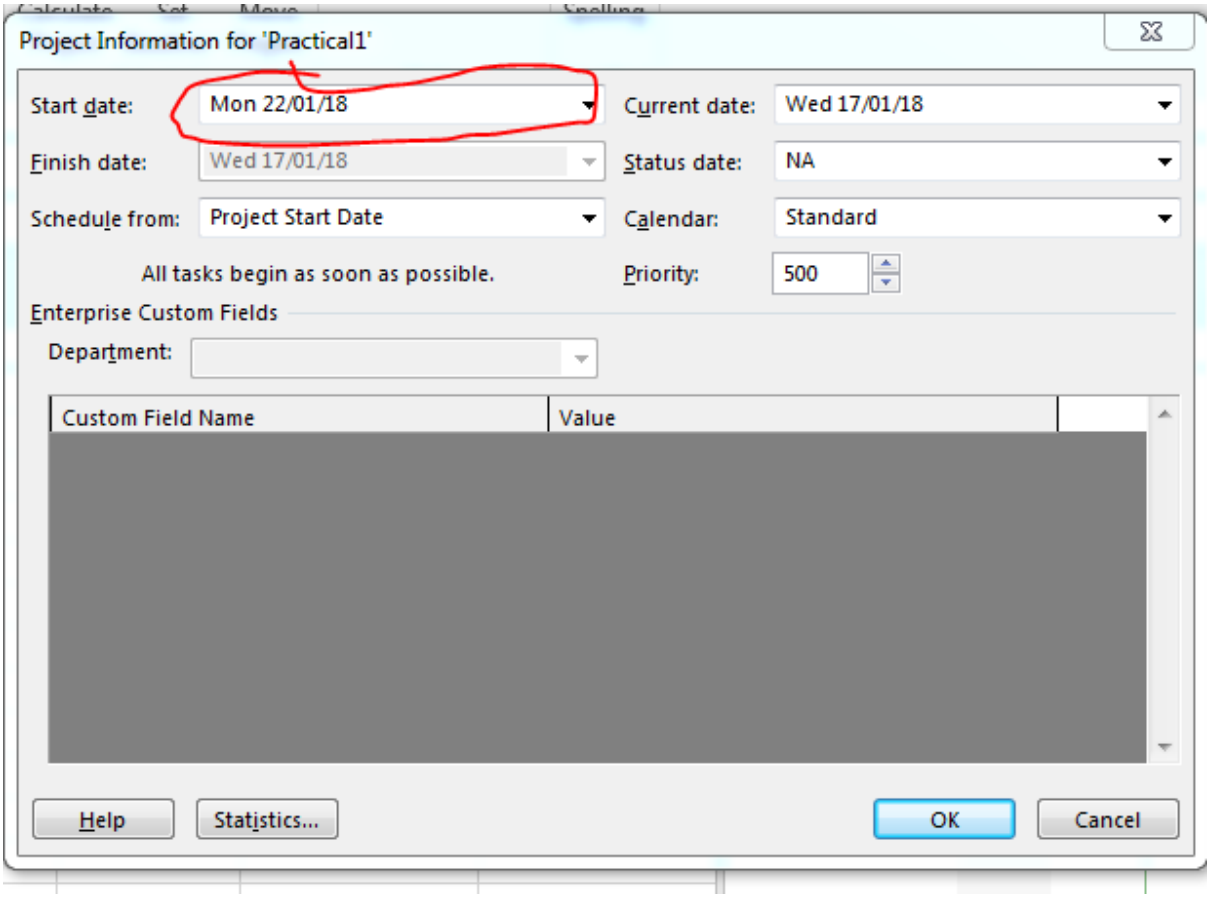
Enter Project Information – change the start date

- Click the Project tab and select Project Information.



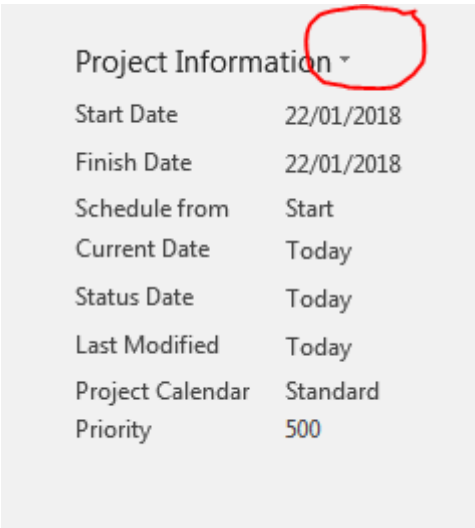
The Project Information dialog box will now be displayed. This allows you to set dates for the project, select the calendar to use etc. The start date will be set to today's date by default.

- Set the start date (of the project) to Monday of next week. You achieve this by selecting the date in the calendar and then clicking OK. The Project Information dialog box will now disappear. (Note that this means that the screen shots shown in this document will have different dates to your exercises. Some of the screenshots in this document were created in 2015 and are only representative of what you should see.)

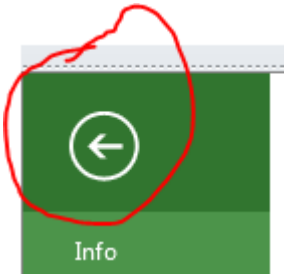


Enter Project Properties – change the title and author

- Click the File tab and select Info to view the project information on the right-hand side.
- Click on the "Project Information" drop down box on the right-hand side (above the information about the start date etc.)

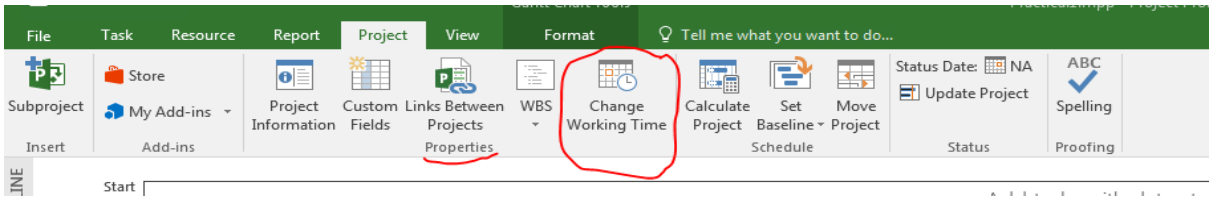


- Select "Advanced Properties".
- Type **New Billing System** in the **Title** text box and type your name in the **Author** text box, then click OK.
- Click on the "back-arrow" symbol to return to the normal view of the project.



Enter holiday information

- Click the Project tab (if it is not already selected) and select “change working time” from the Properties group.



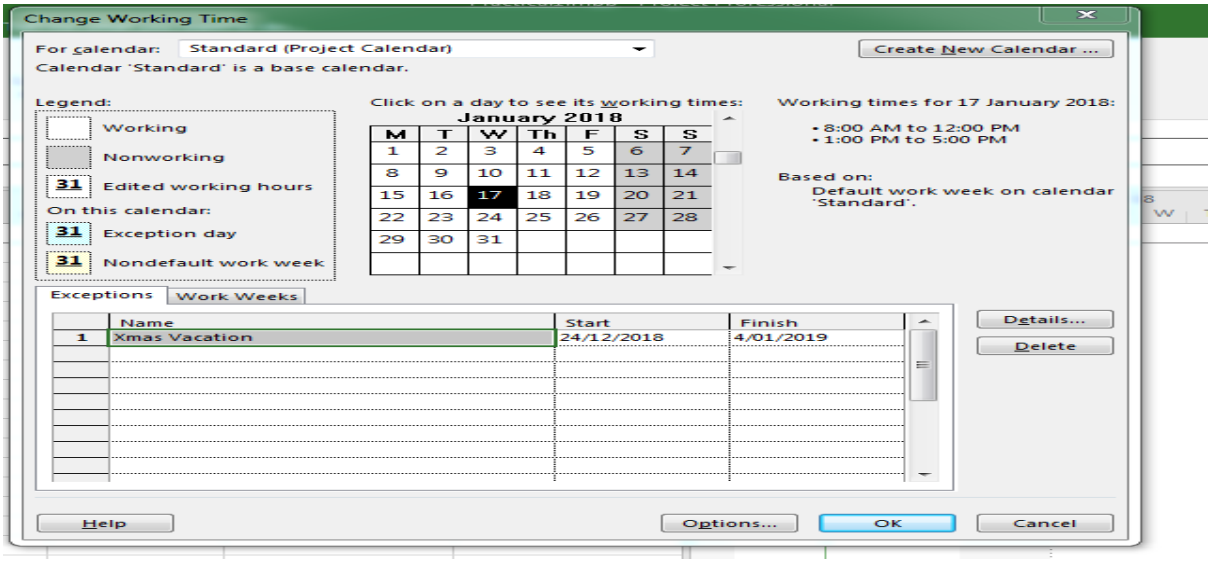
- You will see the “change working time” window appear.

  The standard calendar (Project calendar) is the default. Note that it assumes a 5 day working week with 8 hour days and Saturday and Sunday as the non-working days of the week.

  To enter additional holidays etc., you must enter and name the exceptions in the exceptions tab of the table at the bottom of the window. For the purpose of this exercise, we will assume that you need to enter the Xmas and New Year holidays and that this company always takes 2 weeks of leave over Xmas and New Year. The holiday is to commence on the 24th of December and finish two weeks later (10 working days).

- Enter the 2 weeks of Xmas holiday information in the table. Call the exception “Xmas vacation”. If you click on the drop down box in the start column, you will be able to use the calendar that appears to select the start date. You can set the finish date in a similar way.

- Your dialog box should appear similar to the screen below, although the year may be different depending on when you complete these practicals.



Enter the WBS

Assume that you have already worked out your work breakdown structure, resources, time estimates and predecessor/successor relationships for our example project.

- Click on the "Task tab" and enter the following information in the "Task Name" column. **Note that to save time in this practical you can copy and paste the list from this document into your mpp file.**

Requirements Analysis
Information gathering
Define Requirements
Disk Storage Upgrade
Purchase
Install
Software Modifications
Database Changes
Design DB Changes
Modify DB
Programs
Design Programs
Program A
Code program A
Unit test A
Program B
Code program B
Unit test B
Program C
Code program C
Unit test C
Program D
Code program D
Unit test D
Program R1
Code program R1
Unit test R1
Integration
Integrate
Test
Advertising Brochure
Design
Print
Mail Out

- To delete a task click on the task, right -click the mouse and select “delete task” from the menu. Try this now with the Modify DB task.

- To re- insert the Modify DB task, click on the “Programs” entry that was below the modify DB task that you just deleted. Right-click the mouse and select insert task. A new blank task should now be available for you to enter the Modify BD task. Enter the Modify DB task. (Note that you could have used the undo arrow to get the modify db task re-inserted. There are undo and redo arrows available at the top of the Microsoft Project window if you make an error.)

- Return to the Task ribbon (if you are not there already).

- Use your mouse to select the two tasks below the ”Requirements Analysis” entry and then click on the “indent” (green arrow pointing to the right) icon in the schedule group on the **Task** ribbon. (To select you can click on the first task in your selection, hold the <shift> key then click on the last task in your selection.)

- Repeat this procedure to achieve the following project WBS structure:

Requirements Analysis
- Information gathering
- Define Requirements

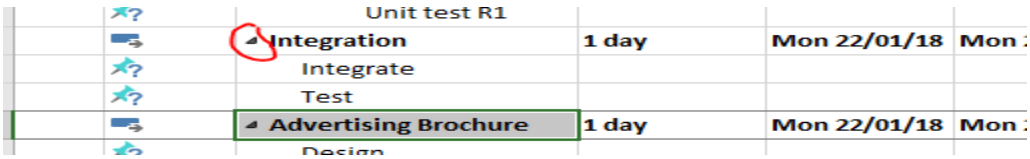
Disk Storage Upgrade
- Purchase
- Install

Software Modifications
- **Database Changes**
  - Design DB Changes
  - Modify DB
- **Programs**
  - Design Programs
  - **Program A**
    - Code program A
    - Unit test A
  - **Program B**
    - Code program B
    - Unit test B
  - **Program C**
    - Code program C
    - Unit test C
  - **Program D**
    - Code program D
    - Unit test D
  - **Program R1**
    - Code program R1
    - Unit test R1

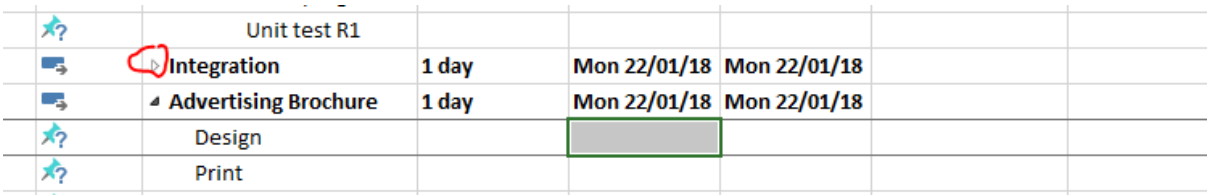
Integration
- Integrate
- Test

Advertising Brochure
- Design
- Print
- Mail Out

Notice that the entries with subtasks are in bold. This indicates that they are summary tasks. Their symbol on the Gantt chart also appears as a black line. The summary tasks also have a "collapse symbol" on their left hand side.



- Click on one of the collapse symbols and observe how this hides the subtasks beneath it. When subtasks are hidden, an "expand symbol" appears to the left of the summary task name.



- Click on the expand symbol and notice how it expands the summary task.

Add the numerical codes for the WBS.

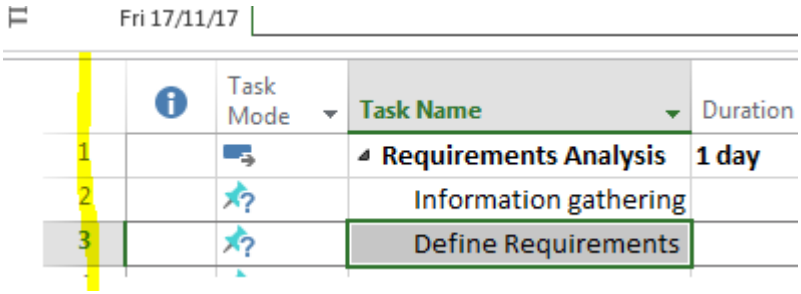
- Select the "Outline Numbers" check box on the ribbon of the Format tab. You should now see the numerical codes on your WBS. If you have indented the hierarchical structure correctly, you should see the following result.

Task Number	WBS Number	Task names
1	**1**	**Requirements Analysis**
2	1.1	Information gathering
3	1.2	Define Requirements
4	**2**	**Disk Storage Upgrade**
5	2.1	Purchase
6	2.2	Install
7	**3**	**Software Modifications**
8	**3.1**	**Database**
9	3.1.1	Design DB Changes
10	3.1.2	Modify DB
11	**3.2**	**Programs**
12	3.2.1	Design Programs
13	**3.2.2**	**Program A**
14	3.2.2.1	Code program A
15	3.2.2.2	Unit test A
16	**3.2.3**	**Program B**
17	3.2.3.1	Code program B
18	3.2.3.2	Unit test B
19	**3.2.4**	**Program C**
20	3.2.4.1	Code program C
21	3.2.4.2	Unit test C

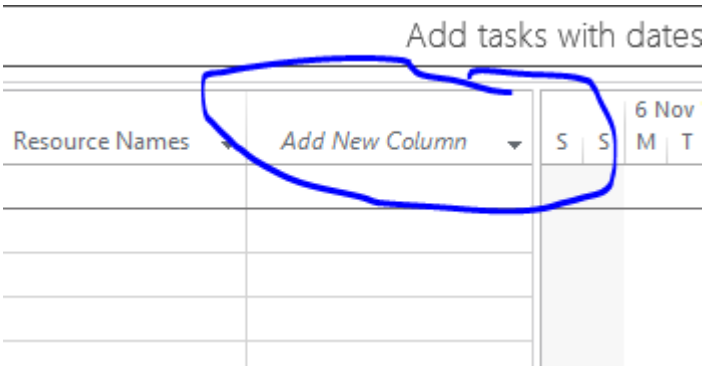
22	**3.2.5**	**Program D**
23	3.2.5.1	Code program D
24	3.2.5.2	Unit test D
25	**3.2.6**	**Program R1**
26	3.2.6.1	Code program R1
27	3.2.6.2	Unit test R1
28	**4**	**Integration**
29	4.1	Integrate
30	4.2	Integration testing
31	**5**	**Advertising Brochures**
32	5.1	Design
33	5.2	print
34	5.3	Mail out

Table 1: WBS numbers

Note that the **task number** is the number in the column on the left hand side as highlighted below:

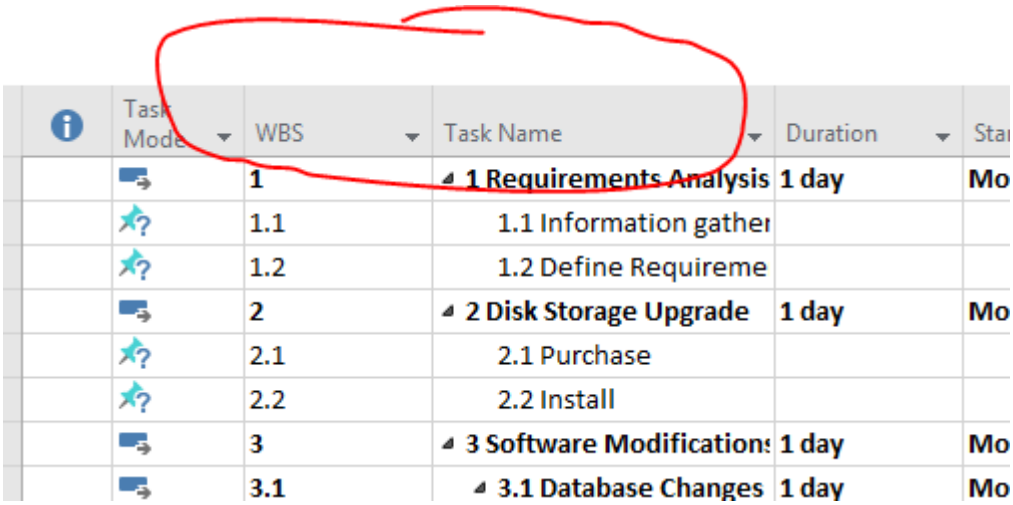


- An alternative is to create a separate WBS column. This is required in the assessment case study. If you scroll through the list of available columns in the column with the heading "Add a New Column" which should appear after the "Resource Names" column, you will find the WBS option. Columns can be rearranged, so this could be positioned before the "Task Name" column if required.



- To move a column click on the column heading and use the mouse to drag the column to the new position. Add the WBS column now and position it before the "task name column".
- Check that the numbers in the WBS column are correct. If they do not correspond to the numbers in table 1, you have made an error in your indentation and have the incorrect

structure. Make any corrections to indentations necessary so that your WBS column is correct.

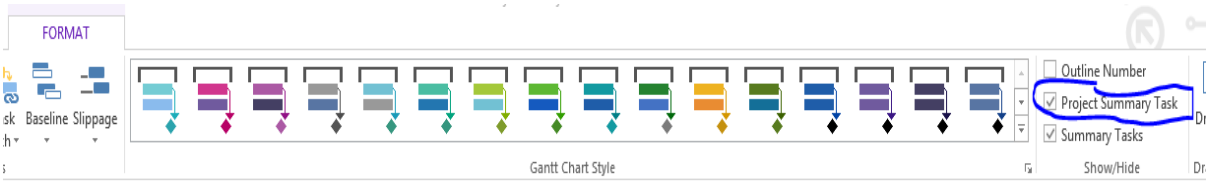
- 

Task Mode	WBS	Task Name	Duration	Sta
	1	1 Requirements Analysis	1 day	Mo
	1.1	1.1 Information gather		
	1.2	1.2 Define Requireme		
	2	2 Disk Storage Upgrade	1 day	Mo
	2.1	2.1 Purchase		
	2.2	2.2 Install		
	3	3 Software Modification:	1 day	Mo
	3.1	3.1 Database Changes	1 day	Mo

- The task mode is manually scheduled by default. We will see the difference between manual and automatic scheduling later in the practicals, so for now we will leave the task modes as manually scheduled. If you cannot already view a "task mode column" add the "task mode" column to allow you to view whether tasks are automatically or manually scheduled. Position it just before the WBS column. **You will set the default to automatically scheduled when you begin building you schedule for your assessment 2 case study**, but we will keep it as manual scheduling at this stage in the practicals.

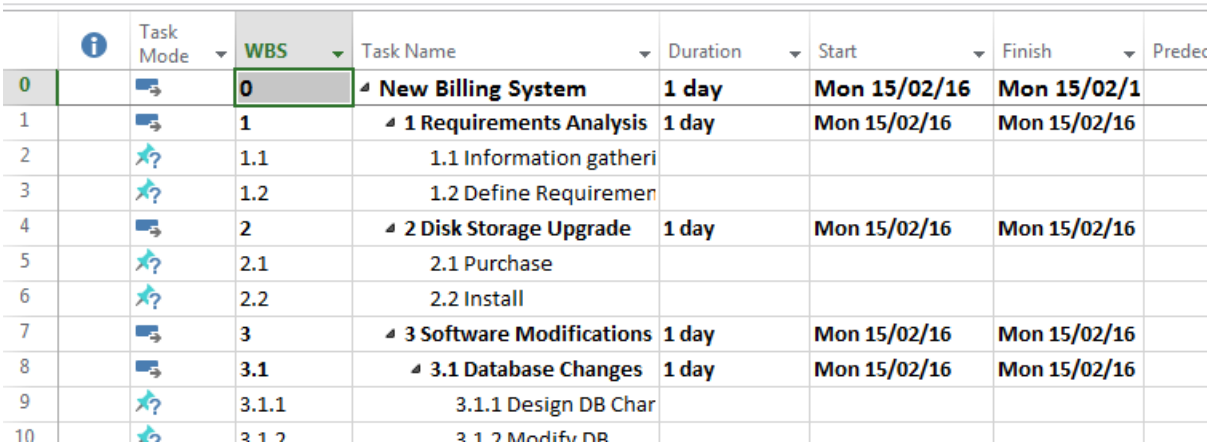
Adding the Project Title as a Project Summary Task

- Click the Format ribbon and select the "Project summary Task" tick box.



- The file title should now appear as number 0 at the top of the task list (WBS 0) and the summary task should display the total duration of the project (which is only one at this stage as we have not entered task durations or predecessor information).

- The top of your project should now appear similar to the following screenshot.



	Task Mode	WBS	Task Name	Duration	Start	Finish	Predec
0		0	New Billing System	1 day	Mon 15/02/16	Mon 15/02/1	
1		1	1 Requirements Analysis	1 day	Mon 15/02/16	Mon 15/02/16	
2		1.1	1.1 Information gatheri				
3		1.2	1.2 Define Requiremen				
4		2	2 Disk Storage Upgrade	1 day	Mon 15/02/16	Mon 15/02/16	
5		2.1	2.1 Purchase				
6		2.2	2.2 Install				
7		3	3 Software Modifications	1 day	Mon 15/02/16	Mon 15/02/16	
8		3.1	3.1 Database Changes	1 day	Mon 15/02/16	Mon 15/02/16	
9		3.1.1	3.1.1 Design DB Char				
10		3.1.2	3.1.2 Modify DB				

- **Save your work so far.**

Practical 2

Adding durations and predecessor/successor relationships

Adding durations

- Open practical1.mpp file and save to a file called practical2.mpp. You now have a copy of your work to use in practical2.mpp. You will use practical2.mpp as the starting point for this week's practical.

- If it is not already open, open practical2.mpp by double clicking on the file (or by opening project and browsing to it).

- Enter the task durations given in the table below. Note that the durations are only entered for specific tasks and not for deliverables/summary tasks. You will notice that as you enter durations for the specific tasks, Microsoft Project automatically calculates the totals for the summary tasks. The units we are using are weeks, but durations can be months, days or even minutes.

Task names	Durations
New Billing System	
Requirements Analysis	
Information gathering	3 weeks
Define Requirements	3 weeks
Disk Storage Upgrade	
Purchase	11 days
Install	3 days
Software Modifications	
Database	
Design DB Changes	2 weeks
Modify DB	1 week
Programs	
Design Programs	3 weeks
Program A	
Code program A	2 weeks
Unit test A	1 week
Program B	
Code program B	4 weeks
Unit test B	2 weeks
Program C	
Code program C	3 weeks
Unit test C	2 weeks

Program D	
Code program D	3 weeks
Unit test D	2 weeks
Program R1	
Code program R1	2 weeks
Unit test R1	1 week
Integration	
Integrate	2 weeks
test	1 week
Advertising Brochures	
Design	2 weeks
print	1 day
Mail out	1 day

Table 2: Durations

Adding predecessor/successor relationships

- Scroll out the left hand window (with the task name, duration etc columns) until you can see the predecessor column.

- There are various options for entering the predecessor relationships. We will enter them by adding the predecessor task number into the predecessor column. (The "link" icon in the schedule group on the Task ribbon is another option you might like to experiment with in at some point.) It is possible that a task has more than one predecessor. In that case enter the list of predecessor task numbers separated by commas (e.g. 3,7,9). Enter the predecessor relationships shown in the table below:

Task Number	WBS Number	Task names	Predecessor (task numbers)
0	**0**	**New Billing System**	
1	**1**	**Requirements Analysis**	
2	1.1	Information gathering	
3	1.2	Define Requirements	2
4	**2**	**Disk Storage Upgrade**	
5	2.1	Purchase	3
6	2.2	Install	5
7	**3**	**Software Modifications**	
8	**3.1**	**Database**	
9	3.1.1	Design DB Changes	3

10	3.1.2	Modify DB	9
11	**3.2**	**Programs**	
12	3.2.1	Design Programs	3
13	**3.2.2**	**Program A**	
14	3.2.1.1	Code program A	12
15	3.2.1.2	Unit test A	14
16	**3.2.3**	**Program B**	
17	3.2.3.1	Code program B	12
18	3.2.3.2	Unit test B	17
19	**3.2.4**	**Program C**	
20	3.2.4.1	Code program C	12
21	3.2.4.2	Unit test C	20
22	**3.2.5**	**Program D**	
23	3.2.5.1	Code program D	12
24	3.2.5.2	Unit test D	23
25	**3.2.6**	**Program R1**	
26	3.2.6.1	Code program R1	12
27	3.2.6.2	Unit test R1	26
28	**4**	**Integration**	
29	4.1	Integrate	6, 10, 15, 18, 21,24,27
30	4.2	Test (Integration testing)	29
31	**5**	**Advertising Brochures**	
32	5.1	Design	3
33	5.2	print	32
334	5.3	Mail out	33

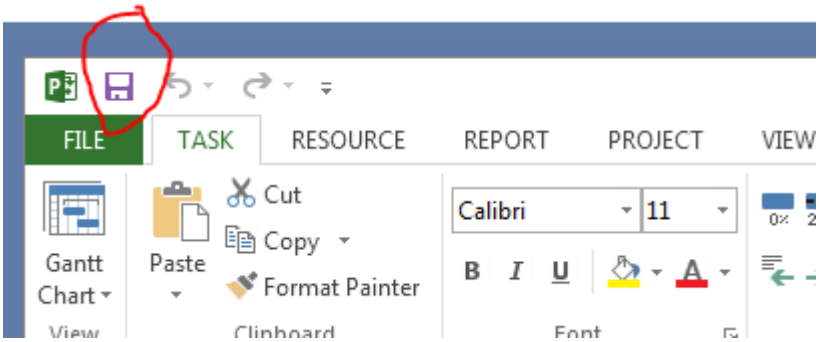
Table 3: Predecessors

Note:

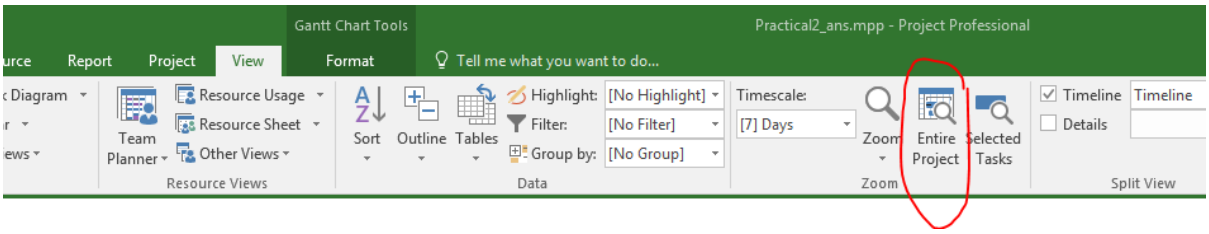
1. The predecessor(s) should be the lowest level in your WBS, i.e. a predecessor task should **not** be a "**summary task"**.

2. **You can include a "WBS predecessor" column**. If you scroll through the list of available columns in the column with the heading "Add a New Column" which should appear after the "Resource Names" column, you will find the WBS Predecessors column. Columns can be rearranged, so this could be positioned after the "Task Name" column if required. **This column will be useful to check your schedule if the predecessor information was provided in terms of WBS numbers.**

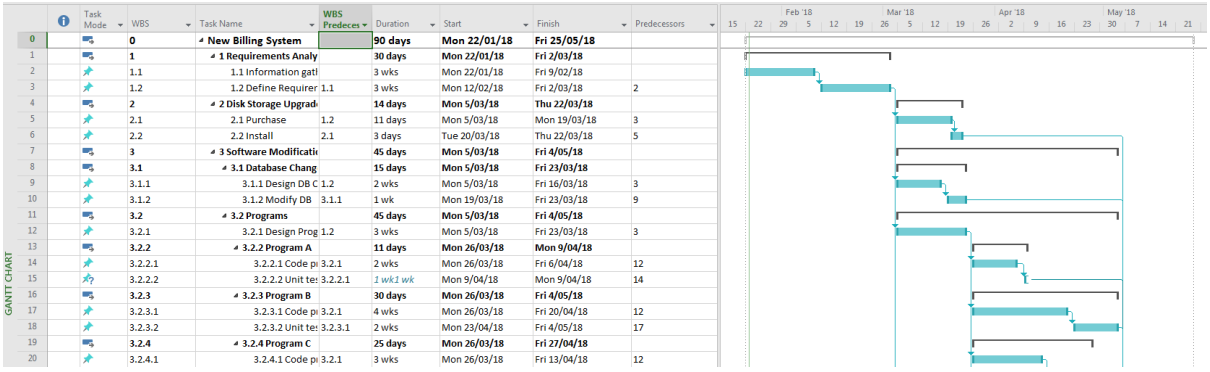
- It is always a good idea to save your work regularly. You can use the (Ctrl+S) shortcut or the ”save” icon at the top of Microsoft Project to save your work (see screenshot below). Save the current version of your work before you continue.



- Observe the predecessors in the Gantt chart. It may be difficult to view the entire project at this point. One option is to use the scroll bar at the side and bottom of the Gantt chart. Another option to allow you to see an overview is to **select “Entire Project” in the zoom group on the View ribbon.**



Your project should appear similar to the following:



	Task Mode	WBS	Task Name	WBS Predeces	Duration	Start	Finish	Predecessors
0		0	New Billing System		90 days	Mon 22/01/18	Fri 25/05/18	
1		1	1 Requirements Analy		30 days	Mon 22/01/18	Fri 2/03/18	
2		1.1	1.1 Information gatl		3 wks	Mon 22/01/18	Fri 9/02/18	
3		1.2	1.2 Define Requirer	1.1	3 wks	Mon 12/02/18	Fri 2/03/18	2
4		2	2 Disk Storage Upgrad		14 days	Mon 5/03/18	Thu 22/03/18	
5		2.1	2.1 Purchase	1.2	11 days	Mon 5/03/18	Mon 19/03/18	3
6		2.2	2.2 Install	2.1	3 days	Tue 20/03/18	Thu 22/03/18	5
7		3	3 Software Modificati		45 days	Mon 5/03/18	Fri 4/05/18	
8		3.1	3.1 Database Chang		15 days	Mon 5/03/18	Fri 23/03/18	
9		3.1.1	3.1.1 Design DB C	1.2	2 wks	Mon 5/03/18	Fri 16/03/18	3
10		3.1.2	3.1.2 Modify DB	3.1.1	1 wk	Mon 19/03/18	Fri 23/03/18	9
11		3.2	3.2 Programs		45 days	Mon 5/03/18	Fri 4/05/18	
12		3.2.1	3.2.1 Design Prog	1.2	3 wks	Mon 5/03/18	Fri 23/03/18	3
13		3.2.2	3.2.2 Program A		11 days	Mon 26/03/18	Mon 9/04/18	
14		3.2.2.1	3.2.2.1 Code pi	3.2.1	2 wks	Mon 26/03/18	Fri 6/04/18	12
15		3.2.2.2	3.2.2.2 Unit te:	3.2.2.1	1 wk1 wk	Mon 9/04/18	Mon 9/04/18	14
16		3.2.3	3.2.3 Program B		30 days	Mon 26/03/18	Fri 4/05/18	
17		3.2.3.1	3.2.3.1 Code pi	3.2.1	4 wks	Mon 26/03/18	Fri 20/04/18	12
18		3.2.3.2	3.2.3.2 Unit te:	3.2.3.1	2 wks	Mon 23/04/18	Fri 4/05/18	17
19		3.2.4	3.2.4 Program C		25 days	Mon 26/03/18	Fri 27/04/18	
20		3.2.4.1	3.2.4.1 Code pi	3.2.1	3 wks	Mon 26/03/18	Fri 13/04/18	12

- **Save your work so far.**

How scheduling works in Microsoft Project

The following notes were extracted from Microsoft Project "Help" in earlier versions of the software. The notes are still relevant. Project 2010 introduced manual scheduling.

> "Project 2010 introduces a new mode that gives users complete control over how tasks are scheduled — **manual scheduling**.
>
> Project can schedule tasks using two methods: **manual scheduling** and **automatic scheduling**. With manual scheduling, changes to factors such as task dependencies, constraints, and project calendars **do not automatically adjust task dates.**
>
> Tasks are **manually** scheduled by **default**. Project managers who are accustomed to automatic scheduling with past versions of Project can turn the manual scheduling feature off for specific tasks or for the entire project. Some projects, especially complicated ones, may require Project's powerful scheduling engine to take care of scheduling for you. " (Microsoft Help, 2010)
>
> **Note: we will only use automatic scheduling for our project schedules in this course.** The difference between the behaviour of automatically and manually scheduled tasks is demonstrated in the next practical where we also learn about inserting lags.

- **You will change to automatic scheduling in the next practical after we demonstrate the difference between manual and automatic scheduling.**
- The details of how Microsoft Project schedules tasks can be quite complicated and depends on whether the task is automatically or manually scheduled, the link types, any task constraints etc. To quote Microsoft Project help "*This stuff isn't necessarily easy to understand at first, but charging forward through it will make you a more knowledgeable project manager - and give you firmer control over the end date of your project*."
- **In the next practical in the section on "Lags" we show how to add lags and also demonstrate the difference between automatic and manual scheduling.**

Practical 3

Adding Lags, Milestones, Viewing Critical Path(s) and Assessing Sensitivity

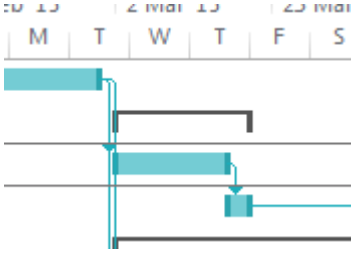
- Open practical2.mpp file and save it to a file called practical3.mpp. You now have a copy of your work to use in practical3.mpp. You will use this practical3.mpp as the starting point for this week's practical.
- If it is not already open, open practical3.mpp by double clicking on the file.

Lags

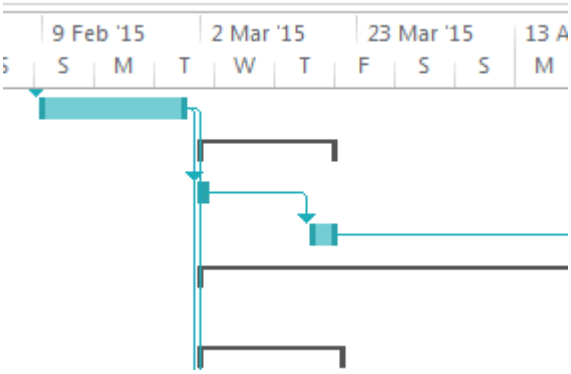
Note that this section not only illustrates the use of a lag, it also demonstrates the difference between manual and automatic scheduling.

In practical 2 we allowed 11 days for purchasing of the hardware. However, actually placing the purchase order is only likely to take 1 day. The remainder of the time was to allow for shipment and delivery. We could add another task that is "delivery" to make this clearer or we could introduce a lag time between the purchase and the installation to allow for the delivery time. We will introduce a lag time now.

- Change the duration for the purchase of the disk storage upgrade to 1 day.
- **Notice that when you reduce the time for the purchase, the installation is still scheduled to be in 10 days <u>after</u> the purchase not immediately after purchase is complete**.
- This is because we are still using the default scheduling which **manual** scheduling of tasks. Although the finish time of purchase is earlier now, the software does **NOT automatically adjust the start time of the install task.**
- You should observe this in the Gantt chart. The view of the tasks where purchase took 11 days was:

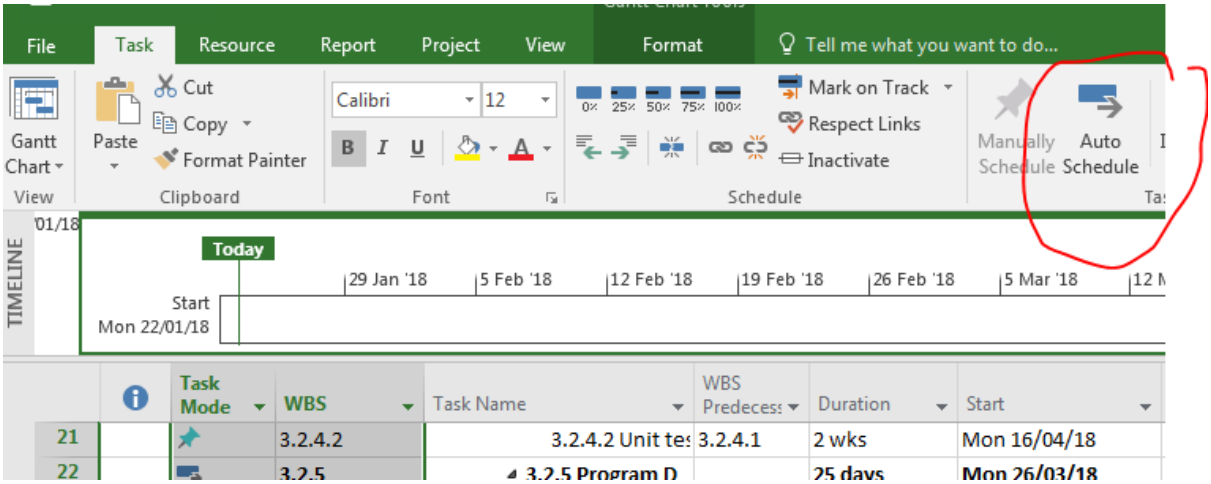


After the time for the purchase task was been reduced to one day, disk storage upgrade appeared as follows:



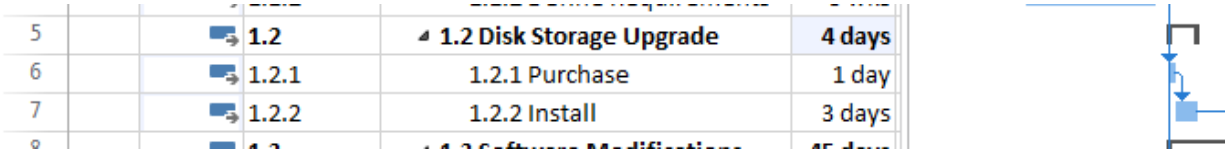
- To observe the difference between manual and automatic scheduling we will now change all the tasks so that they will be automatically scheduled.

- **Change all the tasks to use automatic scheduling** by using your mouse to select (highlight) all the tasks, followed by clicking on "Auto Schedule" in the tasks group on the Task ribbon.



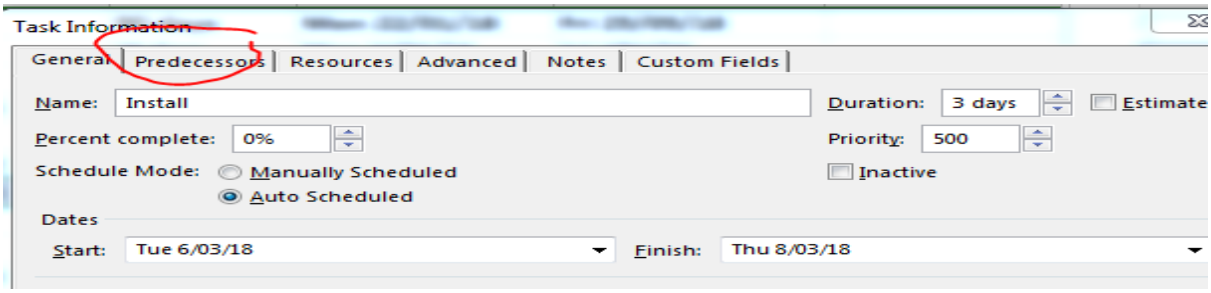
- **From this point on we will use automatic scheduling. You will learn how to change the default to automatic scheduling shortly.**

- Note that the **disk storage upgrade now only takes 4 days** and the installation is started immediately after purchase. This has been scheduled **automatically** according to its predecessor relationship.



- However, now that we understand the difference between automatic and manual scheduling, **remember that we did actually want to introduce a lag time to allow for the delivery of the new hardware.** We will do that now.

- Double click on the “install” disk storage task and select the predecessors tab in the pop-up “task information” window that appears.



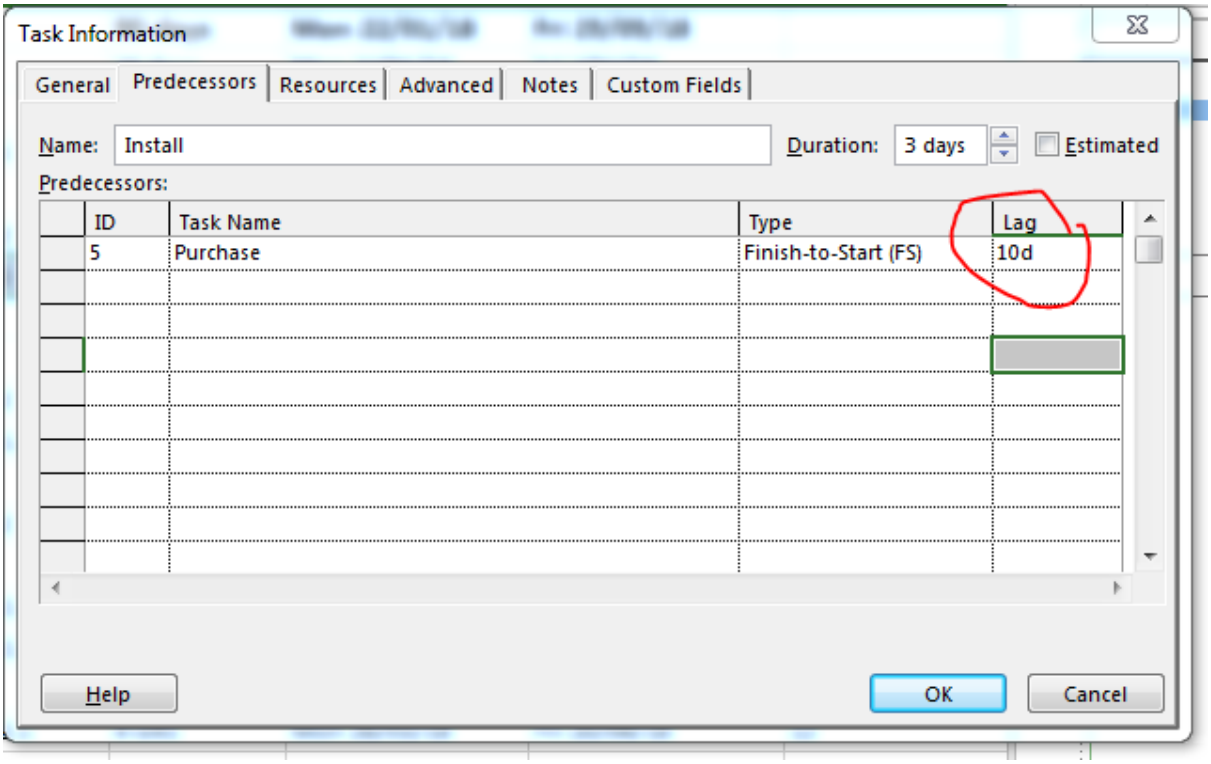
- Click on the Finish-to-Start(FS) relationship in the Type column and notice that there is a dropdown list associated with the type cells.
- Open the drop down list and observe the different types of predecessor relationships.
- What are the different relationships and what do they mean?

  Answer:

  - FS – the second task cannot start until the first task finishes
  - SS – the second task cannot start until the first task has started
  - FF – the second task cannot finish until the first task has finished
  - SF – the second task cannot finish until the first task has started

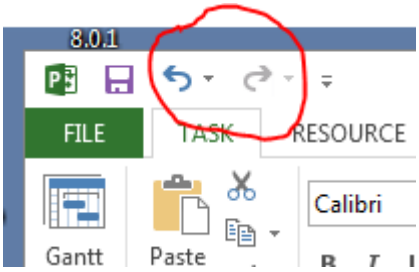
  Read the following useful URL for more details (you can do this after the practical):
  http://blogs.msdn.com/b/project/archive/2008/07/29/back-to-basics-understanding-task-dependencies.aspx

- The link between the purchase and install tasks for the disk storage upgrade is a Finish-to-Start relationship (the default). However, we wish to introduce a “**lag time**”, i.e. there is to be **a delay between the purchase order being completed and the installation to allow for the delivery of the new hardware**.
- Introduce this lag now by changing the value in the lag column of the task information window for the “install” task. Change the lag value in this column to 10 days and click the OK button. (If you no longer have this window open, remember that it can be opened by double clicking on the task.)



- Observe the change in the Gantt chart. The time for the disk storage upgrade should now be 14 days again.

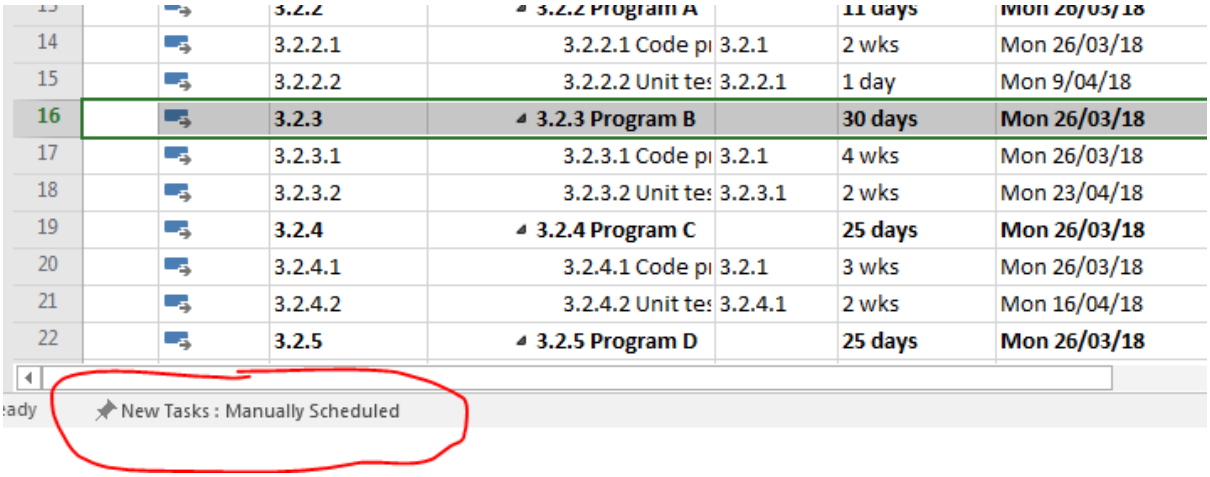
- (Use the undo and re-do arrows to check that you are achieving the desired result.)



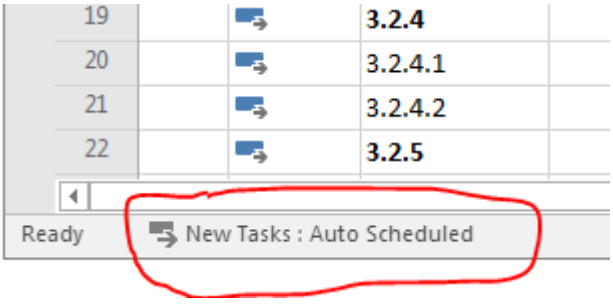
- Note that the predecessor column for the install task now has 5FS+10 days showing the predecessor relationship and lag. **This could also have been entered manually in the predecessor column.**

- **To ensure that any new tasks added to your schedule are automatically scheduled, you should click on "New Tasks: Manually Scheduled" on the bottom left hand corner and select "New Tasks: Auto Scheduled".** Unless you have a situation where you specifically want manual scheduling, you would normally set the default value to "New Tasks:

automatically scheduled" at the beginning of your project schedule development. The change is illustrated in the images below:



Changes to:



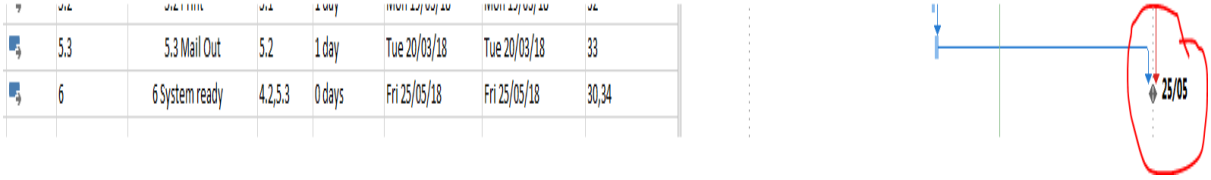
Adding a milestone

When the integration and testing is complete, the new "system is ready to go". This is a milestone for the project. (We could have other milestones during the project, but this is the only one we will add for the purposes of these practical exercises.)

- Insert a new task underneath the final "Mail Out" task called "System ready". If you have inserted the task correctly, it should be "6 System Ready ". Use the indent/outdent arrows on the Task ribbon to make any necessary adjustment to your WBS hierarchy.

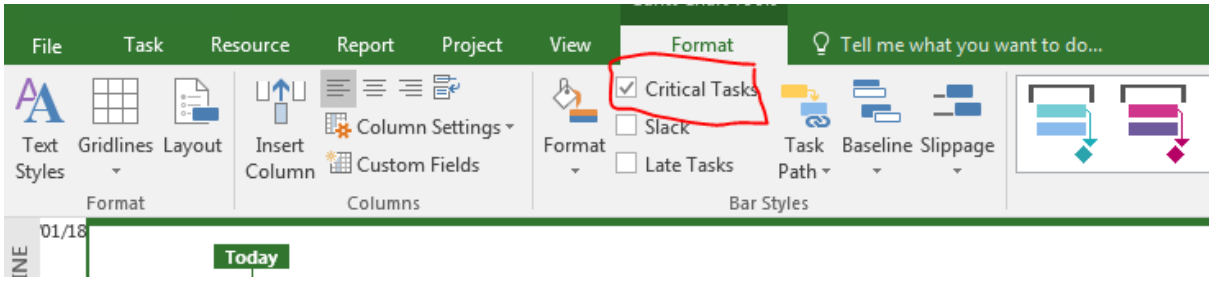
- **Make the predecessors of "system ready" the "integration testing" task (i.e. task 30 with WBS 4.2 and name of Test) and the "mail out task" (i.e. task 34).**

- Change the duration to 0 days. Notice the new milestone symbol that appears on the Gantt chart (a small diamond). Milestones are significant points in the project timeline.
  (It is also possible to have a milestones with a duration greater than 0. You can mark a task as a milestone by opening the task information window and selecting the "mark task as milestone" in the advanced tab.)

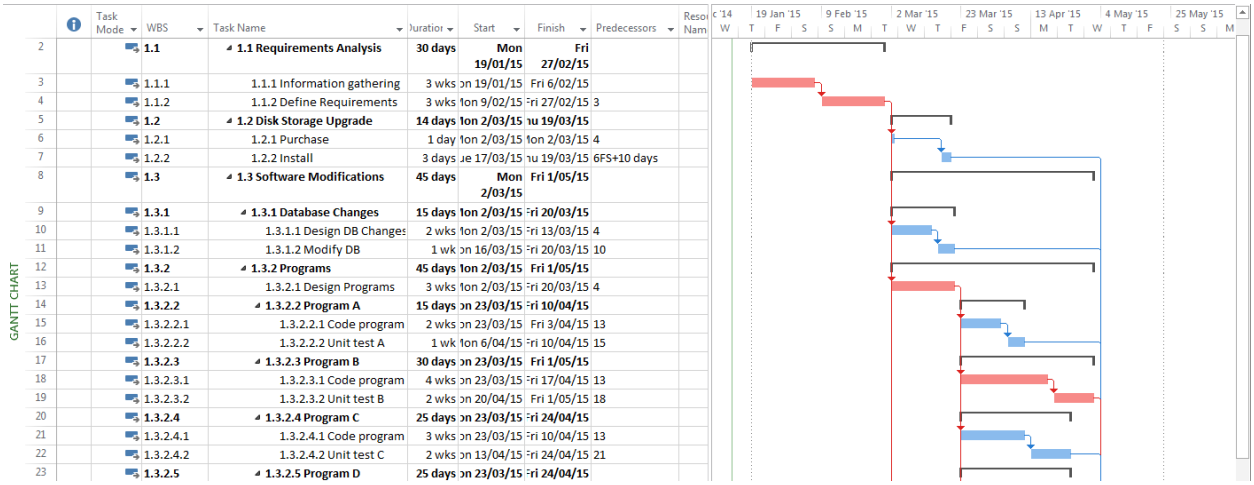


Displaying the critical path

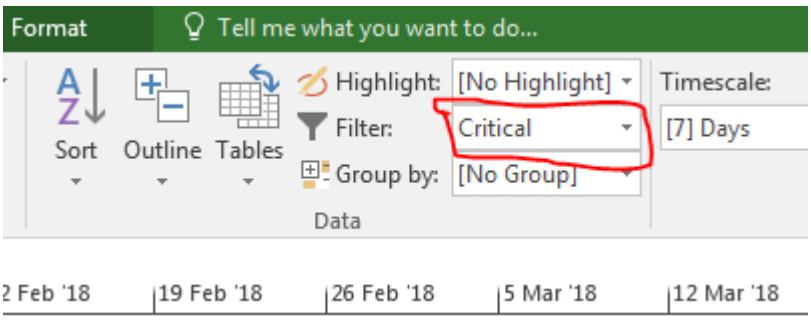
- Select the Format tab and click in the “critical tasks” check box in the bar styles group.

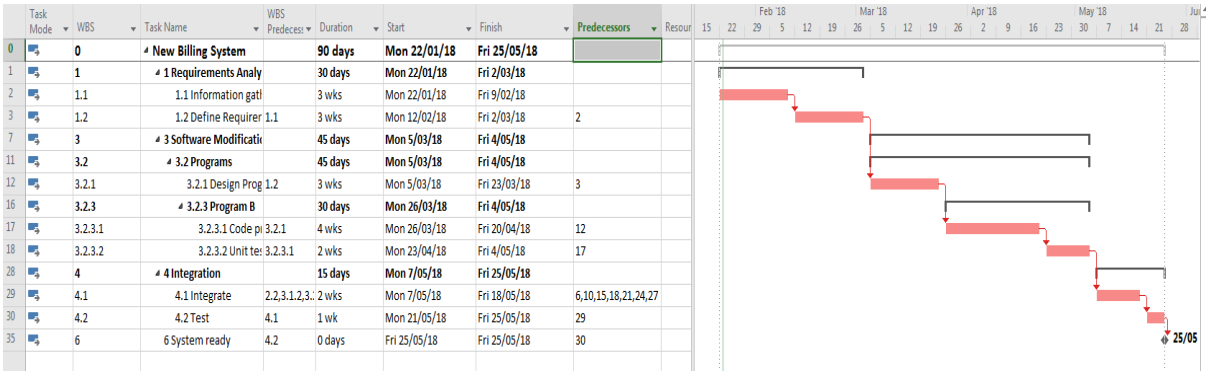


- Observe that the **tasks on the critical path are now displayed as red bars** on your Gantt chart.



- You can also **use the filter in the Data group on the View tab to filter out all tasks except those on the critical path.**





	Task Mode	WBS	Task Name	WBS Predeces	Duration	Start	Finish	Predecessors	Resour
0		0	New Billing System		90 days	Mon 22/01/18	Fri 25/05/18		
1		1	1 Requirements Analy		30 days	Mon 22/01/18	Fri 2/03/18		
2		1.1	1.1 Information gatl		3 wks	Mon 22/01/18	Fri 9/02/18		
3		1.2	1.2 Define Requirer	1.1	3 wks	Mon 12/02/18	Fri 2/03/18	2	
7		3	3 Software Modificatic		45 days	Mon 5/03/18	Fri 4/05/18		
11		3.2	3.2 Programs		45 days	Mon 5/03/18	Fri 4/05/18		
12		3.2.1	3.2.1 Design Prog	1.2	3 wks	Mon 5/03/18	Fri 23/03/18	3	
16		3.2.3	3.2.3 Program B		30 days	Mon 26/03/18	Fri 4/05/18		
17		3.2.3.1	3.2.3.1 Code pi	3.2.1	4 wks	Mon 26/03/18	Fri 20/04/18	12	
18		3.2.3.2	3.2.3.2 Unit tes	3.2.3.1	2 wks	Mon 23/04/18	Fri 4/05/18	17	
28		4	4 Integration		15 days	Mon 7/05/18	Fri 25/05/18		
29		4.1	4.1 Integrate	2.2,3.1.2,3.	2 wks	Mon 7/05/18	Fri 18/05/18	6,10,15,18,21,24,27	
30		4.2	4.2 Test	4.1	1 wk	Mon 21/05/18	Fri 25/05/18	29	
35		6	6 System ready	4.2	0 days	Fri 25/05/18	Fri 25/05/18	30	

- **Question:** What tasks are on the critical path(s) for your project (WBS codes)?

  _____

- If you used the filter, return it back to the default "no filter", so that you can now view all your tasks again.

Assessing the sensitivity of your schedule

The sensitivity of a schedule is a measure of how likely it is that the original critical path (or paths) will change when the project is underway. If the likelihood is high, then the schedule is very sensitive. The sensitivity depends on:

a. **The number of critical paths** in the network. In general, the sensitivity increases as the number of critical paths increases. You have already identified the critical path or paths for your network. How many have you identified? Note that this question is not asking how many tasks are on the critical path (or paths), it is asking **how many critical path(s)** are in the network.

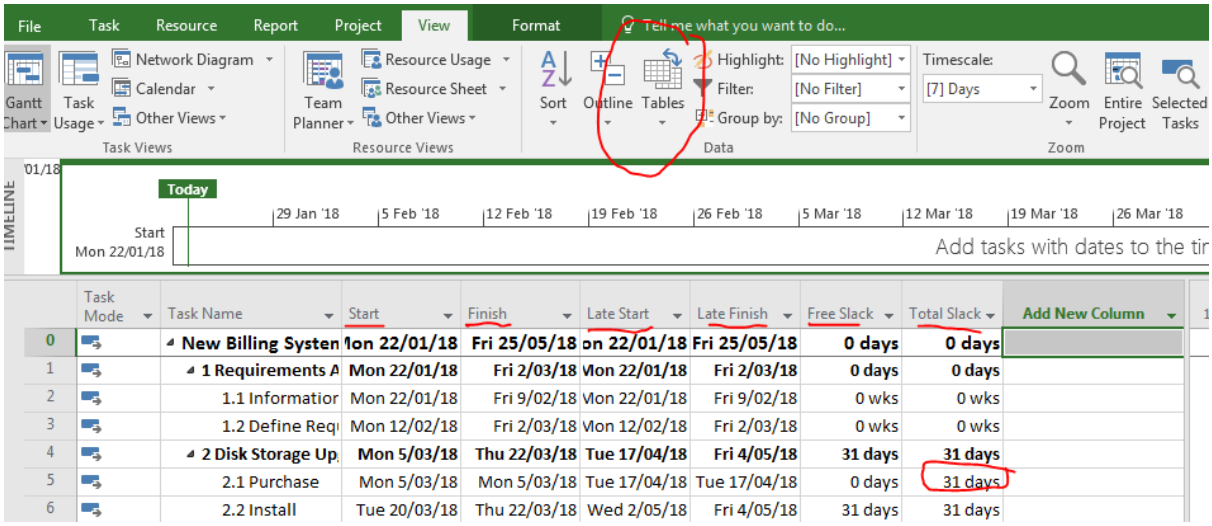
   Question: How many critical paths are there in this schedule? 8

   and

b. **The amount of slack the non-critical tasks have** - if there is a reasonable amount of slack relative to the non-critical task durations, then these tasks are less likely to become critical, i.e. the network is more likely to be stable (insensitive). The instructions to view slack are given below:

- Click the arrow on Tables in the Data group on the View ribbon and select the "schedule" table. This allows you to view the "schedule table".

  You should now see a table of the schedule with ES, EF, LS, LF, Free slack and total slack columns.



- **Question:** What is the slack for the non-critical tasks (list the amounts not all the tasks with slack)? 17

- **Question:** What does this (and the number of critical paths) suggest about the sensitivity of the network?

Remember,

Free slack (FS) is the amount of time a task can be delayed without delaying its successor task(s).

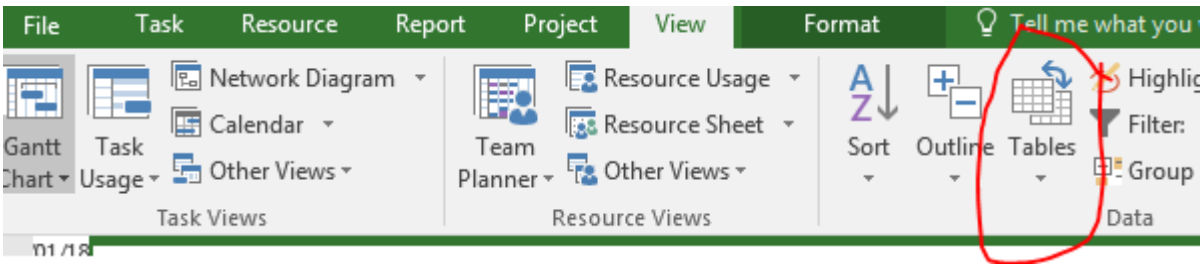
Total slack (TS) is the amount of time a task can be delayed without delaying the project.

Tasks on a path can have the same TS, but different FS – i.e. the tasks on the path "share" the total slack, so if one is delayed it reduces the TS for the path and all the subsequent tasks on that path. However, if a task is not at the end of the chain its delay will delay the start of its successor, so by definition, the task (or tasks) not at the end of the chain will have no free slack. Free slack tends to show up in the last task at the end of a chain of non-critical activities or in a single non critical activity.

You can observe examples where tasks on the same path have the same TS, but only the task on the end of the chain has FS by looking at this in the schedule table.

Question: Give one example of a chain where you observe this in this project.

- Return to the default view of the task entries by selecting "Entry" from the list of available tables in Tables drop-down list. (The drop-down list is in the Data group on the View ribbon.)



- **Save your work so far.**

Additional/Optional Work

Note that the following sections have not been tested in Microsoft Project 2016 and later.

Make a backup copy of your practical 3 mpp file before you experiment with the following – you can call it practical3_extra.mpp. The practical3.mpp file you completed in the previous section is to be used as the starting point for practical 4.

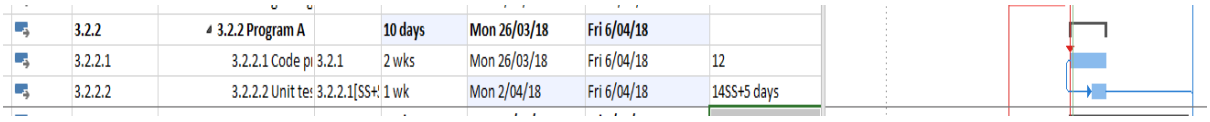
Experiment with different types of predecessor/successor relationships

- Experiment with the different predecessor success or relationship (e.g. FF, SF, SS).
- For example, assume that we want to start unit testing 1 week after coding starts so that the testing will be carried out concurrently with code development.

  Question: What relationship would you add between code program A and unit test program A

  _____

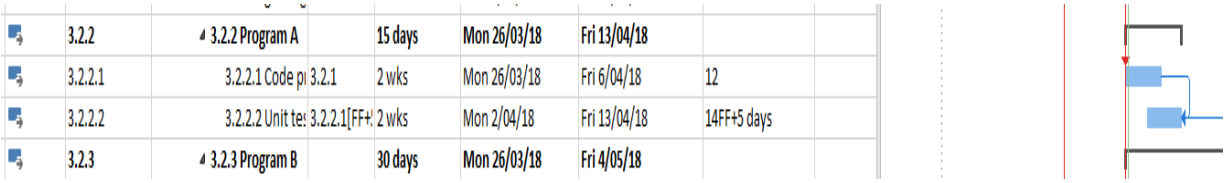
- Try that now.



- Now assume that instead we want to say unit testing cannot finish until 1 week after coding finishes.
- **Question: What relationship would you add between code program A and unit test program A**

  _____

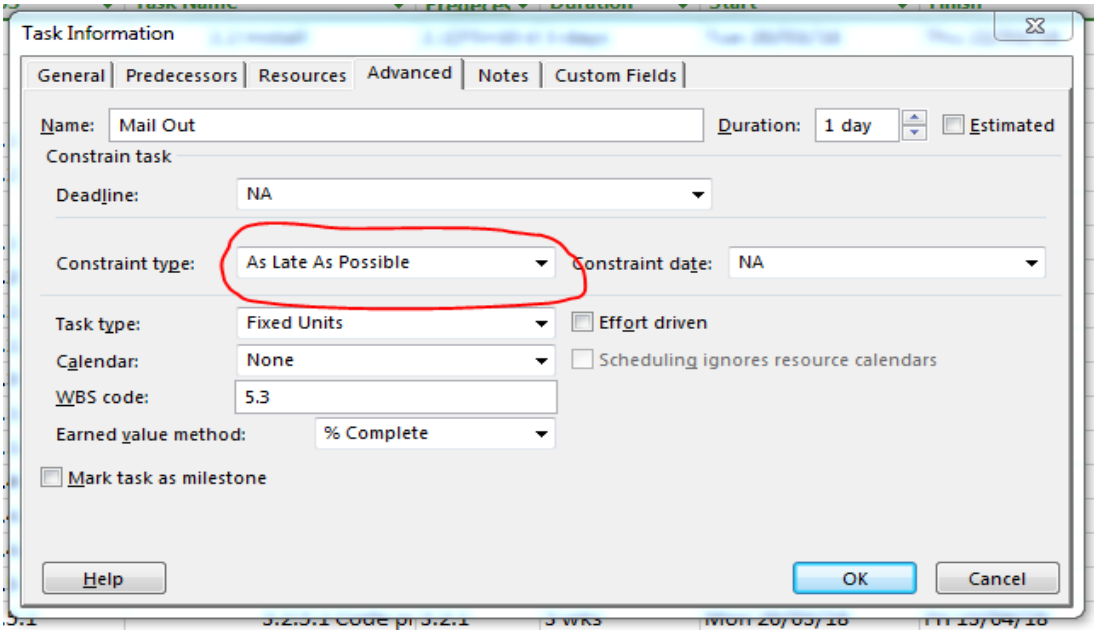
- Try that now.



	3.2.2	3.2.2 Program A		15 days	Mon 26/03/18	Fri 13/04/18	
	3.2.2.1	3.2.2.1 Code pi	3.2.1	2 wks	Mon 26/03/18	Fri 6/04/18	12
	3.2.2.2	3.2.2.2 Unit te:	3.2.2.1[FF+	2 wks	Mon 2/04/18	Fri 13/04/18	14FF+5 days
	3.2.3	3.2.3 Program B		30 days	Mon 26/03/18	Fri 4/05/18	

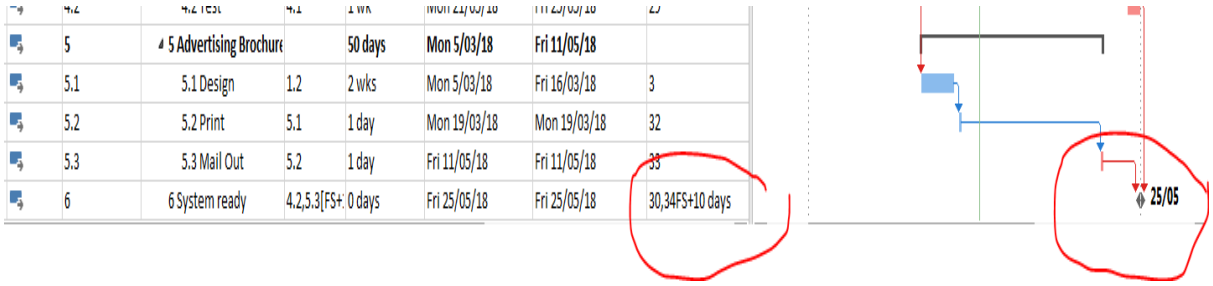
- Now suppose that we want to mail the brochures out 2 weeks before the system is ready.

  → Double click on the mail out task and select the "advanced" tab from the task information window that appears. Make the "mail out task" have a constraint type of "as late as possible".



- The mail out task is a predecessor of "system ready", but because it has to be completed 2 weeks before "system ready" therefore it should have a 2 week lag.

- Try this now.

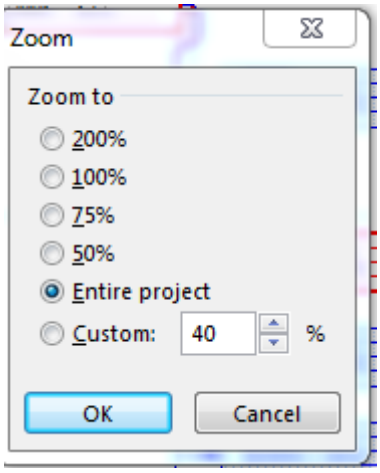


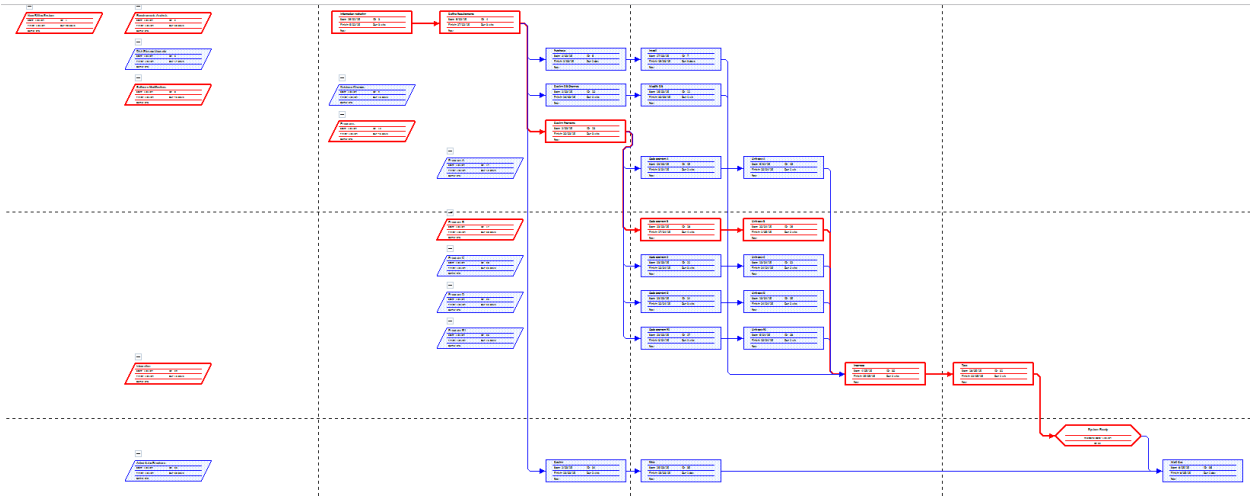
	5	5 Advertising Brochure		50 days	Mon 5/03/18	Fri 11/05/18	
	5.1	5.1 Design	1.2	2 wks	Mon 5/03/18	Fri 16/03/18	3
	5.2	5.2 Print	5.1	1 day	Mon 19/03/18	Mon 19/03/18	32
	5.3	5.3 Mail Out	5.2	1 day	Fri 11/05/18	Fri 11/05/18	33
	6	6 System ready	4.2,5.3[FS+	0 days	Fri 25/05/18	Fri 25/05/18	30,34FS+10 days

Viewing the network diagram

- Select "Network diagram" from the "Task Views" group on the View ribbon. You should now see the network diagram view of the project.

- It may be difficult to see the whole project. Select Zoom from the Zoom drop-down list in the Zoom group on the View ribbon and select “Entire Project”.





- There are various options you can explore to modify the network diagram. For example, you can remove the “summary task” boxes, so that your network diagram is less cluttered (uncheck the Summary Tasks check box on the Format ribbon). You can also manually position the boxes. Select the layout option from the Layout group on the Format ribbon and you will see the various options available in the Layout window. Experiment with some of the options available on the Format ribbon.

Modifying the timescale

In some situations you may not want to use the default time scale used in the Gantt chart. For example, it can be useful to condense the Gantt chart to see the "big picture" better. In other situations it may be clearer if you expand the chart.

- One way to view the whole project is to select the "Entire Project" from the zoom group on View ribbon. Note that if you select "Zoom …" from the drop-down list of zoom options, there are options that allow you to zoom to 1 week, 1 month etc. Experiment with some of these options now.

- You can also modify the timescale by selecting the Timescale option from the Timescale drop-down list in the zoom group on the View ribbon.

- There are three tiers that can be displayed above your Gantt chart. Experiment with the different "Timescale options" that you can select from the "Show" drop down box. This will clarify what is meant by the different tiers. (Try one tier, then three tiers and observe what happens on your Gantt chart.)

- Return to the default which shows two tiers (middle, bottom).

- Again in the Timescale window, select the "middle tier" tab and change the units to quarters instead of weeks.

- Select the bottom tier and change the units to months instead of days.

  Notice how this has condensed your Gantt chart.

- Set the middle tier back to weeks and the bottom tier back to days or select "Entire Project" from the zoom group.

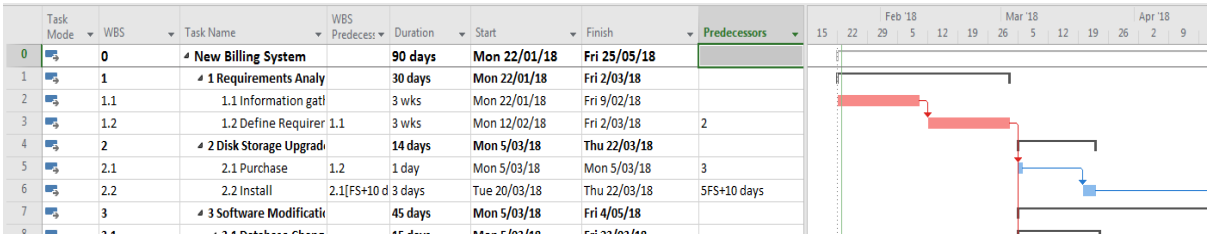
Practical 4

Adding Resources

- Open practical3.mpp file (if it is not already open) and save it to a file called practical4.mpp. You now have a copy of your work to use to develop practical4.mpp. You will use this practica4.mpp file as the starting point for this week's practical.

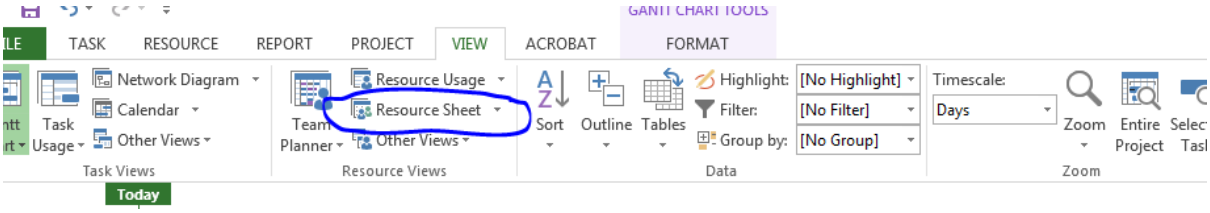
Create the resource pool

- If it is not already open, open practical4.mpp by double clicking on the file.
- Make sure you are using the Gantt chart view and the Entry table.

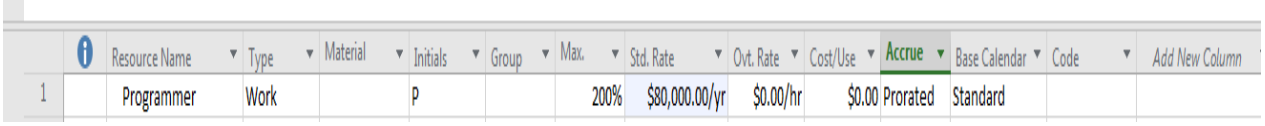


	Task Mode	WBS	Task Name	WBS Predecess	Duration	Start	Finish	Predecessors
0		0	New Billing System		90 days	Mon 22/01/18	Fri 25/05/18	
1		1	1 Requirements Analy		30 days	Mon 22/01/18	Fri 2/03/18	
2		1.1	1.1 Information gatl		3 wks	Mon 22/01/18	Fri 9/02/18	
3		1.2	1.2 Define Requirer	1.1	3 wks	Mon 12/02/18	Fri 2/03/18	2
4		2	2 Disk Storage Upgrad		14 days	Mon 5/03/18	Thu 22/03/18	
5		2.1	2.1 Purchase	1.2	1 day	Mon 5/03/18	Mon 5/03/18	3
6		2.2	2.2 Install	2.1[FS+10 d	3 days	Tue 20/03/18	Thu 22/03/18	5FS+10 days
7		3	3 Software Modificati		45 days	Mon 5/03/18	Fri 4/05/18	

- Select the "Resource Sheet" option from the View ribbon. In the table that is displayed, you should see columns for the resource name, type, material label, initials, group, max units, std rate etc. (If this is not the table you see displayed, select Entry from the Tables drop-down list in the Data group on the View ribbon.)



- Add the following information about the resources for the project. The resources could include both workers and materials such as equipment hire. In our example we only have to add the staff responsible for the tasks. The staff resources that are available for our example project are listed in the table below. An example of the first entry you should see in your completed resource table (details for the programmer) is given in the following screenshot:



	Resource Name	Type	Material	Initials	Group	Max.	Std. Rate	Ovt. Rate	Cost/Use	Accrue	Base Calendar	Code	Add New Column
1	Programmer	Work		P		200%	$80,000.00/yr	$0.00/hr	$0.00	Prorated	Standard		

Note:

a. You are to enter the resource units into Microsoft Project as a percentage. The default percentage is 100%. 100% indicates that there is one of those resources available. If, as in the case of programmers, there are 2 available, you enter 200%. Similarly, if there was a full-time programmer and one part-time (or 0.5 time) programmer available, you would enter 150%. When you group resources together in this way it means that they are interchangeable, i.e. all programmers can do the same work, have the same skill level and get the same salary. If you need to make a distinction then you should enter the details of the different resources separately.

b. It is easy to switch between hourly and annual pay rate. If you enter the numeric value/yr, the entry will be an annual pay rate.

c. If you entered an hourly rate, then that group could qualify for overtime rates which would then be entered in the "Ovt rate" column.

d. In the "Accrue at" column, there are various options available in the drop down list: start, prorated, end. Prorated means that the cost/payment is accrued on a day to day basis. Start means payment is required at the start. End means the payment is required when the work is complete.

e. The calendar can also be changed for each resource entry. This would allow you to take into account the differences in availability of work groups or individuals in the project.

- Enter the details for all the resources in the following table in the resource table of your mpp file now.

Resource Name	Type	Max Units	Std. Rate	Accrue At	Base calendar
Programmer	Work	200%	$80,000/yr	Prorated	standard
Analyst	Work	100%	$120,000/yr	Prorated	standard
Hardware engineer	Work	100%	$110,000/yr	Prorated	standard
Marketing specialist	Work	100%	$120,000/yr	Prorated	standard
Purchasing agent	Work	100%	$75,000/yr	Prorated	standard
Tester	Work	200%	$100,000/yr	Prorated	standard
Senior Programmer	Work	50%	$120,000/yr	Prorated	standard
Graphic Designer	Work	100%	$100,000/yr	Prorated	standard
Admin Assistant	Work	100%	$50,000/yr	Prorated	standard
Printer	Work	100%	$60,000/yr	Prorated	standard

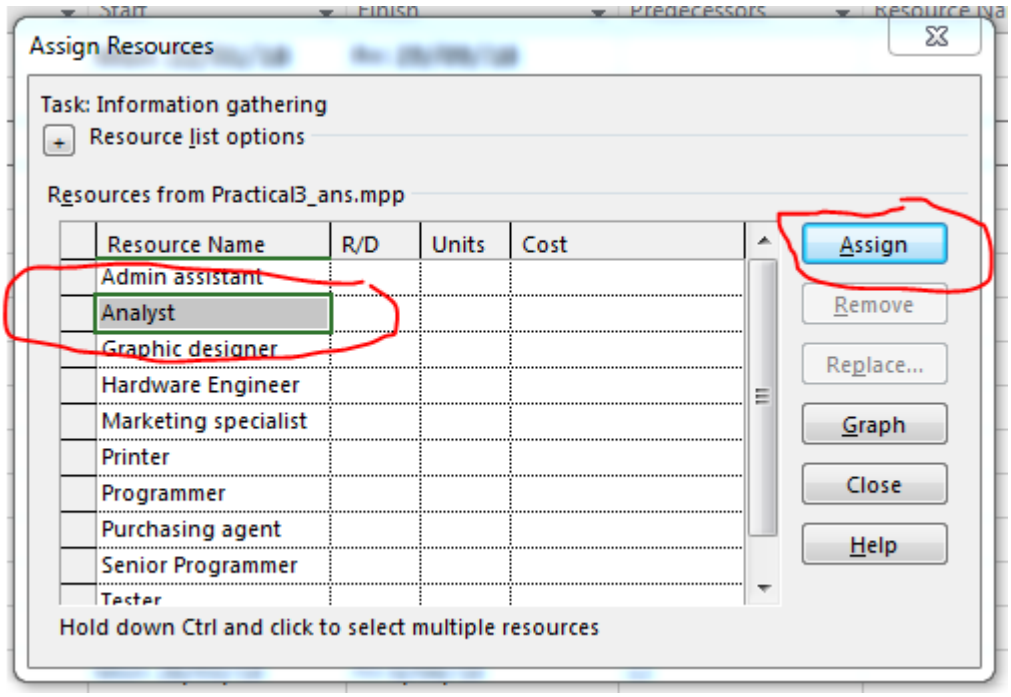
Assigning resources

- Return to the Gantt chart view and click the Resource tab.

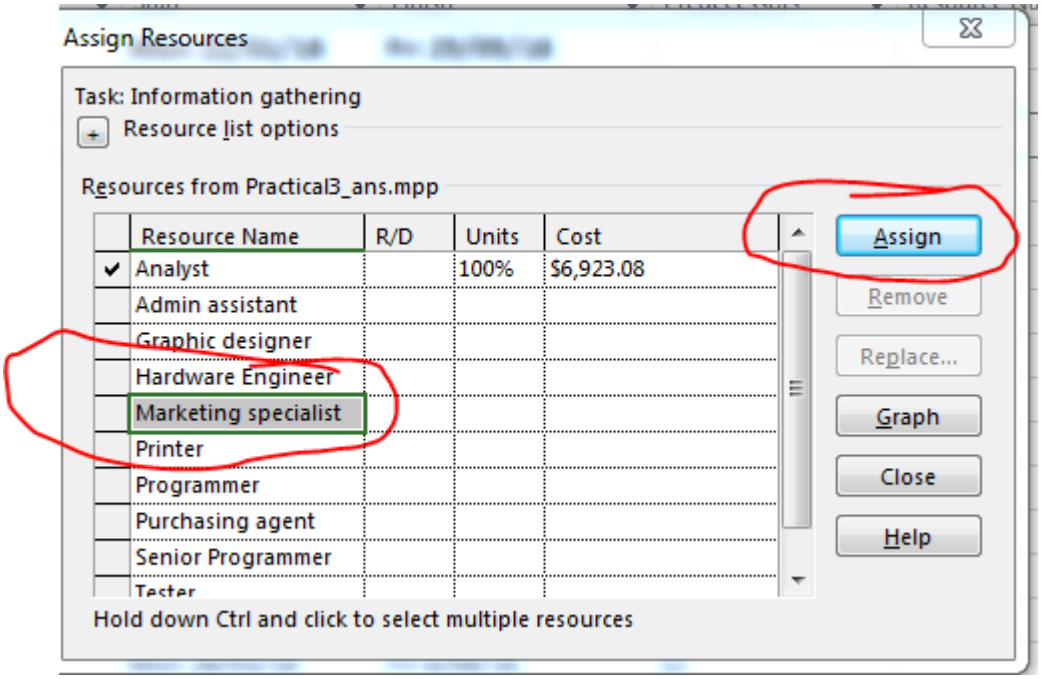
  Note that there is an icon on the toolbar that is for assigning resources. (It has the appearance of the head and shoulders of two people.)

- Click the "Information Gathering" **task** in your project (in the task list). You are now going to assign resource to this information gathering task. Click on the "assign resources" icon on the toolbar. In the pop-up window that appears you will see all the resources available for the project.

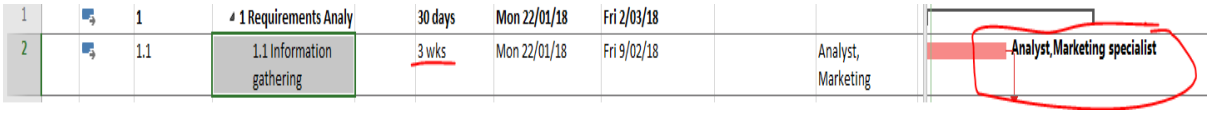
- Select analyst and click on the assign button.

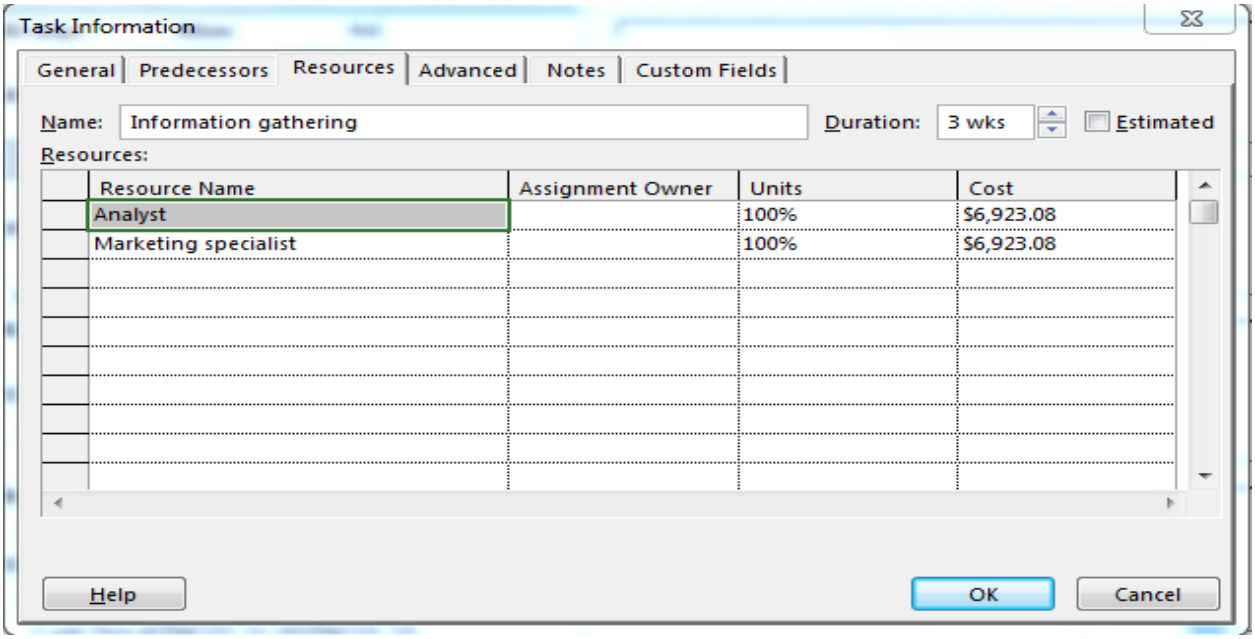


The analyst is going to work with the marketing specialist on the information gathering task, so you must now select marketing specialists and click on the assign button again.



Notice that although the number of resources have increased, the duration of the task has not been reduced. This is because Microsoft Project 2010 (and 2013) sets automatically scheduled tasks to "fixed units" that are **not** "effort driven". (In earlier versions of Microsoft Project the default setting was different. Check the behaviour in the version of the software you are using.)





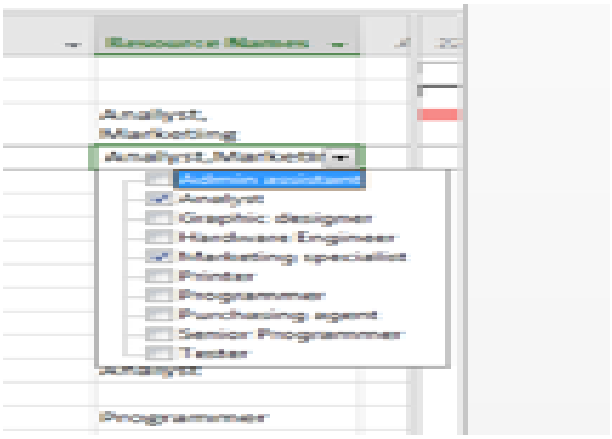
If the task was effort driven, then the additional resource would have reduced the duration for the task accordingly.

Microsoft Project uses resource and assignment information when calculating the schedule. This is something you should read about more and experiment within your own time to make sure that you understand the subtleties and achieve the behaviour you require for your situation. See the section on "additional work" at the end of this practical.

- In our example, the information gathering task is to take 3 weeks (15 working days) with both the analyst and marketing specialist working on this together (and both allocated 100% to this task). Make sure that this is correct in your schedule.

  Always take care when you modify resource assignments. Check that the result is the desired **duration** and **resource** allocation for your project. You should also check that resources are not over-allocated. This will be discussed further in the next practical.

- Note that there is a very quick, easy **alternative method for adding a resource**. You can select the resource from the drop down list of available resources that you observe when you click in the resource column for a particular task.

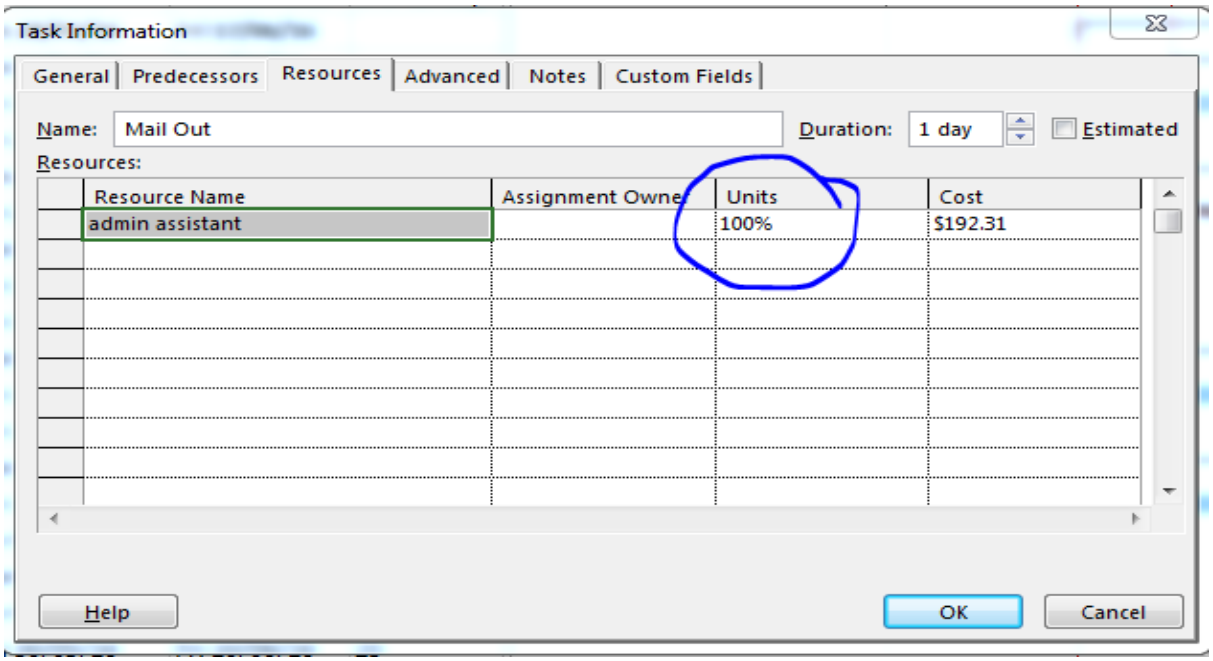


- Add the following resources to the project tasks. Note that the task durations are also given in the table. (If necessary override the durations to correspond to the data in the table below.)

Task names	Durations	Resources
New Billing System		
Requirements Analysis		
Information gathering	3 weeks	1 analyst and 1 marketing specialist
Define Requirements	3 weeks	1 analyst and 1 marketing specialist
Disk Storage Upgrade		
Purchase	1 day (lag of 10 days for delivery introduced earlier)	I purchasing agent
Install	3 days	1 hardware engineer
Software Modifications		
Database		
Design DB Changes	2 weeks	1 analyst
Modify DB	1 week	0.5 senior programmer
Programs		
Design Programs	3 weeks	1 analyst
Program A		
Code program A	2 weeks	1 programmer
Unit test A	1 week	1 tester
Program B		
Code program B	4 weeks	1 programmer
Unit test B	2 weeks	1 tester
Program C		
Code program C	3 weeks	1 programmer
Unit test C	2 weeks	1 tester
Program D		
Code program D	3 weeks	1 programmer
Unit test D	2 weeks	1 tester
Program R1		
Code program R1	2 weeks	1 programmer
Unit test R1	1 weeks	1 tester
Integration		
Integrate	2 weeks	0.5 Senior Programmer, 1 programmer
test	1 week	0.5 senior programmer, 1 tester
Advertising Brochures		
Design	2 weeks	1 graphic designer, 1 marketing specialist
print	1 day	1 printer
Mail out	1 day	1 admin assistant

Table 4: Resources

- If you do not wish to allocate 100% of a resource to a particular task (e.g. if you want the resource to work 50% on one task and 50% on another task for a particular period of time), it is possible to specify this.
- Double click on the "mail out" task. You will see a "Task Information" pop-up window.
- Click on the Resources tab. You can now adjust the units in the "Units" column.

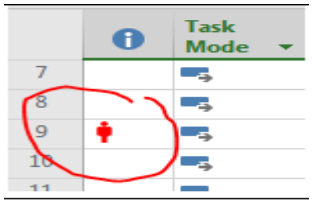


- **Question** Try changing the units for the admin assistant to 50% now. Click ok and note any changes. Did anything happen to the duration and/or cost for this task? Explain.

_____

- Change the units for the admin assistant back to their original value (100%).
- **Save your work so far.**

Note that some of the tasks now have a red symbol in the "i" column to indicate that they use resources that are now over-allocated. You will learn about some techniques to help resolve those issues in the next practical.



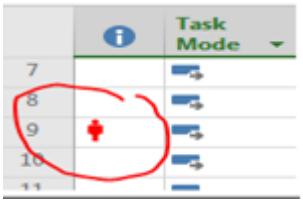
Practical 5

Adjusting Resource Allocation

- Open practical4.mpp file (if it is not already open) and save it to a file called practical5.mpp. You now have a copy of your work to use to develop practical5.mpp. You will use this practical5.mpp file as the starting point for this week's practical.

Identification of resource over-allocation

- In the last practical we noted that some of the tasks had a red symbol in the "i" column to indicate that they use resources that are now over-allocated.

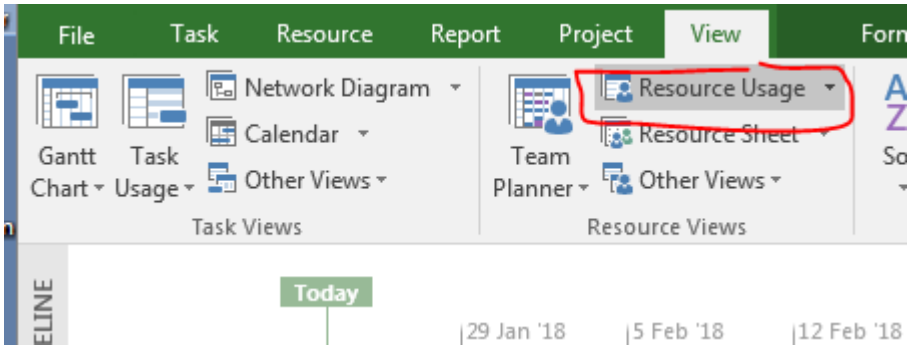


- Select the View tab and click on "Resource Sheet" in the Resource Views group. You should now see a view of the resource sheet. In this view, you should see the over- allocated resources displayed in red. **Are any of your resources over-allocated for this project?**

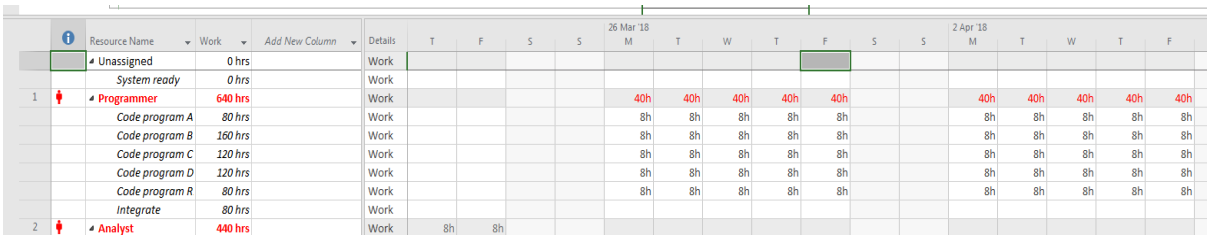
  (The programmers, analysts and testers should be displayed in red because they are over-allocated.)

Resource Name	Type	Material	Initials	Group	Max.	Std. Rate	Ovt. Rate	Cost/Use	Accrue	Base Calendar	Code	Add New Column
Programmer	Work		P		200%	$80,000.00/yr	$0.00/hr	$0.00	Prorated	Standard		
Analyst	Work		A		100%	$120,000.00/yr	$0.00/hr	$0.00	Prorated	Standard		
Hardware Engineer	Work		H		100%	$110,000.00/yr	$0.00/hr	$0.00	Prorated	Standard		
Marketing specialist	Work		M		100%	$120,000.00/yr	$0.00/hr	$0.00	Prorated	Standard		
Purchasing agent	Work		P		100%	$75,000.00/yr	$0.00/hr	$0.00	Prorated	Standard		
Tester	Work		T		200%	$100,000.00/yr	$0.00/hr	$0.00	Prorated	Standard		
Senior Programmer	Work		S		50%	$120,000.00/yr	$0.00/hr	$0.00	Prorated	Standard		
Graphic designer	Work		G		100%	$100,000.00/yr	$0.00/hr	$0.00	Prorated	Standard		
Admin assistant	Work		A		100%	$50,000.00/yr	$0.00/hr	$0.00	Prorated	Standard		
Printer	Work		P		100%	$60,000.00/yr	$0.00/hr	$0.00	Prorated	Standard		

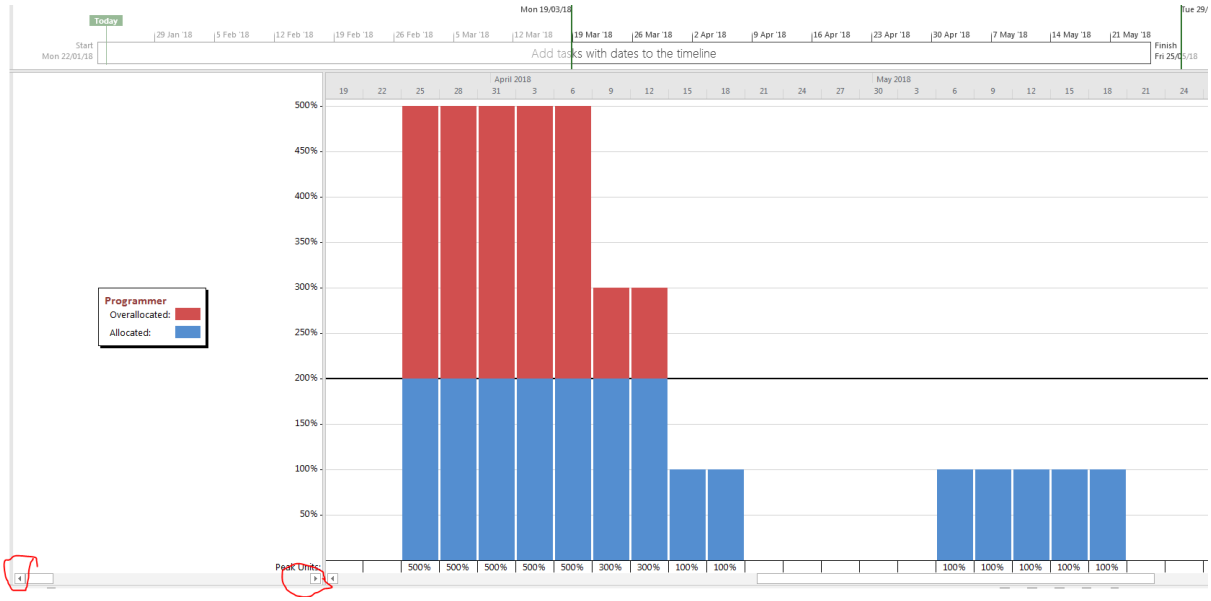
- To obtain more information about the over-allocation problem, select the "Resource Usage" option in the Resource Views group in the Views tab.



- If you use the bottom scroll bar to view all the data (or zoom in/view entire project), you will be able to see where/when the various resources are over-allocated. Where/when does this project have problems with over-allocation of resources? [Tip: Check the information noted in red]



- An alternative view that can be very useful is the resource graph. You can view the resource graph by selecting the "Resource Graph" option from the "Other Views" drop-down list. Try that now. (You may need to select "entire project" from the zoom block on the View ribbon.)



Clicking on the arrows at the bottom of the page allows you to move back and forward to view alternative resources.

Dealing with over-allocation issues

There are various options for dealing with resource over-allocation:

1. It may be possible to overcome the problems by levelling the resources within existing slack. This does not extend the project duration, but because you have absorbed some of the existing slack [i.e. pushed a task later in the timeline], it will make the network more sensitive.

2. It may **not** be possible to overcome the over-allocation problem by using slack. In this situation, options include:

   a. extending the project duration;

   b. allocating additional resources to the project;

   c. making the existing resources work overtime.

In our example, the analyst is over-allocated when he/she has to design the database changes **and** the programming tasks.

- If you are not in the Gantt Chart view, return to the Gantt chart view.
- Click the arrow on Tables in the Data group on the View ribbon and select the "Schedule" table. This allows you to view the "schedule table".

  Observe that there are 6 weeks of slack (30 days) for the "Database Changes" tasks, but 0 slack for the Design Programs.

7	**3 Software Modifications**	**Mon 5/03/18**	**Fri 4/05/18**	**Mon 5/03/18**	**Fri 4/05/18**	**0 days**	**0 days**
8	**3.1 Database Changes**	**Mon 5/03/18**	**Fri 23/03/18**	**Mon 16/04/18**	**Fri 4/05/18**	**30 days**	**30 days**
9	3.1.1 Design DB Changes	Mon 5/03/18	Fri 16/03/18	Mon 16/04/18	Fri 27/04/18	0 wks	6 wks
10	3.1.2 Modify DB	Mon 19/03/18	Fri 23/03/18	Mon 30/04/18	Fri 4/05/18	6 wks	6 wks
11	**3.2 Programs**	**Mon 5/03/18**	**Fri 4/05/18**	**Mon 5/03/18**	**Fri 4/05/18**	**0 days**	**0 days**
12	3.2.1 Design Programs	Mon 5/03/18	Fri 23/03/18	Mon 5/03/18	Fri 23/03/18	0 wks	0 wks

1.2.2 Install	Tue 18/10/11	Thu 20/10/11	Wed 30/11/11	Fri 2/12/11	31 days	31 days
1.3 Software Modifications	**Mon 3/10/11**	**Fri 2/12/11**	**Mon 3/10/11**	**Fri 2/12/11**	**0 days**	**0 days**
1.3.1 Database Changes	**Mon 3/10/11**	**Fri 21/10/11**	**Mon 14/11/11**	**Fri 2/12/11**	**30 days**	**30 days**
1.3.1.1 Design DB Changes	Mon 3/10/11	Fri 14/10/11	Mon 14/11/11	Fri 25/11/11	0 days	30 days
1.3.1.2 Modify DB	Mon 17/10/11	Fri 21/10/11	Mon 28/11/11	Fri 2/12/11	30 days	30 days
1.3.2 Programs	**Mon 3/10/11**	**Fri 2/12/11**	**Mon 3/10/11**	**Fri 2/12/11**	**0 days**	**0 days**
1.3.2.1 Design Programs	Mon 3/10/11	Fri 21/10/11	Mon 3/10/11	Fri 21/10/11	0 days	0 days

- **Question:** Record the slack you see for the "Database Changes" tasks in your schedule:

  _____

- **Question:** Record the start date for your project: _____
- **Question:** Record the end date for your project: _____

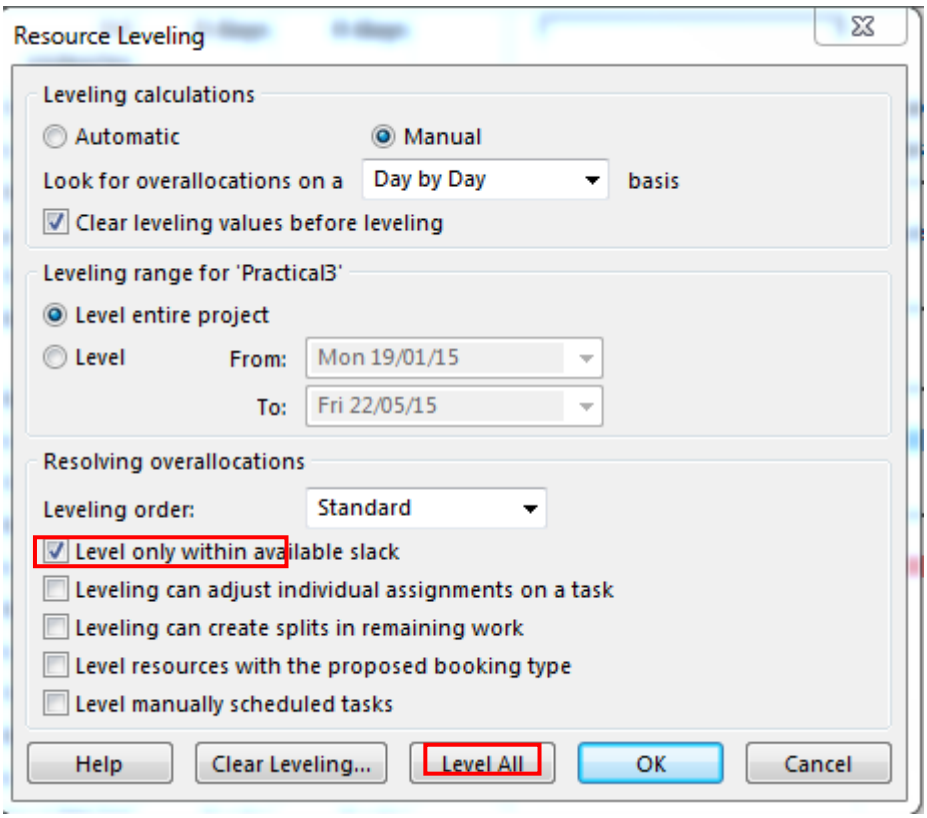
- **Question:** Record the duration of the project (in days): _____

- **Question:** Record the critical path (how many tasks are critical and list their WBS codes):

_____

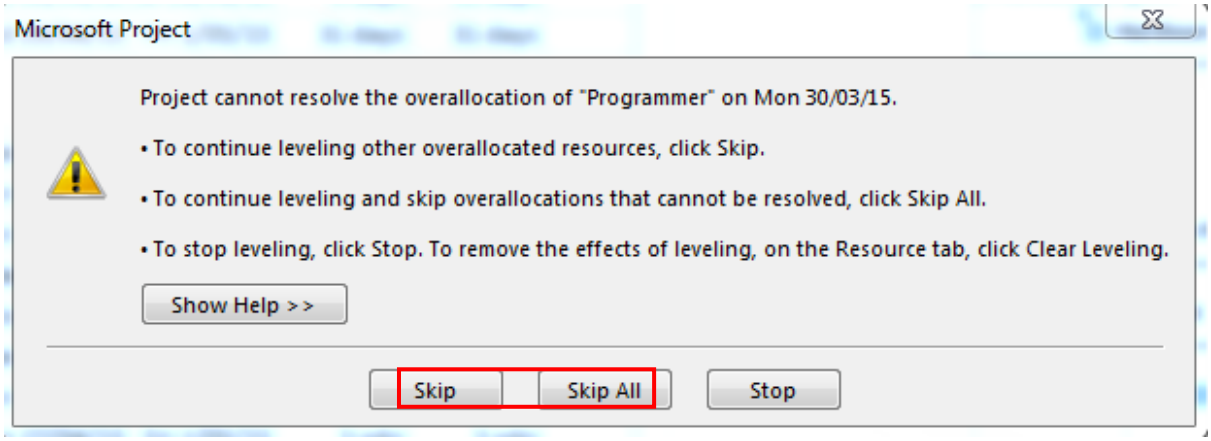
_____

- Click the Resource tab and select "Levelling Options" from the Level group. In the Resource Levelling window that appears, select "Level only within available slack" in the "resolving over-allocations section". Make the selections as shown below and click OK.



- This option will attempt to resolve the problems without adding extra resources or extending the duration. Click the "level all" button at the bottom of the pop-up window.

- After selecting the "level only within available slack" click the "level all" button at the bottom. You will find that you start to get warnings about the difficulties with the programmer and tester resources. (Remember that there was 0 slack for the programming tasks, so that you would not have expected to be able to resolve the issues by using available slack.) Select skip or skip all.



- **Question:** What affect has this had? (View the result in the "Resource Sheet" and on the Gantt chart. What impact has this had (has there been a change in the resources that are over-allocated)?)

  _____

- **Question:** How much slack is there for the "database changes" tasks now and has it changed?

  _____

- **Question:** What tasks are now "critical" (how many tasks are critical and list their WBS codes)?

  _____

  _____

  Note that this is now considered to be a "**critical chain**". This term was coined by by Eliyahu Goldratt who recognised that that a project network may be constrained by both resource and technical dependencies as is the case in this example. The term critical path tends to be associated with just technical dependencies, not resource dependencies.

- **Question:** Record the end date and duration (in days) of the project now:

  _____

- **Question:** Have they changed? (Explain.) _____

- You should find that the end date has not changed and that the over-allocation of the analyst has been resolved, but not the problem with the programmers and testers. We were able to resolve the over-allocation of the analyst using available slack, but not the problem with the programmers and testers.

  To resolve the other resource over-allocation issues we either need to extend the duration of the project or add extra programming and testing resources. For the purposes of this

exercise, we will assume that the addition of extra resources is not an option and that we have no option but to extend the duration.

- Again Click the Resource tab and select "Levelling Options" from the Level group. The Resource Levelling window will appears. This time "untick" the "Level only within available slack" option.

- Click the "Level All" button. (**Note that now we are not actually performing " resource levelling" according to the text book definition because we are not levelling within available slack**. According to the text book definitions, we are performing "**resource constrained scheduling**" where we are resolving resource over-allocation issues that arise because the number of resources are constrained. With resource constrained scheduling, we allow the duration of the project to be extended if that is necessary to resolve over-allocation when the number of resources are limited. In the text book definition of "**resource levelling**" we aim to achieve a "more even/more level" usage of resources **without extending the duration** of the project by only adjusting the scheduled time for a task "within the available slack".)

- **Question:** Is there still a resource over- allocation problem? _____

- **Question:** What has happened to the duration of the project now that you have performed resource levelling without the "level only within available slack restriction"? If a change, by how much?

  _____

- **Question:** What has happened to the critical tasks (have they changed – what tasks are critical now – how many tasks are critical and list their WBS codes)?

  _____

  _____

- **Question:** When does the project finish now? **(**Record the project end date now – has it changed?) _____

- **Question:** What is the project start date (and has it changed)? _____

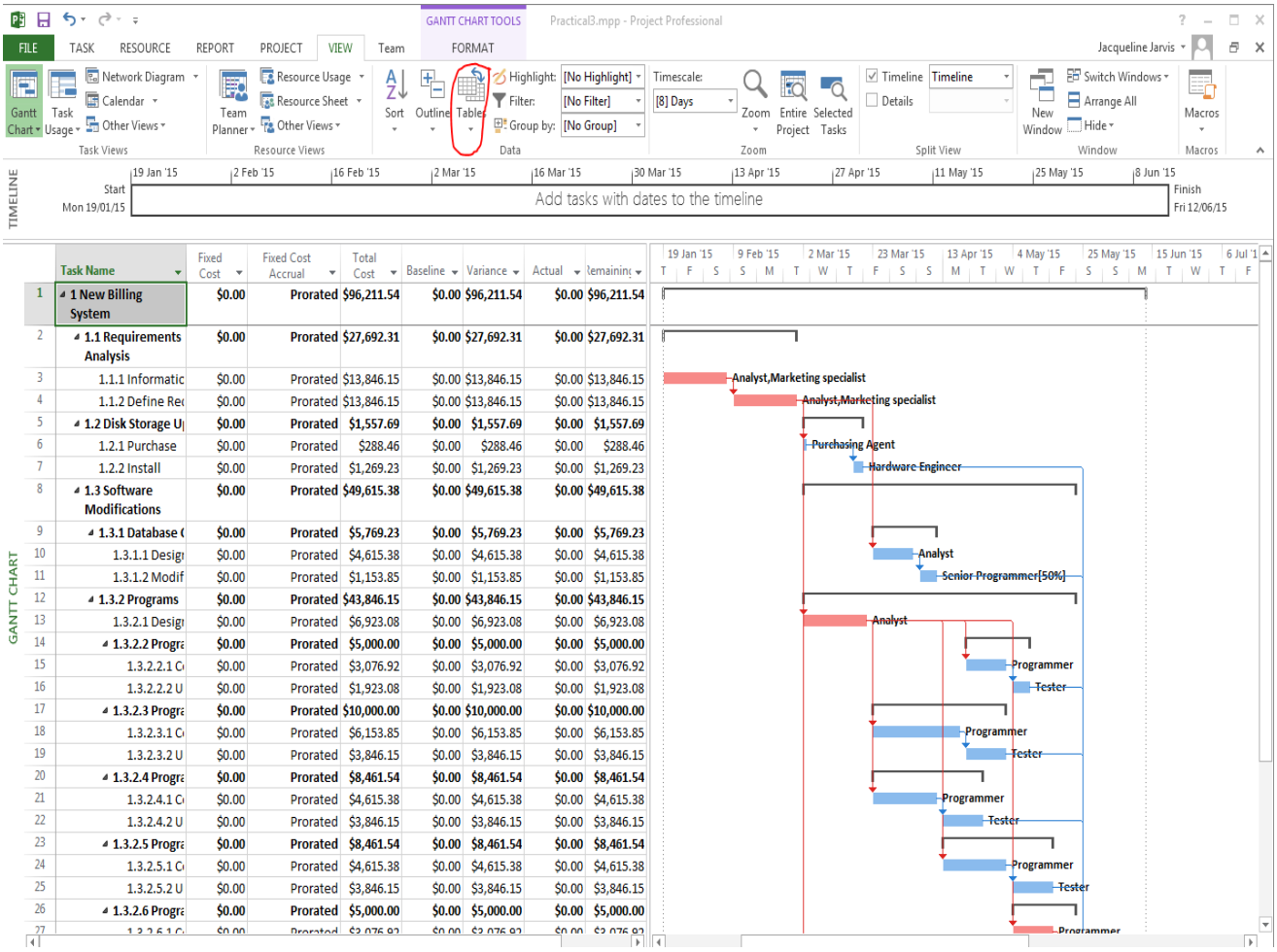
  Note that in this practical we have carried out resource "levelling" over the entire project. However, this is not the only option. For example, you can choose to level only a portion of the project or to perform levelling for selected resources that are in high demand. It is also possible to manually resolve "occasional resource over allocations" by introducing "levelling delays". In addition, you will have noticed that there are various options that you can set when performing levelling (e.g. to allow tasks to be split). Discussion of these options is beyond the scope of these practicals.

- **Save your work so far.**

Viewing the budget details

View the total cost

- Select the "Cost" table from the drop-down list of tables in the View ribbon.
  TIP: Do this by first choosing the VIEW tab (AKA ribbon) – Go to the "Data" section, and select from the drop-down listing under "Tables": Cost

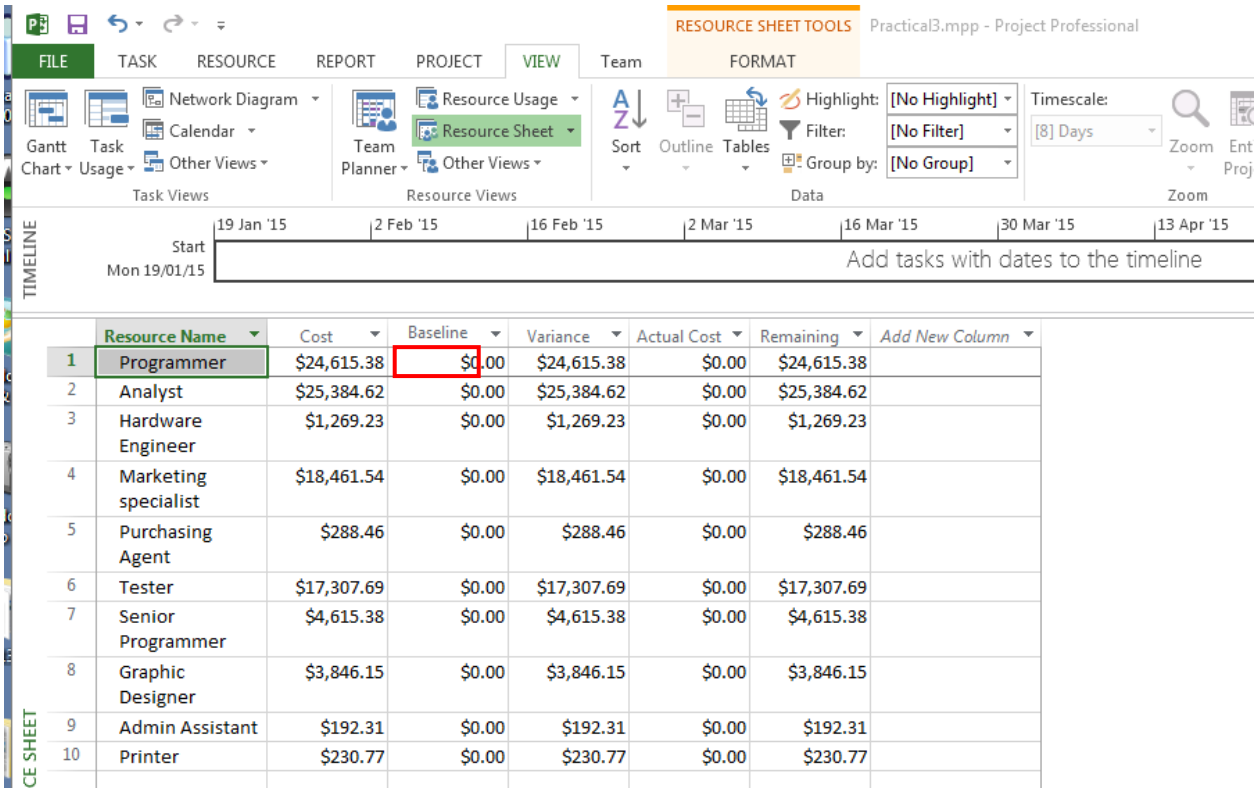


- **Question:** What is the total cost estimate for this project? _____

- **Question:** What is the most expensive individual task(s) (not summary task)? _____

- To view the costs associated with each of the resources select "Resource Sheet" from the "Resource Views" group and select the "Cost" table from the drop-down list of tables in the Data group on the View ribbon. This should allow you to view the cost associated with each of the resources.

- **Question:** What is the total amount estimated to be spent on programming staff in this project?_____



	Resource Name	Cost	Baseline	Variance	Actual Cost	Remaining	Add New Column
1	Programmer	$24,615.38	$0.00	$24,615.38	$0.00	$24,615.38	
2	Analyst	$25,384.62	$0.00	$25,384.62	$0.00	$25,384.62	
3	Hardware Engineer	$1,269.23	$0.00	$1,269.23	$0.00	$1,269.23	
4	Marketing specialist	$18,461.54	$0.00	$18,461.54	$0.00	$18,461.54	
5	Purchasing Agent	$288.46	$0.00	$288.46	$0.00	$288.46	
6	Tester	$17,307.69	$0.00	$17,307.69	$0.00	$17,307.69	
7	Senior Programmer	$4,615.38	$0.00	$4,615.38	$0.00	$4,615.38	
8	Graphic Designer	$3,846.15	$0.00	$3,846.15	$0.00	$3,846.15	
9	Admin Assistant	$192.31	$0.00	$192.31	$0.00	$192.31	
10	Printer	$230.77	$0.00	$230.77	$0.00	$230.77	

- **Save your work so far.**

Additional/Optional Work

- Make a copy of your practical 5 mpp file (practica5_extra.mpp) to use when you are experimenting in this section. Your previously completed practical 5 is to be submitted in Moodle and will be used as the starting point for practical 6.

- Note that these additional exercises have not been tested in Microsoft Project 2016.

- Microsoft Project uses resource and assignment information when calculating the schedule. This is something you should read about more and experiment with in your own time. It takes into account things such as:

  1. The amount of work or overtime a resource is allocated.

  2. The task type.

     - Fixed unit – "A task in which the assigned units [or resources] is a fixed value and any changes to the amount of work or the task's duration do not affect the task's units. This is calculated as follows: Duration x Units = Work" (Microsoft Help, 2010)

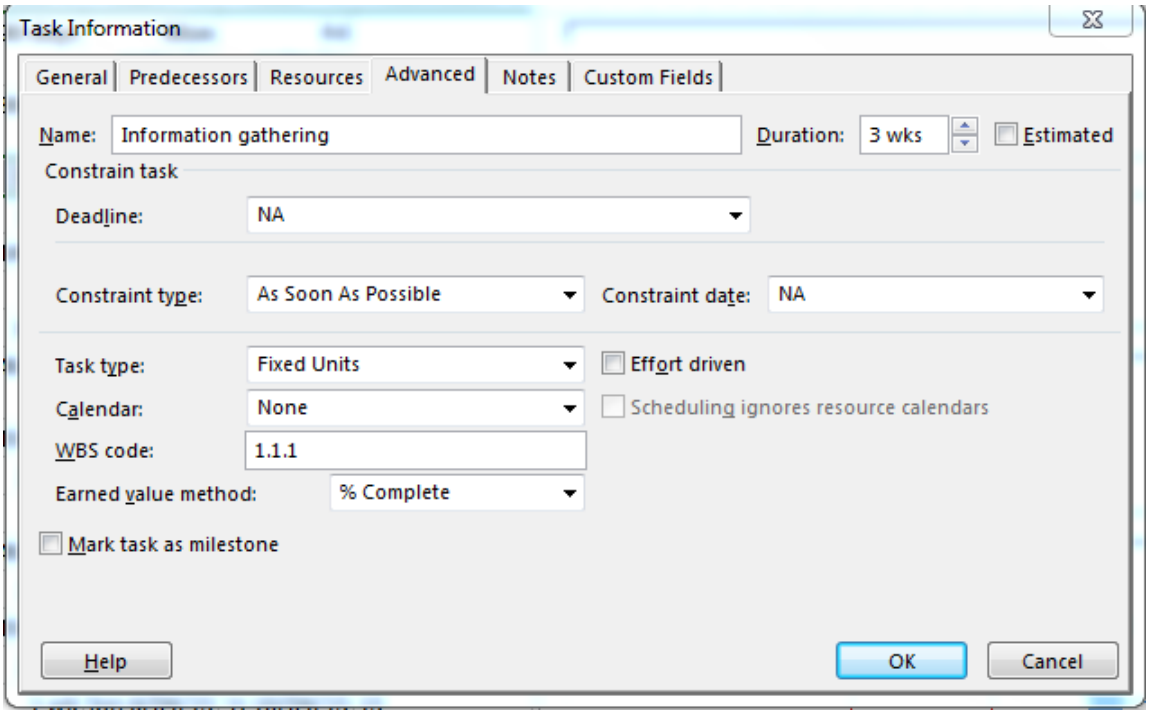
- Fixed duration – "A task in which the duration is a fixed value and any changes to the work or the assigned units [that is, resources] don't affect the task's duration. This is calculated as follows: Duration x Units = Work." (Microsoft Help, 2010)

- Fixed work –"A task in which the amount of work is a fixed value and any changes to the task's duration or the number of assigned units [or resources] do not affect the task's work. This is calculated as follows: Duration x Units = Work." (Microsoft Help, 2010)

3. Whether or not the task is effort driven. "If a task is effort-driven, as resources are added or removed on the assignment, the work remains constant for the task and is redistributed among the resources. For fixed-unit tasks, for example, one result is that if more resources are assigned, a shorter duration is required to complete the task" (Microsoft Help, 2010)

4. The resource calendar.

You may have read the details about "How do resource assignments drive the schedule?" when you read the "How scheduling works in Project" article in Microsoft Help that was referred to earlier in these practicals. If not, read this now and experiment with the various options to make sure that you understand them. (To modify a task type, double click on the task, Select the "Advanced" tab in the "Tasks Information" pop up window and select the task type from the drop down list. Note that there is also a check box to allow you to select whether or not you want the task to be "effort driven".)



Try different combinations such as:

- Fixed unit, effort driven
    - Add a new resource – what happens to the duration?
    - Reduce one of the resources to 50% – what happens to the duration?

etc.

The various options are described in detail in the Microsoft Project "Help" on "How scheduling works in Project" article referred to earlier in the practicals.

Make sure that you understand the various options and the results of your experimentation. If you believe that Microsoft Project has modified your schedule in a way that does not correspond to the requirements for your project, you can override the duration etc. (Note that manually scheduled tasks cannot be set to effort-driven.)

- If necessary, reset the default for the task you have been experimenting with to automatically scheduled and "fixed units" that are **not** "effort driven",

Practical 6

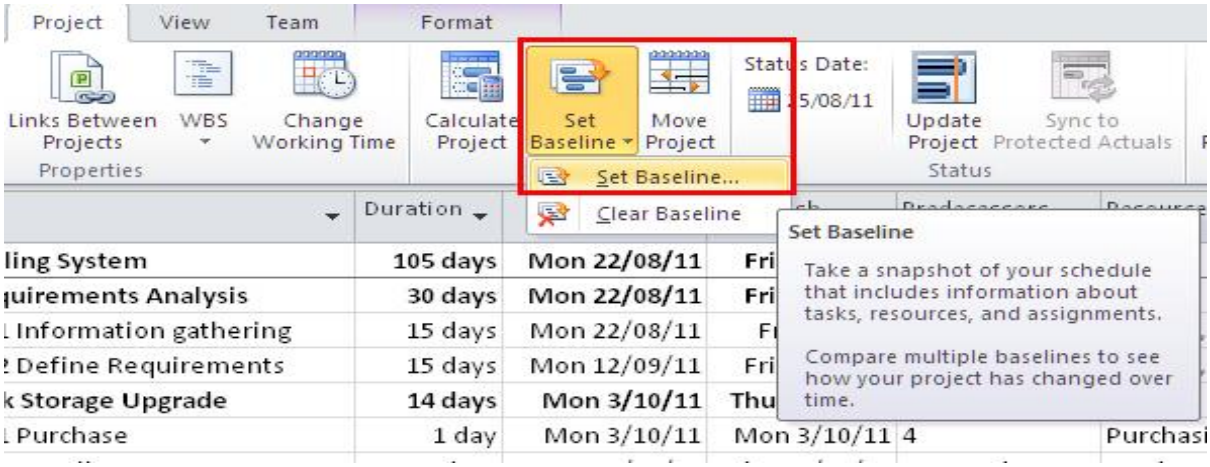
Saving the baseline to allow actual progress to be compared with planned progress

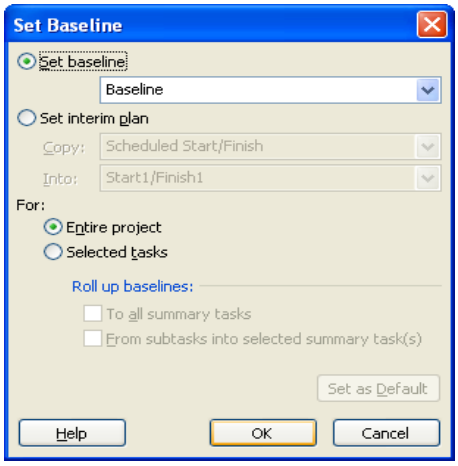
- One of the reasons for developing your project schedule is to allow you to compare actual progress with planned progress. You can accomplish this by saving a baseline as a snapshot of your original schedule before your project gets rolling and then recording actual progress as the project progresses.
- This practical is to demonstrate how to save the baseline and set the status date.
- **Open your practical5.mpp file (if it is not already open) and save it to a file called practical6.mpp. You now have a copy of your work to use in practical 6.** You will use practical6.mpp as the starting point for this week's practical.
- If it is not already open, open practical6.mpp by double clicking on the file.

Saving the baseline

Now that we have identified tasks, predecessor relationships, added durations, assigned resources and resolved the resource issues, we are ready to save our plan as a baseline plan. This will allow us to compare actual progress with planned progress when the project is underway.

- To save the baseline plan, return to the Gantt chart view then click on the Project tab and select "set baseline" from the "Set Baseline" drop-down list in the Schedule group.
- Select "set baseline". As this is the original baseline it should just be called baseline.
- Click the "for the entire project" option followed by OK to complete saving the baseline.





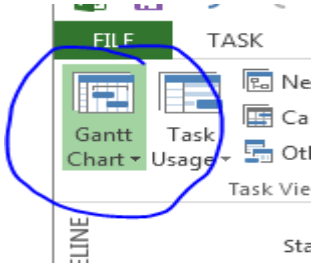
Question: What is the current predicted duation for the project? _____

Question: What is the current predicted end date for the project? _____

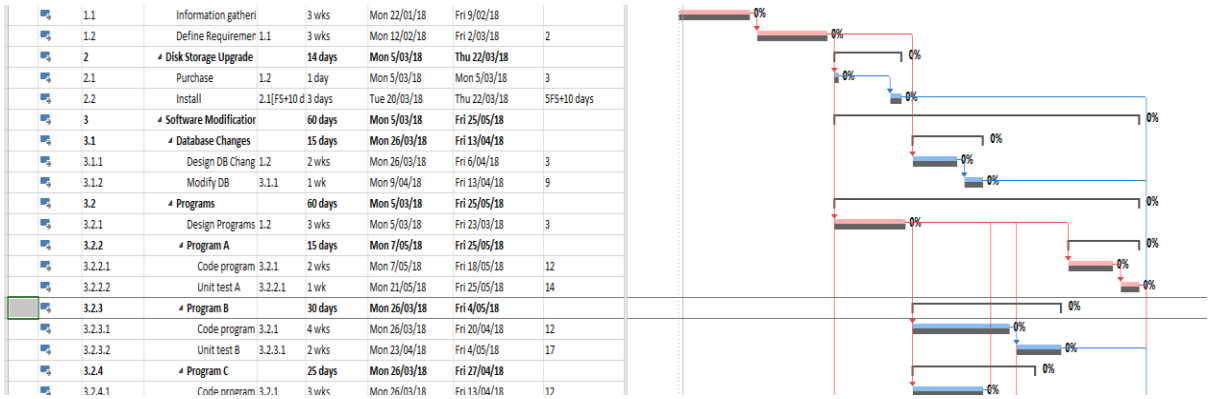
Viewing the Tracking Gantt Chart

If you now view the tracking Gantt chart it will display both the current schedule (bars on top) with the baseline tasks bars below them.

To view the Tracking Gantt chart select the **Tracking** Gantt option from the drop down list you see when you click on "Gantt Chart" in the top left hand corner when you are viewing the task ribbon. (You may need select "entire project" from the zoom section of the View ribbon to see the whole chart clearly.)



Your Tracking Gantt chart should appear similar to the following extract:



1.1	Information gatheri		3 wks	Mon 22/01/18	Fri 9/02/18		
1.2	Define Requiremer	1.1	3 wks	Mon 12/02/18	Fri 2/03/18	2	
2	Disk Storage Upgrade		14 days	Mon 5/03/18	Thu 22/03/18		
2.1	Purchase	1.2	1 day	Mon 5/03/18	Mon 5/03/18	3	
2.2	Install	2.1[FS+10 d	3 days	Tue 20/03/18	Thu 22/03/18	5FS+10 days	
3	Software Modificatior		60 days	Mon 5/03/18	Fri 25/05/18		
3.1	Database Changes		15 days	Mon 26/03/18	Fri 13/04/18		
3.1.1	Design DB Chang	1.2	2 wks	Mon 26/03/18	Fri 6/04/18	3	
3.1.2	Modify DB	3.1.1	1 wk	Mon 9/04/18	Fri 13/04/18	9	
3.2	Programs		60 days	Mon 5/03/18	Fri 25/05/18		
3.2.1	Design Programs	1.2	3 wks	Mon 5/03/18	Fri 23/03/18	3	
3.2.2	Program A		15 days	Mon 7/05/18	Fri 25/05/18		
3.2.2.1	Code program	3.2.1	2 wks	Mon 7/05/18	Fri 18/05/18	12	
3.2.2.2	Unit test A	3.2.2.1	1 wk	Mon 21/05/18	Fri 25/05/18	14	
3.2.3	Program B		30 days	Mon 26/03/18	Fri 4/05/18		
3.2.3.1	Code program	3.2.1	4 wks	Mon 26/03/18	Fri 20/04/18	12	
3.2.3.2	Unit test B	3.2.3.1	2 wks	Mon 23/04/18	Fri 4/05/18	17	
3.2.4	Program C		25 days	Mon 26/03/18	Fri 27/04/18		
3.2.4.1	Code program	3.2.1	3 wks	Mon 26/03/18	Fri 13/04/18	12	

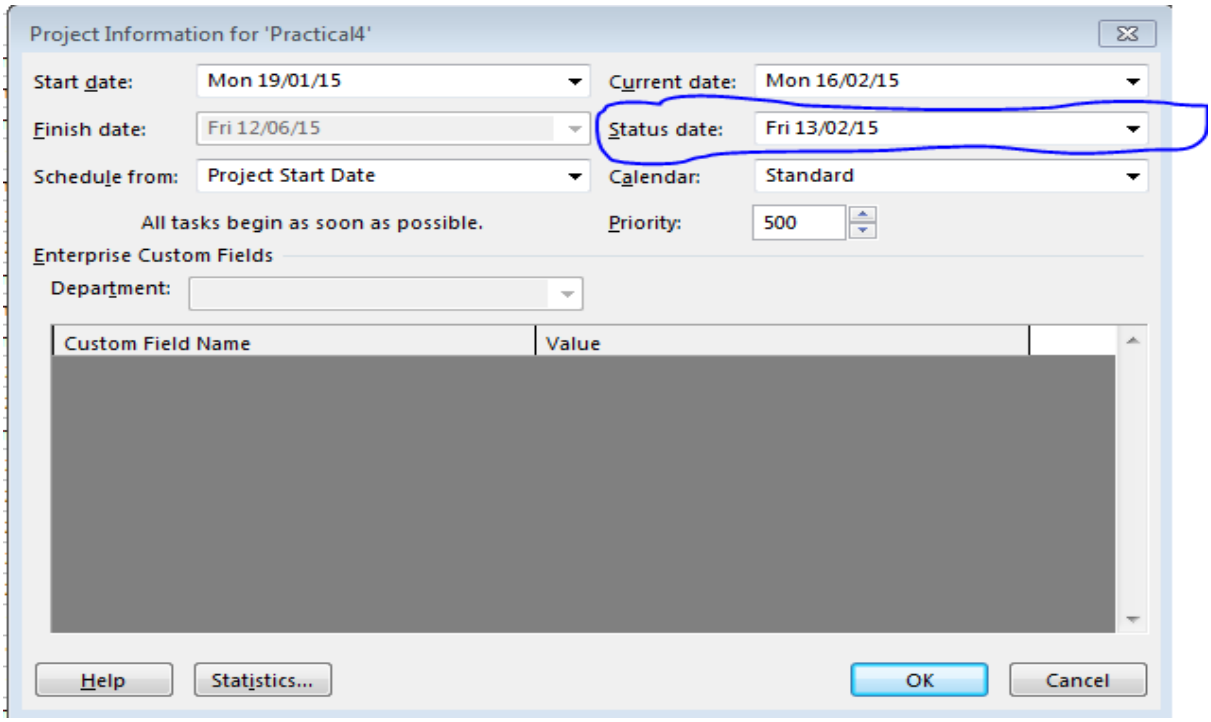
Entering the status date in preparation for entering status information

- Now suppose that you are in the executing stage of the project. In that case you will want to update the schedule to accurately record the actual status of your project on a regular basis. You can do this in Microsoft Project and you can use various features to help you to analyse the status of your project.

- To begin, you need to collect progress data from your team up to the particular status date. You will be given some status information to experiment with shortly. In this practical exercise we are demonstrating some of the Microsoft Project features. However, we are not actually in the executing stage of the project so we are going to artificially select a status date. This could be in the future or past depending on how quickly you are progressing through the practicals. Ignore this anomaly for the purposes of this exercise.

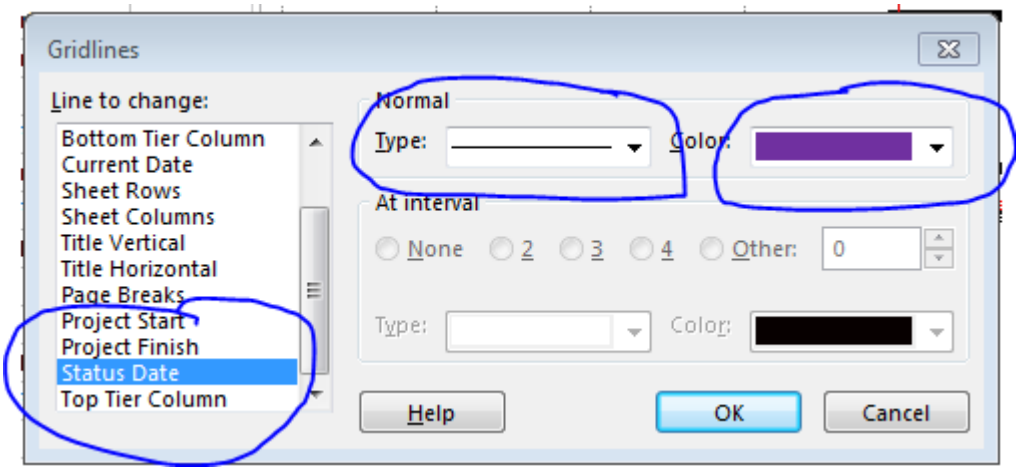
- **For this practical, you are to select the project status date to be the Friday of the 4th week into your project.** (This assumes that you correctly started your project on a Monday as requested in practical 1. If that is not the case make the appropriate adjustments.)

- **To set the status date** select "Project Information" from the Project properties group on the Project ribbon. Enter the status date and click OK. (The screen shot below does not have the actual date that you need to select for your status date. The date will depend on when you started these practical exercises.)

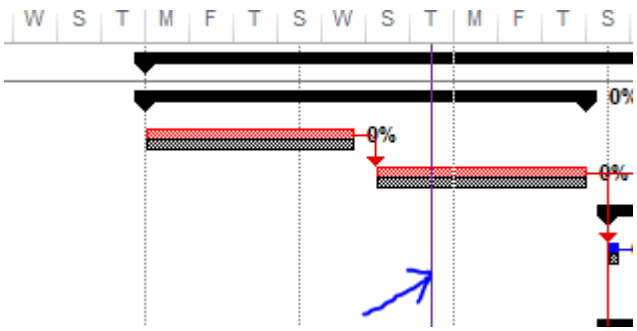


- **Question:** Record **your** progress status date here. _____

- It is also helpful to view the status data as a "gridline" on the Gantt Chart (and Tracking Gantt Chart). To achieve this, click on the drop down arrow below the "Gridlines" icon in the "Format" area of the Format ribbon.
- Select gridlines from the options displayed.
- In the pop up window that appears, scroll down the "Line to change" list and click "Status Date". Make selections for the type and colour that will stand out clearly on your Gantt Chart. (For example, a solid line coloured purple.)

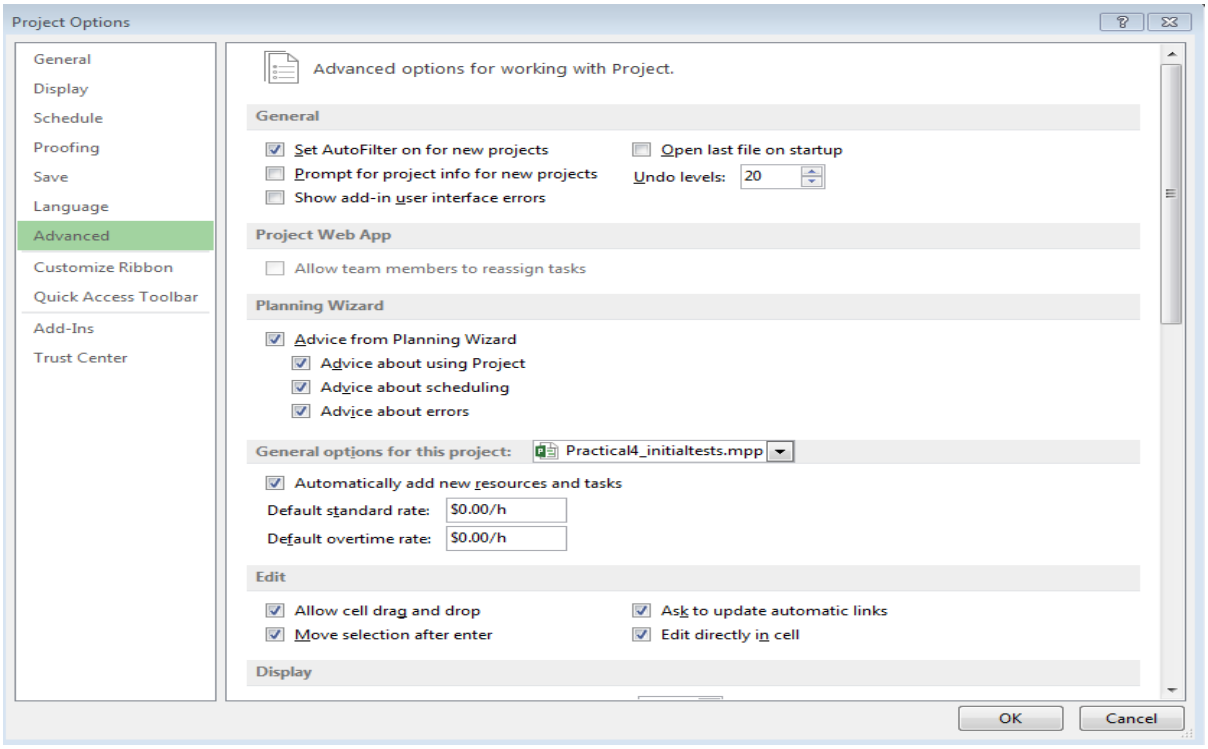


You should now see a line showing the status date on your Gantt Chart.

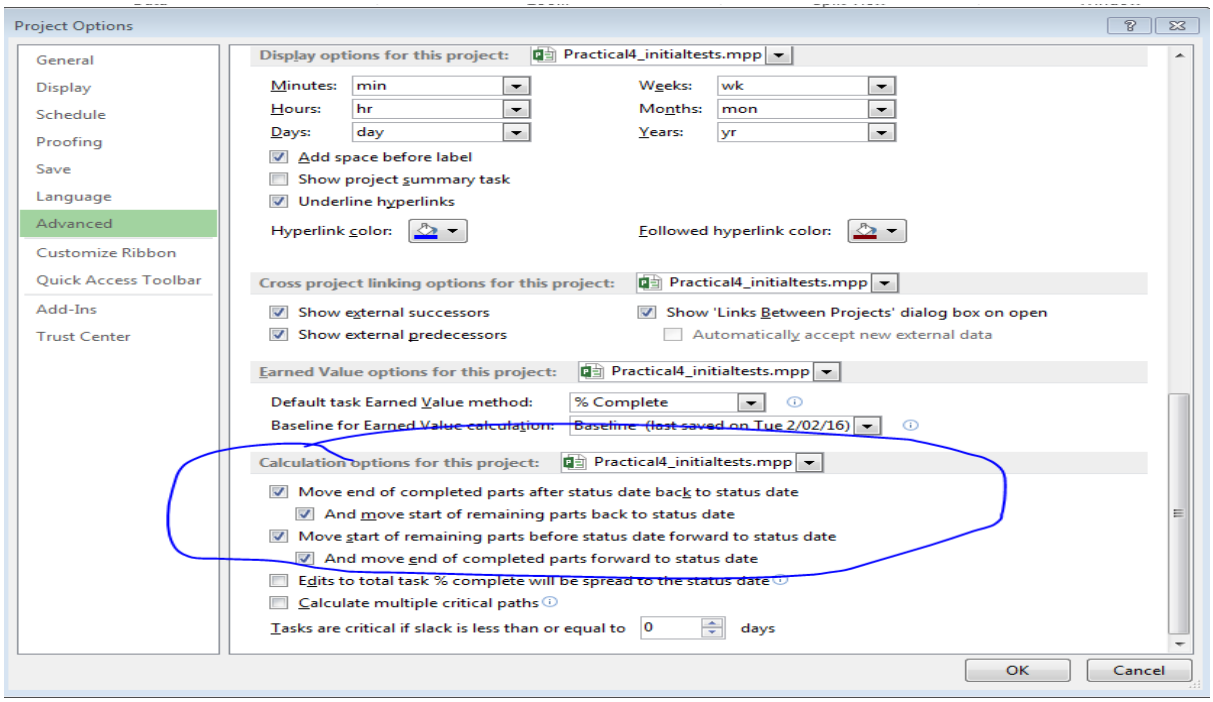


Setting Options Before Updating Task Status

- There are several settings/options related to updating tasks. Mostly the defaults are what we would want in most cases. However, there are some settings in the advanced category that need to be modified before we enter some status data for the project.
- To change the settings, go to File->Options and select "advanced" as shown below.



- Scroll down through the advanced options and modify the “calculation options for this project” as shown in the screenshot below:



The following information explains what we have modified.

"Move end of completed parts after the status date back to the status date" – this means any completed work will be moved moved back to before the status date i.e. the work is now recorded as having been completed in the past.

"And move start of remaining parts back to status date" – means any incomplete parts will start at the status date, i.e. if they were scheduled further in the future they can now start back at the status date.

"Move start of remaing parts before the status date forward to the status date" – meaning that as they have not been completed before the status date, they are now scheduled to be completed in the "future" (from the status date).

"And move end of completed parts forward to status date" – means that the completed and incompleted portions of the task are joined at the status date.

- **Save your work so far.**

Practical 7 Part A:

Entering Status Information

- In the previous practical we saved the baseline for the project and entered a "status date" ready to begin entering status data in this practical.

- This practical will demonstrate some of the Microsoft Project features to help you to compare actual progress with planned progress. To demonstrate the Microsoft Project features we will set imaginary data about the status of tasks for a time in the future (unless you are very behind in your practicals). This is not something you would do in reality. In practice you would be entering status data about actual work completed or underway at that point in time.

- **Open practical6.mpp file (if it is not already open) and save to a file called practical7.mpp. You now have a copy of your work to use in practical 7**. You will use practical7.mpp as the starting point for this week's practical. If it is not already open, open practical7.mpp by double clicking on the file.

- For the purpose of this exercise, we will assume that we have the **actual start dates**, **actual durations** and **estimates of the remaining duration** (or finish dates if the task has completed) for the tasks that have started before the status date we selected earlier. Requesting this information can often be the quickest way to get accurate status data from team member.

Notes:

1. Microsoft Project will calculate the values for status fields that you don't update directly. For example, if you entered the actual start date, the actual duration and remaining duration, it will calculate the following:
    - Duration = actual duration + remaining duration
    - % Complete = (actual Duration /Duration) * 100

2. An alternative when performing earned value calculations is to specify what is believed to be the "actual % complete" and use this value in the calculations, but this can be difficult to estimate accurately. Given that that it can be difficult to accurately estimate the % complete of a task that has started, but is not yet 100% complete, the PMI's Body of knowledge has two recommendations for " % complete" when carrying out earned value analysis:

    1) **All or nothing**. A task is either complete (100%) or incomplete. If incomplete it is not included in any earned value calculations.
    2) **Unstarted, started or complete.** Unstarted should be set to 0% complete, started should be set to 50% complete and complete tasks should be set to 100% complete.

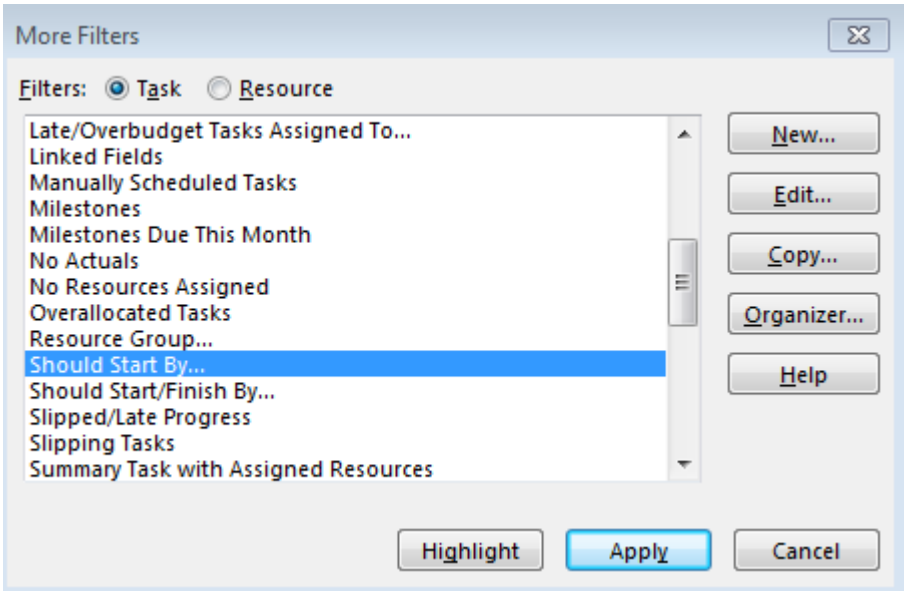
- As stated previously, for the purpose of this practical we will assume that we have the **actual start dates**, **actual durations** and **estimates of the remaining duration** (or finish dates if the task has completed) for tasks that have started before the status date. Note that when "imagining" this data you should not create a situation where you show work completed in the future (e.g. the start date + actual duration of the task should not extend beyond the current status date).

Viewing tasks that should have started

- Remember that we have entered the status date as the Friday 4 weeks into your project. We will now enter some status data for tasks that were scheduled to start before this date.

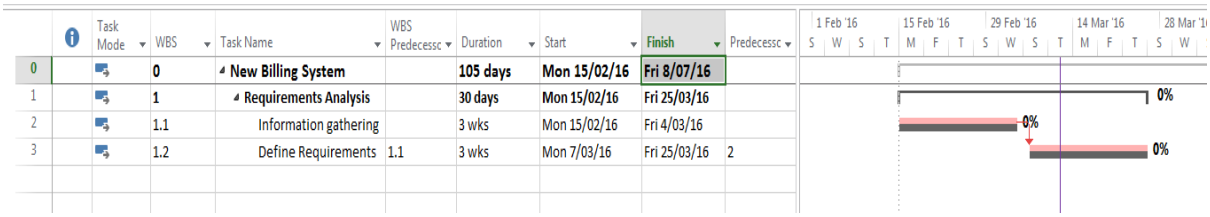
  In these exercises you will see how to update tasks that are:
  - running on schedule (in progress or were completed on schedule)
  - complete, but didn't run on schedule
  - in progress but not on schedule.

- When entering status data, it can be quite helpful to filter out the tasks that you expect to have to update because they are scheduled to have started before the status date. To view those tasks, go to the View ribbon and select "More filters" from the filter drop down list.



- If you the select the "Should start by" option and click on the "apply" button, you will be asked to enter the "should start by date". Enter your status report date and click OK.

- You should now view only the tasks that are scheduled to have started by the status date.

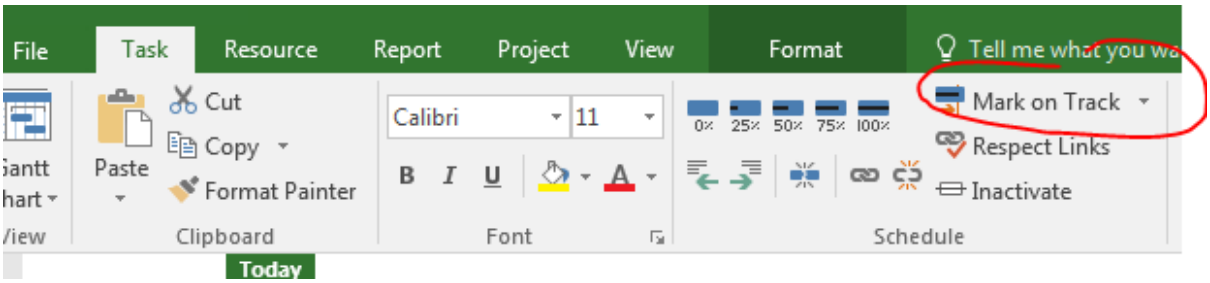


Updating Tasks Running On Schedule

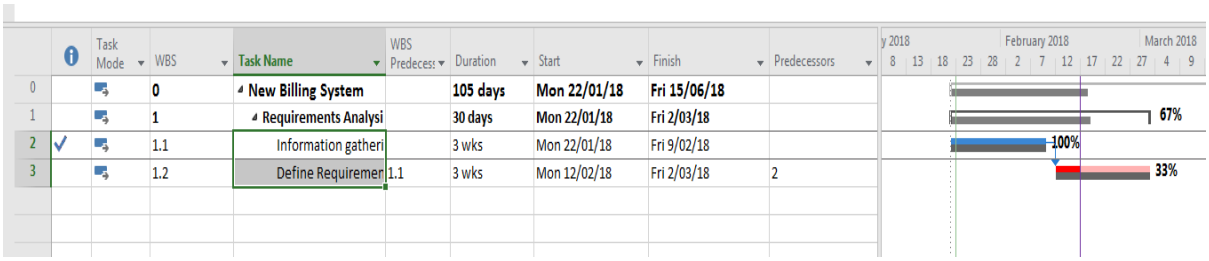
- This step is to demonstrate how easy it is to update tasks that are running on schedule**. We will "undo" this update in the next section so that we can explore how to enter information about tasks that are not running on schedule.**

- Select the "Information Gathering" and "Define Requirements" tasks.

- Select the "Mark on track" option from the drop down list of "Mark on Track" found in the schedule area of the Task ribbon.



- The status for the two tasks should be updated and your Tracking Gantt Chart should be similar to the following:

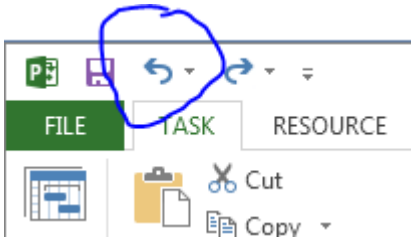


Note that the solid red line for define requirements stops at the status date. Anything after that line is the future so you should not see solid lines showing progress after the status date.

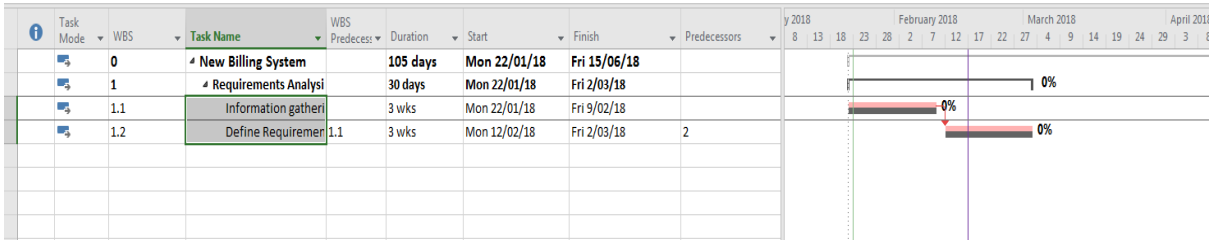
Updating Completed Tasks that did not Run on Schedule

- In this situation we will enter the actual start and finish dates (the tasks are complete so we know finish dates).

- Before we start entering the status data, **undo the previous status updates** simply by clicking the undo arrow at the top of Microsoft Project.



- The Tracking Gantt Chart should now be similar to the following (i.e. no status data has been entered yet).



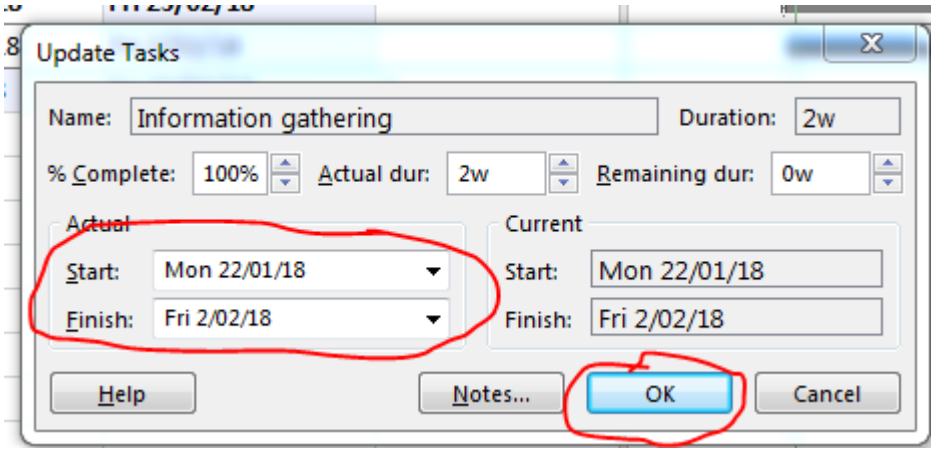
	Task Mode	WBS	Task Name	WBS Predecess	Duration	Start	Finish	Predecessors
		0	New Billing System		105 days	Mon 22/01/18	Fri 15/06/18	
		1	Requirements Analysi		30 days	Mon 22/01/18	Fri 2/03/18	
		1.1	Information gatheri		3 wks	Mon 22/01/18	Fri 9/02/18	
		1.2	Define Requiremer	1.1	3 wks	Mon 12/02/18	Fri 2/03/18	2

- Let us assume that the "information gathering" task has been completed, but that it finished in 2 weeks rather than the estimated 3 weeks in the original schedule. To enter this information, select the "information gathering" task, then click the down arrow on the right of the "Mark on Track" button and select "update tasks".

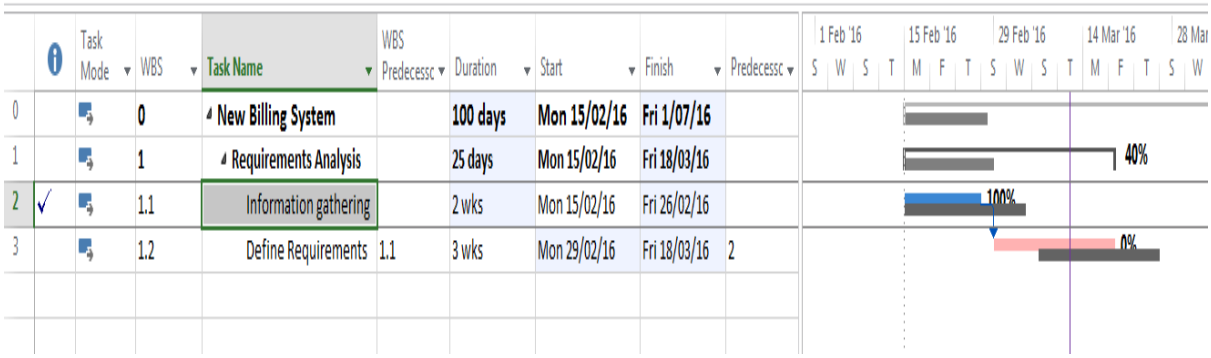
- You should now see a pop up window that will allow you to enter the Actual start and finish dates.

- Enter the actual start date (assume that the task started on time).

- You can now enter the "Actual Finish" date (assuming that the task only took 2 weeks). Note that there is a drop down calendar that you can use to help you with this. Your dates will depend on your start date. The screenshot below is for illustration only.



- If you click the OK button (and you have entered the correct data for your schedule), you should see the following:



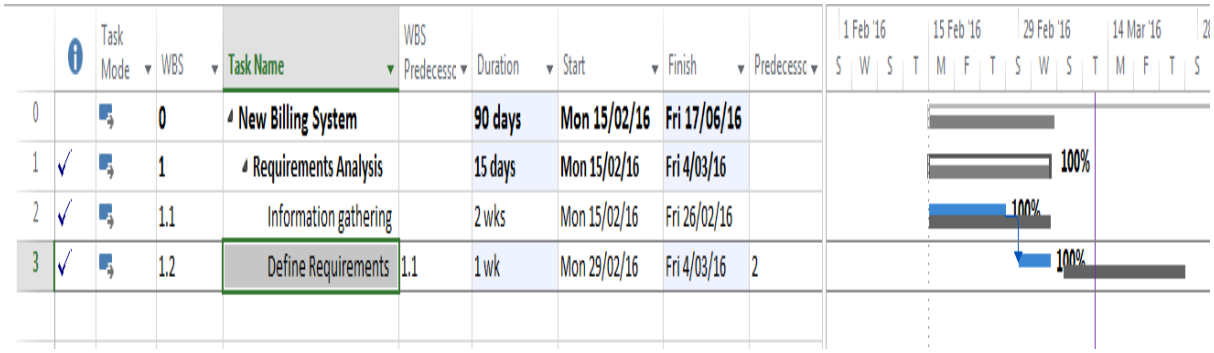
	Task Mode	WBS	Task Name	WBS Predecessc	Duration	Start	Finish	Predecessc
0		0	New Billing System		100 days	Mon 15/02/16	Fri 1/07/16	
1		1	Requirements Analysis		25 days	Mon 15/02/16	Fri 18/03/16	
2	✓	1.1	Information gathering		2 wks	Mon 15/02/16	Fri 26/02/16	
3		1.2	Define Requirements	1.1	3 wks	Mon 29/02/16	Fri 18/03/16	2

- Note that the solid blue line is now 1 week shorter than the solid black line and you can see that task 1.2 can start earlier than the baseline schedule.

- If you select the information gathering task again and click the down arrow on the right of the "Mark on Track" button and select "update tasks", note that % complete, actual duration, remaining duration and duration show the correct information for the task being completed in 2 weeks.

- As we noted earlier, the "define requirements" task can start 1 week earlier than originally scheduled. Assume that this task started as soon as the information gathering task was completed and that it was completed in 1 week and not the originally estimated time of 3 weeks. Update the status for this task.

- Your tracking Gantt Chart should now be similar to the following:



	Task Mode	WBS	Task Name	WBS Predecessc	Duration	Start	Finish	Predecessc
0		0	New Billing System		90 days	Mon 15/02/16	Fri 17/06/16	
1	✓	1	Requirements Analysis		15 days	Mon 15/02/16	Fri 4/03/16	
2	✓	1.1	Information gathering		2 wks	Mon 15/02/16	Fri 26/02/16	
3	✓	1.2	Define Requirements	1.1	1 wk	Mon 29/02/16	Fri 4/03/16	2

- Given that these tasks were completed early, there could be other tasks that are now able to have been started before the status date. Apply the filter again to identify those tasks (View ribbon, more filters, filter according to "should start by").

- **Save your work so far.**

Practical 7 Part B:

Updating tasks that are in progress (but not necessarily progressing according to schedule)

- **Open practical7.mpp file (if it is not already open) and save to a file called practical8.mpp. You now have a copy of your work to use in practical 8** where we can continue entering status data. We are now going to enter status data for tasks that are underway, but not progressing according to schedule.

- In this situation we will enter the actual start, the actual duration (so far) and the estimated remaining duration.

- Based on the data we have entered so far, you should now see that "disk storage" purchase could have been completed and that the "design programs" and "design (advertising brochure) could have been started. However, the two design tasks would not be expected to have been completed by the status date.

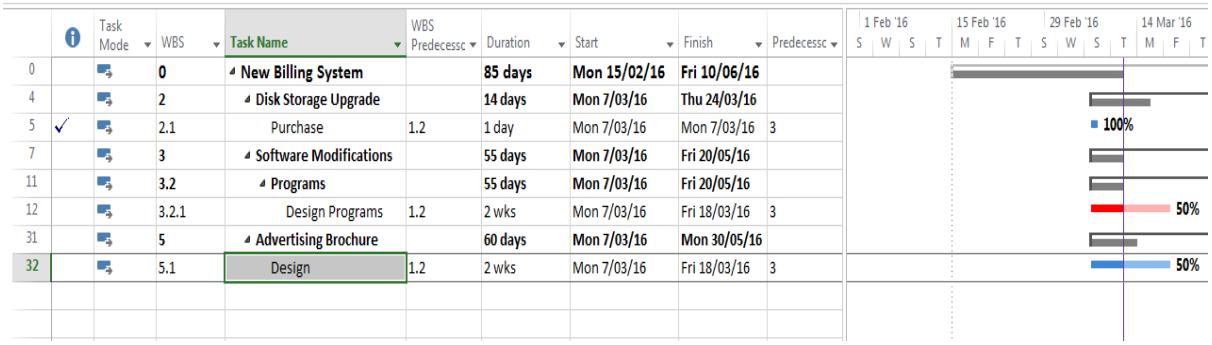
	Task Mode	WBS	Task Name	WBS Predecessc	Duration	Start	Finish	Predecessc
0		0	New Billing System		90 days	Mon 15/02/16	Fri 17/06/16	
4		2	Disk Storage Upgrade		14 days	Mon 7/03/16	Thu 24/03/16	
5		2.1	Purchase	1.2	1 day	Mon 7/03/16	Mon 7/03/16	3
7		3	Software Modifications		60 days	Mon 7/03/16	Fri 27/05/16	
11		3.2	Programs		60 days	Mon 7/03/16	Fri 27/05/16	
12		3.2.1	Design Programs	1.2	3 wks	Mon 7/03/16	Fri 25/03/16	3
31		5	Advertising Brochure		65 days	Mon 7/03/16	Mon 6/06/16	
32		5.1	Design	1.2	2 wks	Mon 7/03/16	Fri 18/03/16	3

- Let us assume that "**design programs**" (highlighted above) started as soon as its predecessor finished (meaning that one week of work should have been completed up to the status date). Assume that this task is also going well and the designers expect to complete the design work in another week (i.e. a week earlier than the original estimate).

    - Select the "design programs" task and again click on the "**update tasks**" option from the "Mark on Track" list (on the task ribbon).

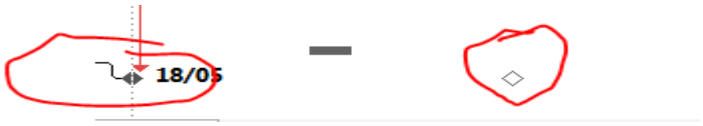
    - Enter
        - the **start date** (the new start date given that the predecessor has finished early),
        - an **actual duration of 1 week** and
        - a **remaining duration of 1 week** and click OK.

- Finish updating the status of your project by completing the status information as "on track" for any other tasks that should have been started before your status date. At this stage, the the tasks that you should still need to update and mark as "on track" are "disk storage purchase" and "advertising brochure design" (see the previous screenshot). Assume that they both started as soon as their predecessors were finished and that you expect them to take the originally estimated duration. (**The easy way to do this is just to select each task in turn and use "Mark on Track"**.) The result should be similar to the following:



- Remove the filter so that you can **view the whole Tracking Gantt Chart**.

- If you are not already viewing the tracking Gantt chart, select that view. Note that you can now see both a baseline "system ready" milestone (not solid) and the solid (current prediction) system ready milestone. Given that we have entered data that makes some of our critical tasks finish earlier (and other tasks that either finished early or according to the original estimate), the new prediction for "system ready" should be earlier that the baseline. If you hover over the non-solid milestone it will indicate that this is the baseline milestone.



- Return to the entry table (accessed through tables in the View ribbon) to answer the following questions:

  Question: What is the new duration for the project based on the current data?

  _____

  Question: What is the new estimate for the finish date for the project based on the current data?

  _____

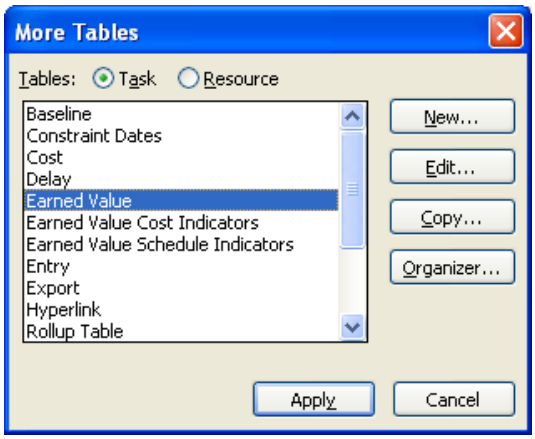
  Question: Have these changed and if so what is the change?

  _____

- **Save your work so far.**

Viewing earned value

- Select “Table” in the View ribbon followed by “more tables”. Double click on “earned value” in the list of available tables and click the “Apply” button.



- You will now be able to view a table with the headings - Planned Value (BCWS), Earned Value (BCWP), AC (ACWP), SV ,CV, EAC, BAC and VAC. Note that Microsoft Project still has the old acronyms in the headings as well as the names and acronyms that you should be familiar with from this course.

Simple definitions:
PV – the planned value – planned budget based on the original estimates *up to the status date you have set.*

EV – the “earned value” of the work completed so far (i.e. based on the % complete - calculates that % of the value of the original estimate to complete the whole task.)

AC – the actual cost to date (e.g. the actual cost for the number of hours worked on the task).

EAC – also known as the forecasted cost at completion. It is calculated in Microsoft using the following formula:

EAC = AC (so far) + (baseline cost – EV (so far))/CPI

BAC – total planned cost for the task.

VAC – Variance at completion (= BAC – EAC)

There is also a help link available if you hover above any of the headings in Microsoft Project.

- From the table you should be able to complete the following information for your project. (Note: You are to fill in the blanks and select the appropriate option where you are given a choice in brackets. Choices are in italics.)

- **Question: Complete the following**

  The planned budget for this project to spend by the status date you have selected is _____ . (From the PV (BCWS) column in row 1 for the whole project)

  So far the project has earned _____ in terms of the work completed (from the Earned Value column in row 1)

  At the same time, it has actually spent _____ (from the AC column in row 1)

  According to the table, there is _____ (SV) (*worth of work that was supposed to have been completed that hasn't been done yet/additional worth of work that has been completed that was not scheduled to be completed yet*) and of the existing work that has been carried out so far, the project is _____ (CV) (*over/under*) budget.

  You can also look at the variance at completion (VAC). This takes into account the CPI we have generated so far – if this continues over the rest of the life of the project we can expect to be _____ (VAC) (*over/under*) budget.

  VAC is calculated by subtracting the EAC (forecasted cost at completion) from the BAC (planned cost). EAC is calculated using the CPI. If you hover over the heading for this column (or any of the others) you can see formula used for the calculation in Microsoft Project. It was also given in the definitions above.

  Note that if you were actually monitoring the project, you would also check that the variations have not re-introduced any resource allocations issues. If that was the case, it would be necessary to resolve the problems. We will not investigate this aspect of the project in the lab exercises.

- As you probably noticed, the schedule variance is measured in terms of dollars. If it is negative it indicates that we are "behind schedule" in the sense that there is work that should have been carried out that has not been done. Similarly, if it is positive, it is an indication that we are "ahead of schedule" in the sense that there is additional work that has been completed that was not scheduled to have been completed by this stage in the original plan. Note however that a negative schedule variance does not necessarily mean the project will not finish on time.

  The SV is useful to identify whether or not there is work that should have been carried out that has not been completed yet. However, SV does not give us information about when the project is expected to finish (or when tasks within the project are expected to start and finish once the project is underway). By viewing the variance table you can also see what is happening in terms of the actual finish dates for activities in the project and the overall project.

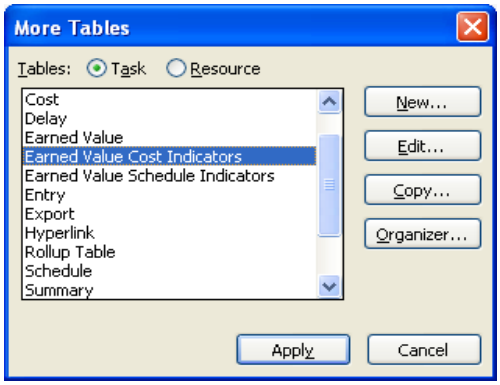
Similarly, although a positive SV is a good sign, it does not guarantee that the project will finish early. Again you should check the Tracking Gantt chart and view the variance tables to check your schedule status.

Viewing the start and finish variances

- Select "Tables" from the View ribbon and then select "Variance" from the list of tables. This will result in the display of a table with the headings start (actual recorded or predicted start dates), finish (actual recorded or predicted finish dates), baseline start, baseline finish, start variance and finish variance. In the case of those activities that have been completed the start and finish variances are the actual variances, in the case of those activities that have yet to be started or completed, the variances are based on what we know already know and what we expect to happen.

Viewing the CPI

- Select Tables from the View ribbon followed by "more tables".
- Select "Earned Value Cost Indicators"



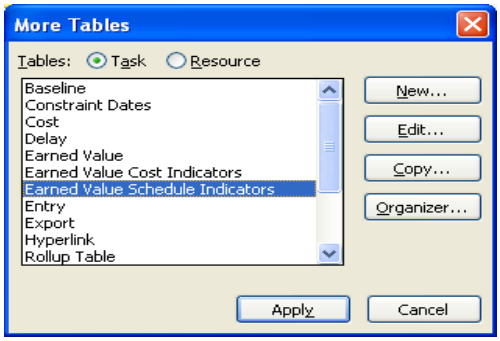
- What is the CPI for your project?_____
- What does this mean? Is your project over or under budget?

_____

- Note also that the TCPI tells us how much we would have to earn on the remaining work to achieve the original target. What is the TCPI for this project? _____
- What does this value of TCPI mean? _____

Viewing the SPI

- Select Tables from the View ribbon followed by “more tables”.
- Select “Earned Value Schedule Indicators” and click the Apply button.



- What is the SPI for your project? _____
- What does this mean about your schedule? Is it ahead of schedule or behind schedule?

  _____
- Is there anything else you should view to check the status of the project schedule?

  _____

- Do you have any additional comments and/or concerns about the CPI and SPI values for the project ?

  _____

- Note that you could also add SPI and CPI columns to your “Earned Value” table.

- **Save your work so far.**