UESTC 3010: Team Design Project & Skills

Routes, Tasks and Rules – An Overview

Dr Rami Ghannam

Objectives

1. Analyse technical requirements to develop an overall design plan.

2. Design, construct and test electronic hardware to perform specific functions.

3. Maintain control of a project budget.

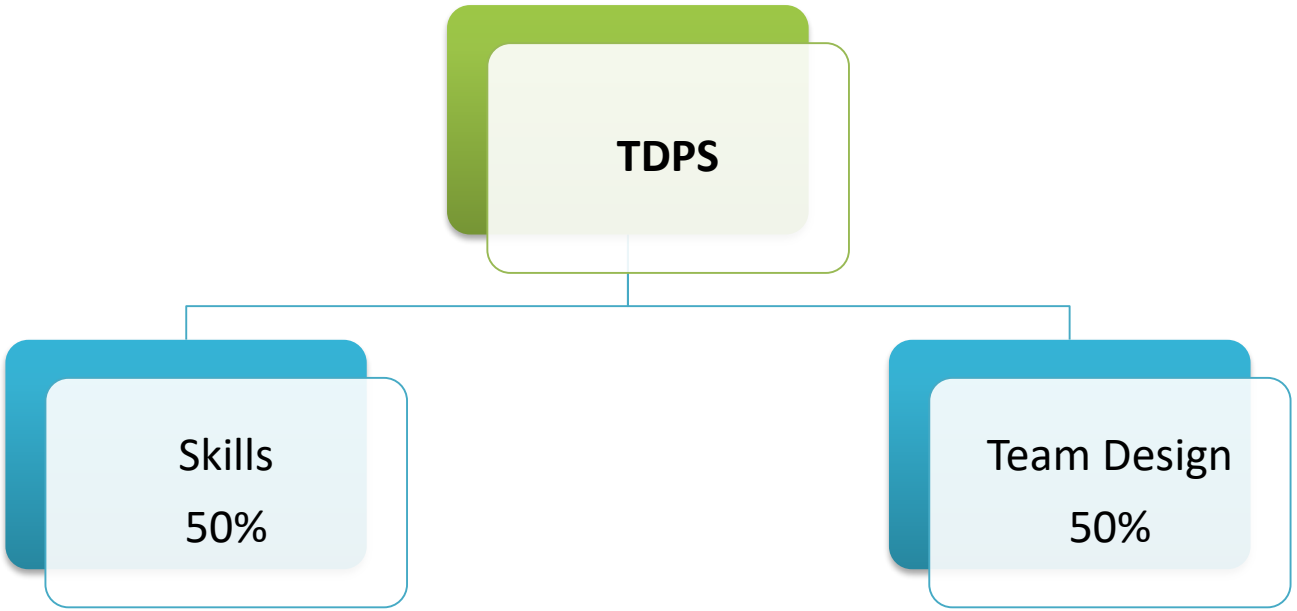
4. Use a project planning methodology (such as Gantt charts) to define milestones and measure achievement against such milestones.

5. Run a project without undue reliance on the course instructor to perform

productively as a team and to recognise contributions from all team members.

6. Write a concise researched technical report that clearly addresses and analyses pertinent issue.

Course Organization



Course Assessment

%	Assessment Type	When	Details
10	Preliminary Report	Week 5	Initial design and responsibilities. Lab notebook and group report assessed with teams during group meetings. This will be a "mini viva", where staff will assess the groups during their meetings with the students.
15	Final demonstration	Week 14 Saturday 1/6/2019	In week 13, all teams will be required to upload their 10 minute PPT presentations and demos (videos) online for the two tracks. Early in week 14, we will inform the teams which of the two tracks they will be demonstrating during the competition.
25	Final team presentation	Week 14	PPT and Video presentation of the other track that hasn't been demonstrated during the competition. Presentations will take place on Friday 31st May and Sunday 2nd June (if necessary).
25 + 25	**Final team Report + Personal Contributions**	**Week 17**	**Joint team report. Students can divide the report into chapters, with each student underlining their contributions to the project. Alternatively, students can indicate their personal contributions to the overall project in the footnotes of each page. Consequently, the new mark scheme and rubrics will enable the report to be assessed as a group and individually.**

Teaching and Supervision

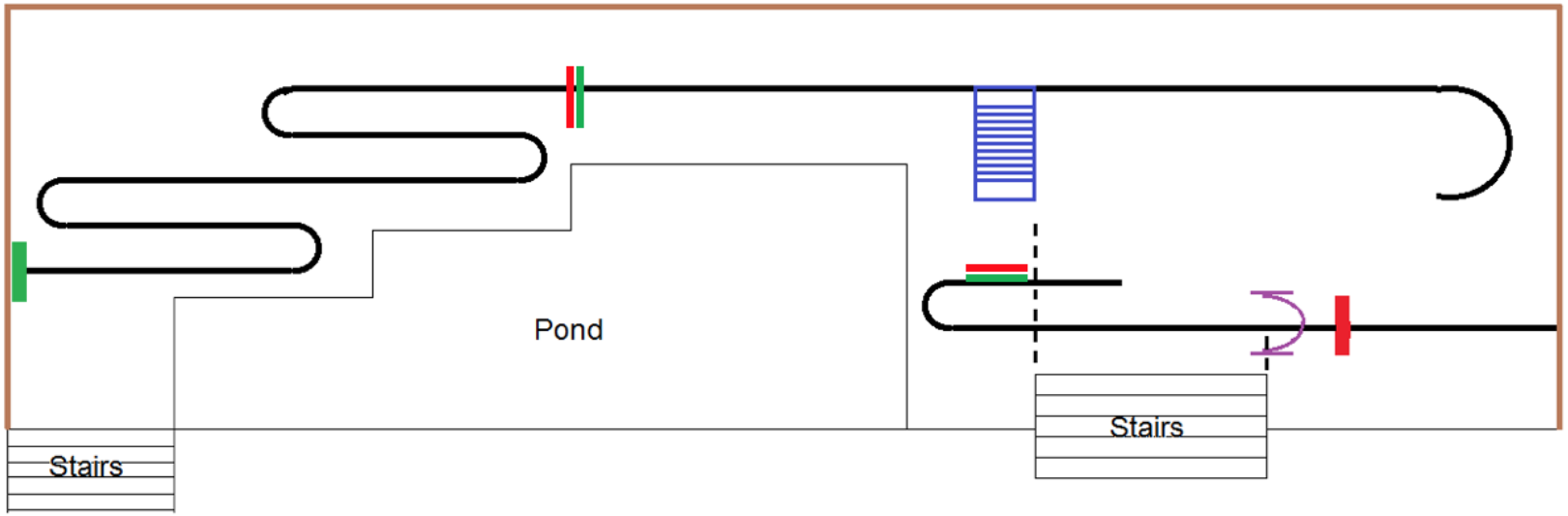
- Teaching and supervision team consists of three members of staff:
  - Dr. Rami Ghannam
  - Dr. Julien Le Kernec
  - Dr. Imran Ansari

Teaching and Supervision

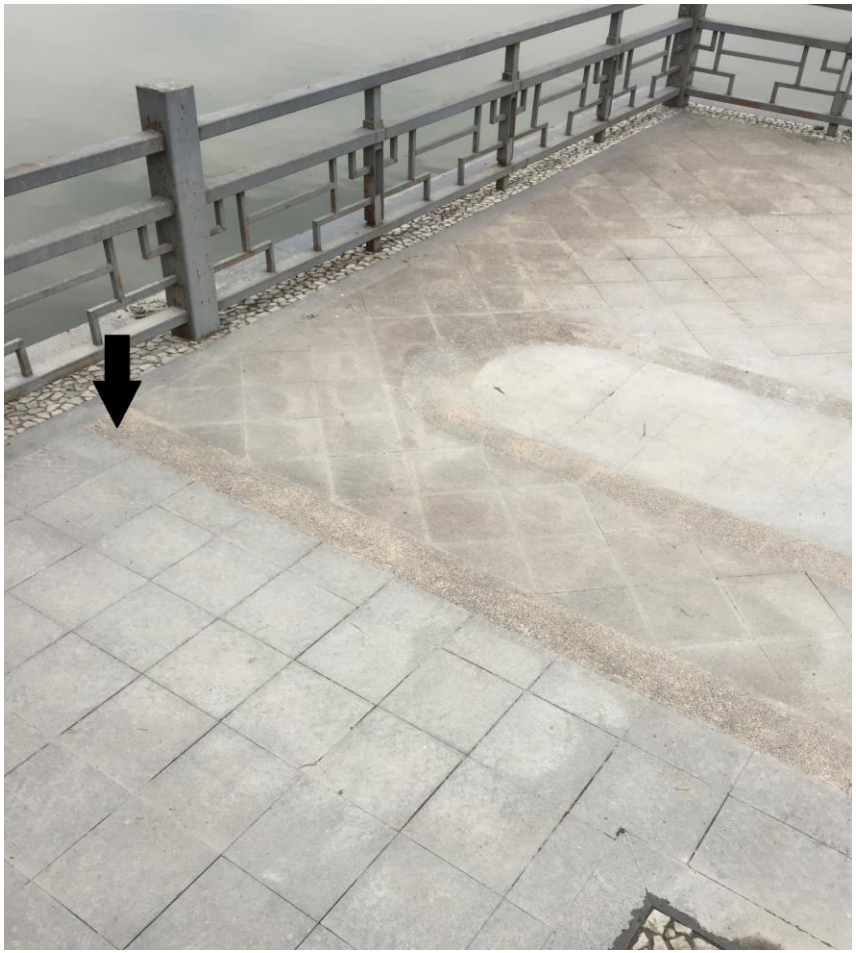
Supervisor	Team Number and Name
Dr Rami Ghannam	Teams 1-13
Dr Julien Le Kernec	Teams 14-25
Dr Imran Ansari	Teams 26-37

Teaching and Supervision

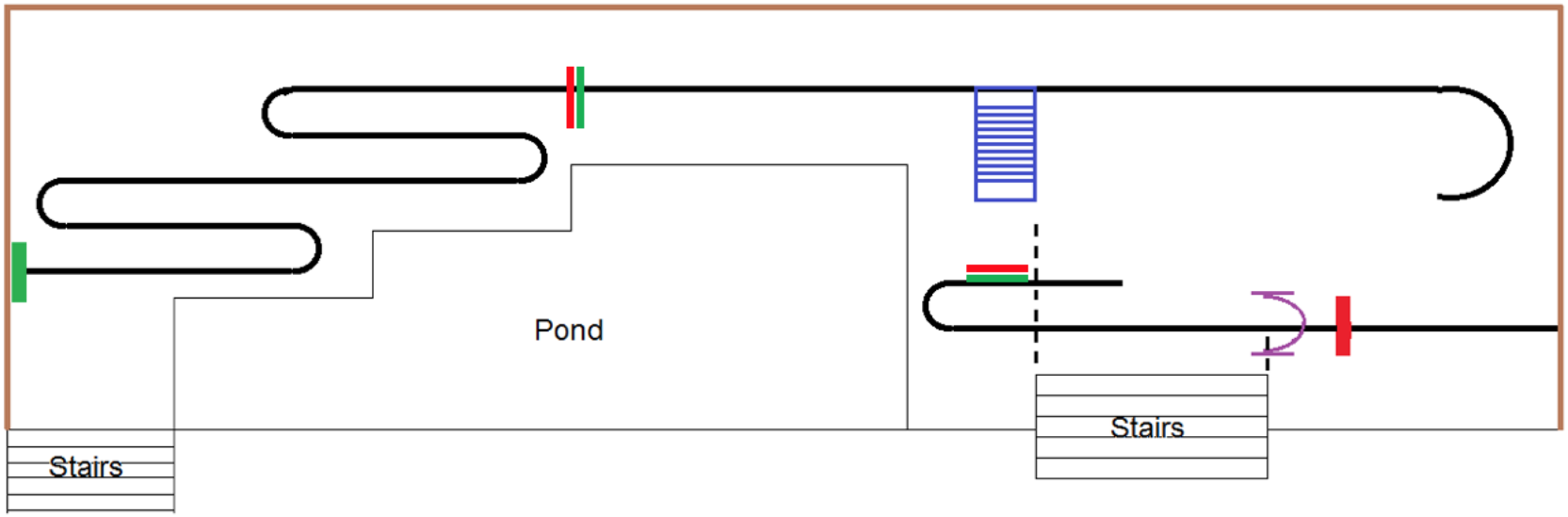
Task 1. From the start (green), follow the path of the coloured tiles to the bridge (blue) general rules



Patio 1 – Task 1

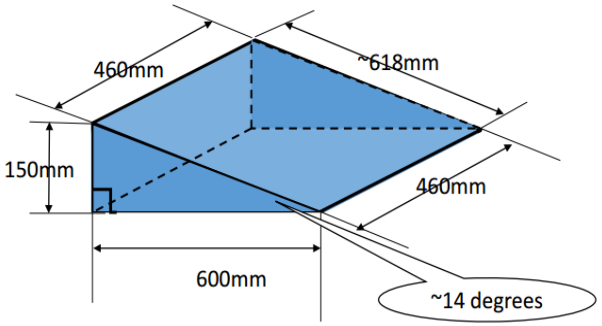


Patio 1 – Task 1



Patio 1 – Task 2

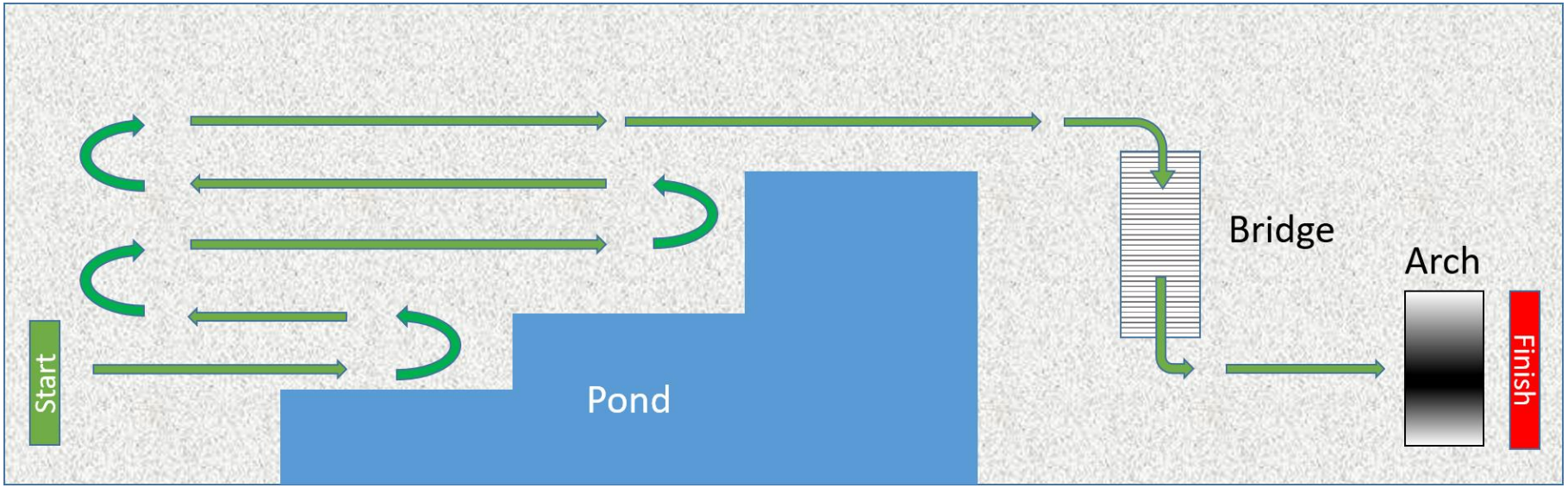
- **Task 2:** Find the bridge and cross on top of it.



Patio 1 – Task2

- As shown in the sketch of Patio 1 on the previous slide, the right-most edge of the bridge will be aligned with the left-most edge of one of the stairs.
- The bridge is approx 0.45 m in width and 2.2 m in length, which includes the ramps that will be used to roll up and off the bridge.
- The bridge consists of a wire mesh.

Patio 1 – Task 3



Patio 1 – Task 3

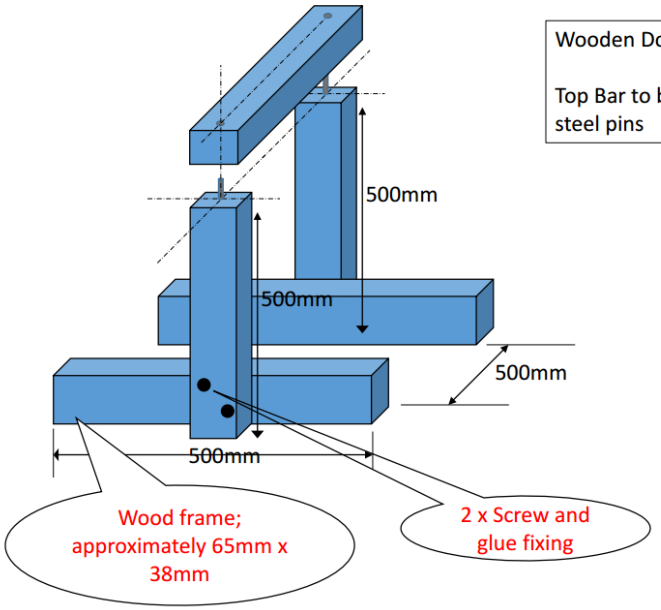
Task 3: Find the gate, go through it, then stop.

1. The gate is shown in purple in the sketch of Patio 1, while the end of the run is noted as a red box.
   - The arch of the gate will be aligned with the right-most edge of one of the stairs.
   - The gate will be 50 cm tall and 50 cm wide.

Patio 1 – Task 3

– The arch of the gate will be aligned to the strip of coloured tiles located at the end of the right-most black line should in the photo below. The left-most black line in the photo marks the alignment of the right-side of the bridge to the left-side of the staircase .

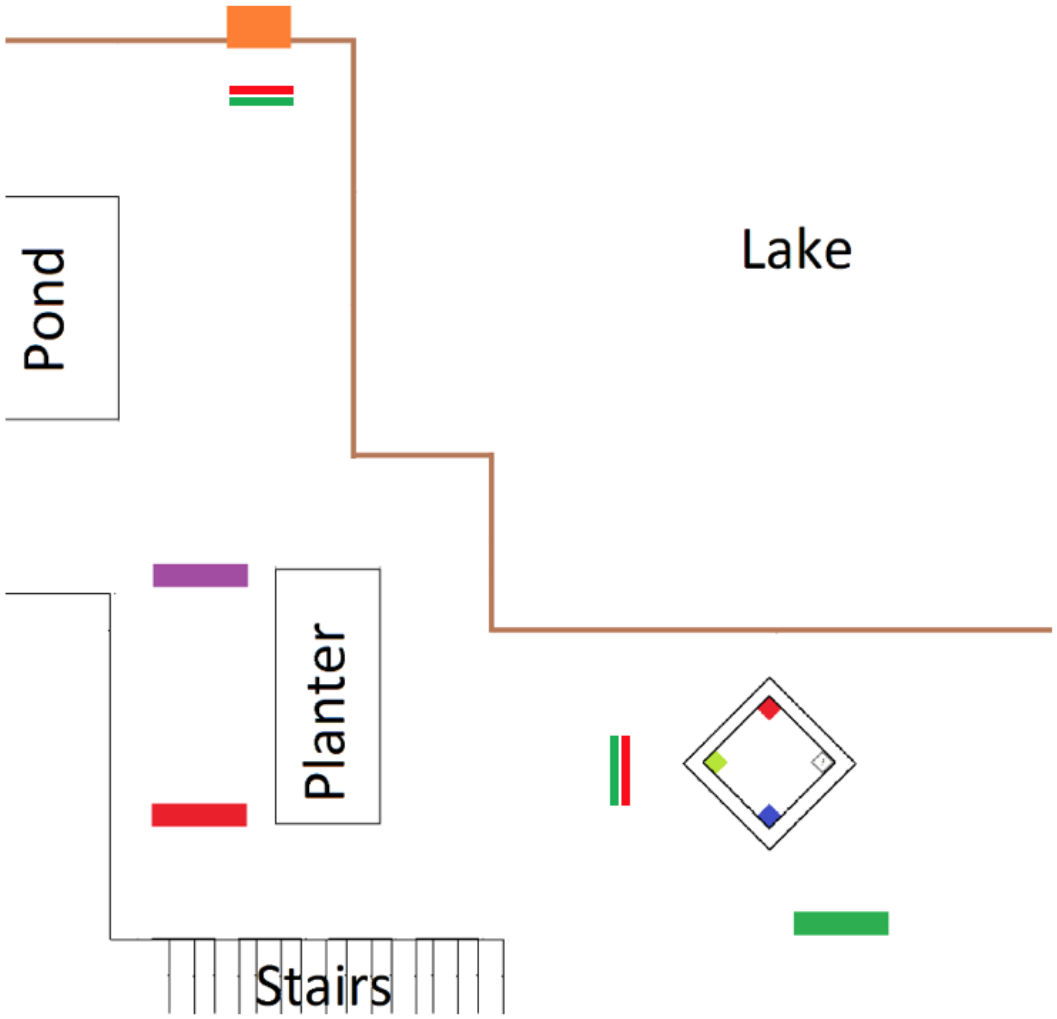
2. The exact point at which the robot stops after passing through the gate is not critical.



Wooden Door Structure for TPD&S course

Top Bar to be removable but located on wood or steel pins

Patio 2 – Task 1



Patio 2 – Task 1

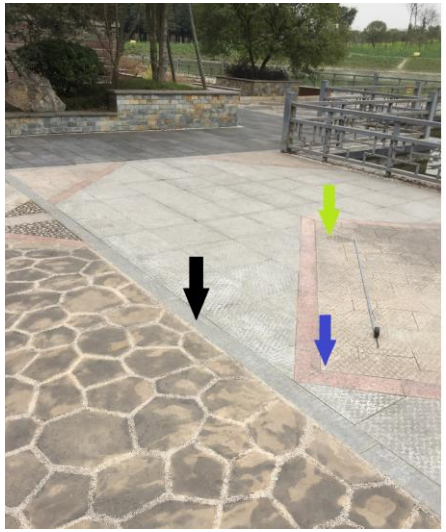
Task 1. From the start (green), match the colour of the square to determine direction

1. You will place your robot at the edge of the patterned tiles below the diamond outlined in the tiles. You will demonstrate that your robot can carry and release an item of your choice into the lake.

    - In your report, you will need to justify why you have chosen this item.

Patio 2 – Task 1

2. The robot should be programmed to move to the coloured square at the right-hand side of the diamond.
3. After the colour of the square has been determined, the robot will then move to the corresponding colour square in the diamond. If the first square is:
   - **Red**, the robot should move to the upper tip of the diamond, going over the **Red** square.
   - **Green**, the robot should move to the left-most tip of the diamond, going over the **Green** square.
   - **Blue**, the robot should move to the lower tip of the diamond, going over the **Blue** square

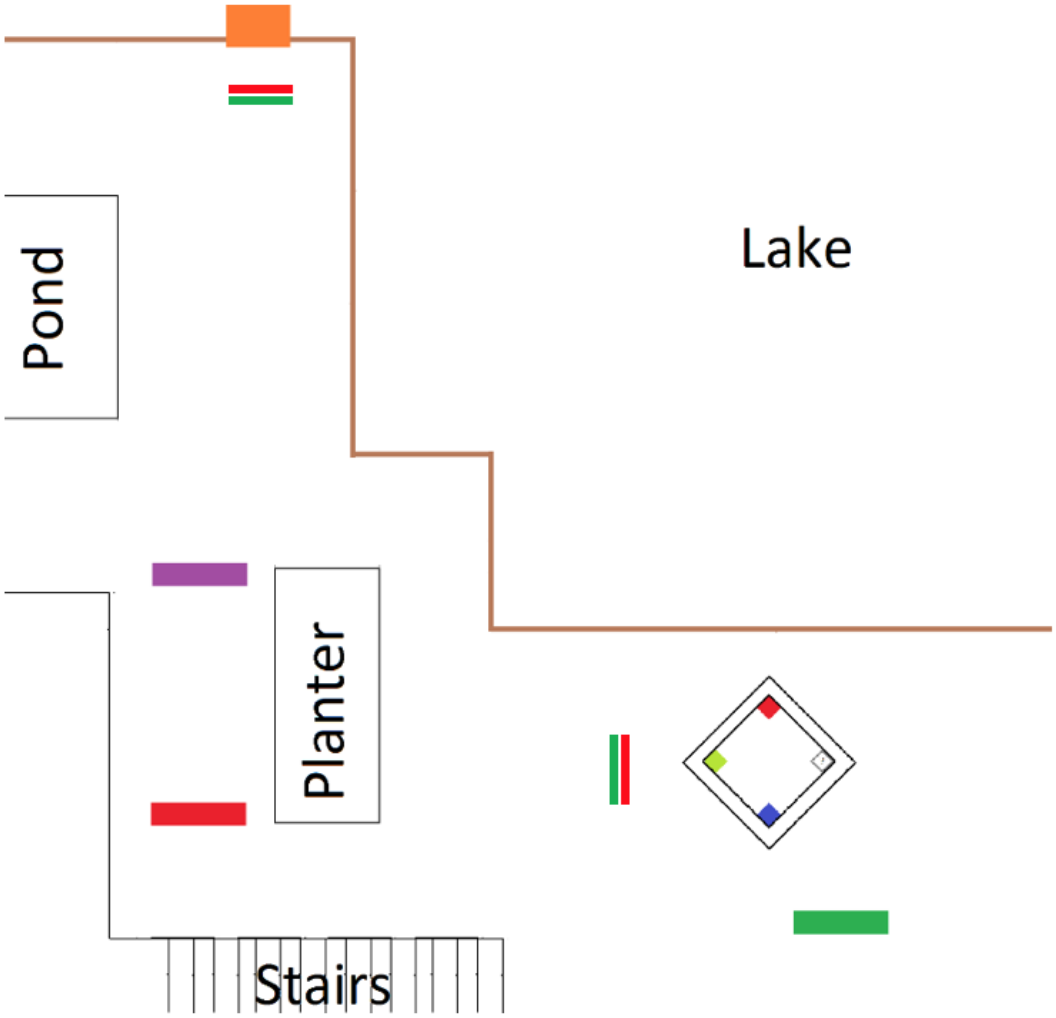


The robot can be placed anywhere along the grey stripe of tiles (black arrow) to begin traveling along the route on Patio 2. The blue and green arrows show where the blue and green squares will be placed. The tip of the squares will be placed on the inside edge of the pink tiles that found the outline of the diamond.

Patio 2 – Task 1

4. After passing over the correct coloured square, the robot should then move to the release point, marked in orange on the sketch of Patio 2.
   – There are no rules associated with the path that the robot must take from the diamond to the slide. Navigation along the side of the planter and pond or the fence or other means that do not violate the general rules.

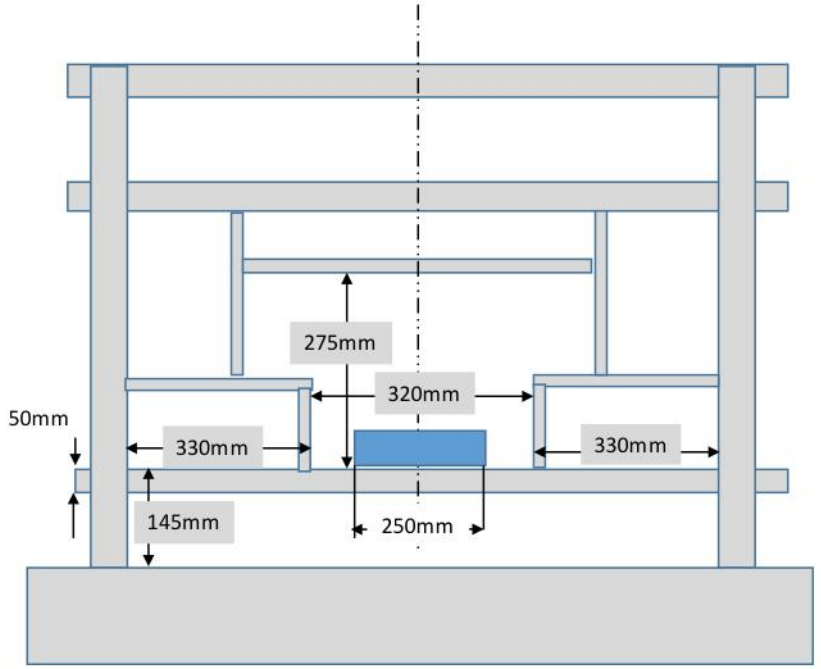
Patio 2 – Task 2

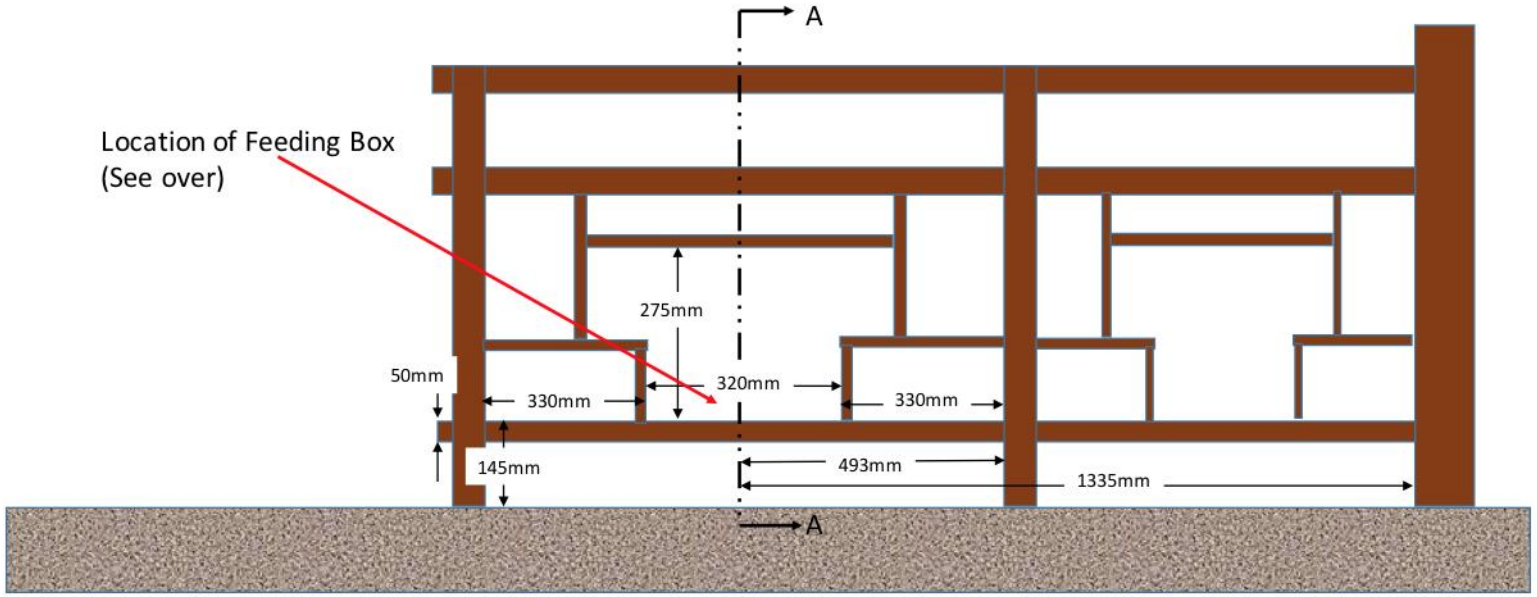


Patio 2 – Task 2

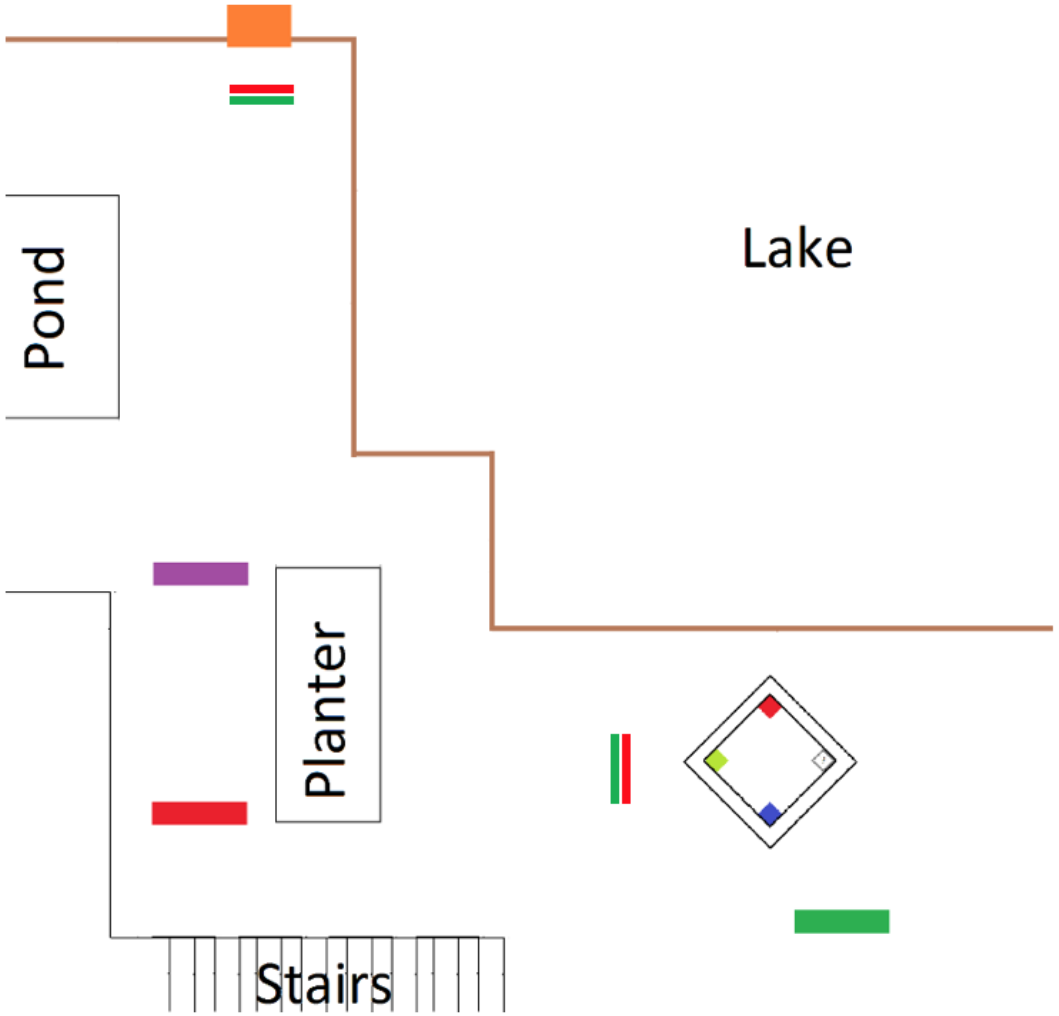
Task 2: Release the item into the lake

1. The robot should travel to the release point, which is marked in orange on the sketch of Patio 2 and in the photo below
   – The slide will be placed on the lower rail of the fence.


275mm
320mm
50mm
330mm
330mm
145mm
250mm


A
Location of Feeding Box
(See over)
275mm
50mm
320mm
330mm
330mm
145mm
493mm
1335mm
A

Patio 2 – Task 3



Patio 2 – Task 3

Task 3: Communications

1. When the robot enters the planter area (the top edge of the planter, shown in purple in the Patio 2 sketch), the robot should stop and transmit a message to a laptop.
2. The message they must transmit from robot to laptop shall include the following data from the robot to a team laptop. The message should consist of:
   - Team Name
   - Team Member Names
   - Time of day (24-hour clock)

Patio 2 – Task 3

Task 3: Communications

3. The transmission should be a radio signal at 433 MHz at fixed data rate using a Wavesens HC-12 wireless transceiver.

4. After the receipt of the transmission has been acknowledged, the robot should continue to the end of the route, indicated by the red box in the Patio 2 sketch and the red arrow and line in the photo below, which is the lower edge of the planter.

General Rules

1. The maximum cost of the project is **1000 RMB**.
   - You are free to design and implement a robot of your choice that accomplishes the tasks in this project. All parts should be listed in the bill of materials, which should be an appendix in the team final report. Excellent projects will provide full justification for the choice of components used.

General Rules

General Rules

2. The race for team robots to complete and demonstrate the tasks will be held on **2019-06-01**. It will begin promptly at **9am** and will end no later than 3pm in the afternoon.
   – Each team will train and program their robot to complete tasks on both Patios. However, during the demo day you are only required to demonstrate your completion of the tasks from only one of the Patios. The selection of Patio number and order of exhibition will be randomly decided.

General Rules

- You are required to prepare a short video that demonstrates your execution of the tasks on the other Patio in a separate presentation. The length of the video should not be **longer than 2 minutes**.
- All teams should be prepared to demonstrate their robots at 9am and at other times when their team is called later in the day.
- Teams should have the batteries that were provided at the beginning of the semester fully charged before 9am. Use of power packs to supplement or replace the battery will not be allowed.

General Rules

3. Each team will have **one** opportunity to complete the tasks on their assigned Patio. Additional opportunities to complete the tasks on a particular patio may be allowed if time permits. However, there is **no guarantee** that this will be allowed.
   - **Each team will be allotted 12 minutes per** run on assigned Patio for the team's robot to complete all the tasks.
   - Every effort will be made to announce when a team should begin a run on their assigned patio, but it is the team's responsibility to check their scheduled demonstration time and be ready at the starting point of the first task. A team that fails to begin the run within the 5-minute window will be given a score of 0 for the first (and possibly only) run on that course.

General Rules

4. The robot must run using a program that has been previously downloaded to a microcontroller on board the robot. Instructions cannot be transmitted real-time to the robot.

General Rules

5. A total of two beacons can be used to provide signals for the robot to follow to assist it with navigation.
   - Teams can propose any beacon design. The cost for the beacons should be included in the budget and bill of materials for the project.
   - Team members should place the beacons that will be used for navigation on a patio at the beginning of the run and remove them immediately at the end of the run. Beacons cannot be moved once the official start of the robot run has begun.

General Rules

6. There are three tasks to be completed on each Patio. Each task carries a maximum of 10 marks.
   - You will receive 10 full marks for the first task only if you complete it in the first run. You will be penalized by one mark for every external interference, touch or restart.
   - To receive full marks for the second and third tasks, the transition from one task to another should be programmed (without any external interference). You will be penalized for any repositioning or restart (minus one mark for each external interference, touch or restart) for second and third tasks if it does not transit automatically from one to another.

General Rules

7. Electricals systems and all connections to circuit components and subsystems must be rugged and reliable.
   - Wires should be soldered onto PCBs, V-board, or punchboard or screwed into terminal blocks on PCBs, V-board or punchboard. Breadboard circuits are not allowed.
   - A fuse and ON-OFF switch should be placed between the battery and the rest of the robot. The fuse should be sized appropriately so that it will not be damaged during normal operation of the robot, but will create an open circuit should more current than expected be drawn from the battery.

General Rules

8. Each team is expected to design a motor driver circuit and the PCB on which this circuit is constructed.

General Rules

- Teamwork
- Team leader and other team members role and responsibilities
- Tasks should be identified / categorized
- Task(s) assignment to individuals or subgroups
- Planning and time management
- Think outside the box
- Have a plan A, B, and may be C

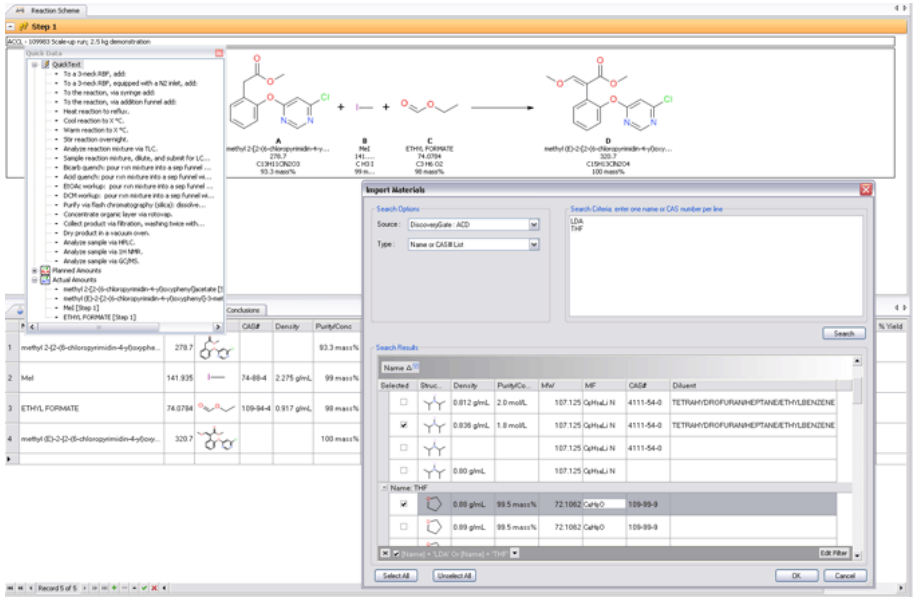
Lab Books

- You are required to keep an updated record of your project progress. Your lab books **<u>will be assessed in week 5.</u>**
- "*Researchers use a lab notebook to document their hypotheses, experiments and initial analysis or interpretation of these experiments. The notebook serves as an organizational tool, a memory aid, and can also have a role in protecting any intellectual property that comes from the research*" – **Wikipedia**.

Lab Books

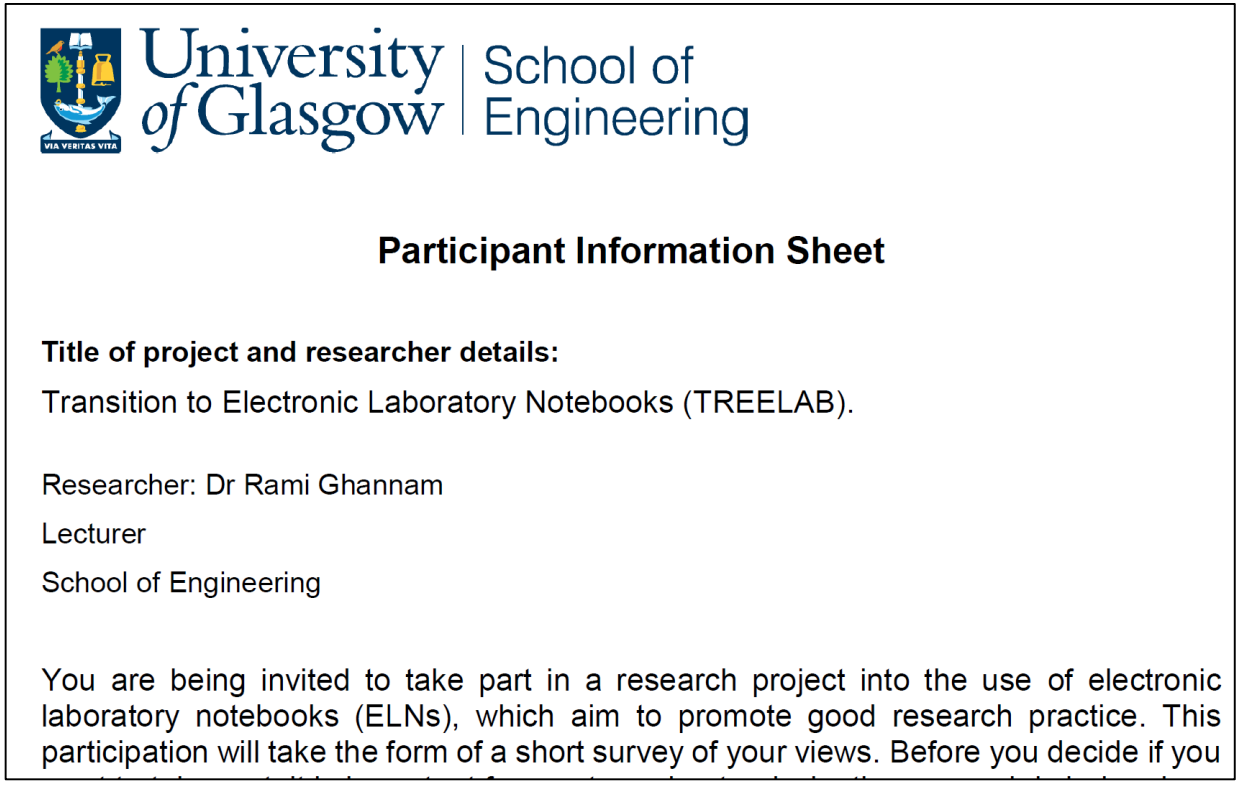
- Paper based Laboratory Notebooks

- Electronic Laboratory Notebooks



Lab Books

- Electronic Laboratory Notebooks – 5 teams will take part in this activity.



University of Glasgow | School of Engineering

Participant Information Sheet

Title of project and researcher details:

Transition to Electronic Laboratory Notebooks (TREELAB).

Researcher: Dr Rami Ghannam

Lecturer

School of Engineering

You are being invited to take part in a research project into the use of electronic laboratory notebooks (ELNs), which aim to promote good research practice. This participation will take the form of a short survey of your views. Before you decide if you

Project Planning – Gantt Charts

- GANTT charts display the tasks in a project as a box or line showing the calendar duration of the task on the horizontal axis (the horizontal length of the task box is proportional to the task duration).
- Tasks are normally arranged in date order on the vertical axis.
- The time relation of all tasks to each other (for example, tasks carried out simultaneously) is therefore clearly apparent in a GANTT chart.

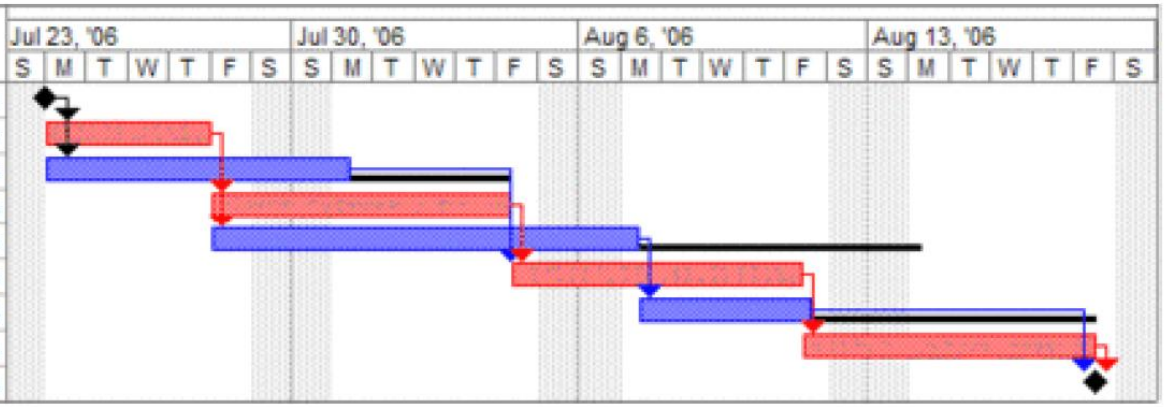
Project Planning – Gantt Charts

- The project status can be easily determined at intermediate dates in the project
- Progress of individual tasks can be shown by filling in the task boxes.
- Dependencies between tasks can be indicated by lines linking tasks.

Project Planning – Gantt Charts

http://video.tudou.com/v/XMjQ0MjA0MTM0OA==.html?spm=a2h0k.11417342.soresults.dposter

ID	Task Name	Predecessors	Duration
1	Start		0 days
2	a	1	4 days
3	b	1	5.33 days
4	c	2	5.17 days
5	d	2	6.33 days
6	e	3,4	5.17 days
7	f	5	4.5 days
8	g	6	5.17 days
9	Finish	7,8	0 days



Gantt Charts - Example

Project Start Date : 1st March 2019			
Task Identifier	**Task Description**	**Predecessor Task(s)**	**Time (days)**
1	Establish project	-	2
2	Establish customer requirements	1	3
3	Produce software specification documents	2	4
4	Write test plans	3	1
5	Write code	3	2
6	Developer testing	5	2
7	System testing	4, 6	4
8	Write customer documentation	3	3

Pert Charts - Example

- Program Evaluation Review Technique (PERT) charts show each task in a project as a node.
- Dependencies between tasks (e.g. where one task requires another one to be completed before it can start) are clearly shown by interconnections between the task nodes.
- PERT charts also show timing information for each task.

Pert Charts - Example

- PERT charts try to make a realistic estimate by considering three scenarios and then generating an Expected Time as a weighted average
- The PERT method requires the project manager to supply three estimates to make the estimates as accurate as possible. The three estimates are:

Pert Charts - Example

- Optimistic Time (O) – the shortest time that the activity is likely to take. There will be a small probability (less than 5%) of this happening
- Most Likely Time (M) – the project manager should have a high degree of certainty that the task will be completed within this time
- Pessimistic Time (P) – the project manager should be almost certain (e.g. 99%) that the task will be completed within this time

Pert Charts - Example

- The ‘expected time’ T_E is then calculated as

$$T_E = \frac{O + 4M + P}{6}$$

Pert Charts - Example

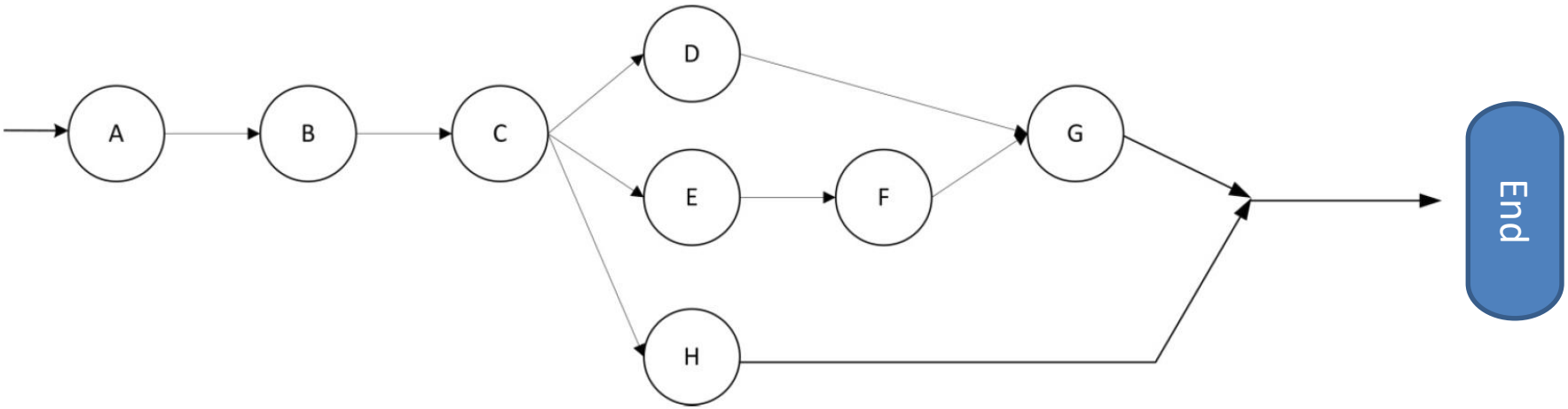
Task Identifier	Task Description	Predecessor Task(s)	Optimistic Time (O)	Most Likely Time (M)	Pessimistic Time (P)	Expected Time (T_E)
A	Establish project		4	5	12	
B	Establish customer requirements	A	2	3	4	
C	Produce software specification documents	B	6	8	22	
D	Write test plans	C	4	6	8	
E	Write code	C	3	4	5	
F	Developer testing	E	2	4	6	
G	System testing	D, F	2	3	4	
H	Write manuals	C	5	7	15	

Pert Charts - Example

Task Identifier	Task Description	Predecessor Task(s)	Optimistic Time (O)	Most Likely Time (M)	Pessimistic Time (P)	Expected Time (T_E)
A	Establish project		4	5	12	**6**
B	Establish customer requirements	A	2	3	4	**3**
C	Produce software specification documents	B	6	8	22	**10**
D	Write test plans	C	4	6	8	**6**
E	Write code	C	3	4	5	**4**
F	Developer testing	E	2	4	6	**4**
G	System testing	D, F	2	3	4	**3**
H	Write manuals	C	5	7	15	**8**

Pert Charts - Example

- Network Diagram – which shows the tasks and their dependencies.



Pert Charts - Example

- Critical Path –is determined by using the estimated times to work out the earliest start (ES) and finish (EF) times, and latest start (LS) and finish (LF) times, and identifying the tasks where ES and LS are equal.

Early Start	Duration	Early Finish
Task Name		
Late Start	Slack	Late Finish

Pert Charts - Example

Early Start	Duration	Early Finish
Task Name		
Late Start	Slack	Late Finish

The critical path is the path that takes the **longest** to complete.