GNG1103 – Engineering Design
GNG1503 – Génie de la conception

Time Management & Project Management

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http://ncdswiss.ch/wp-content/uploads/2014/05/shutterstock_200694239.jpg

Agenda

- Reminders
- Comments on Quiz 2
- **Review Questions**
- **Definition of Project & Project Management**
- **Personal Time Management**
  - Importance to be Organized
  - Work in Multitasking Mode
  - Time Management in a Team Environment
- **Introduction to Project Management**
  - Basic Scheduling/Project Plan
  - Task Duration Estimation
  - Project Planning & Risks
  - Project Cost
  - Project Execution & Tracking (Trello Tool)

Reminders

- **Lab 5** (Project specific Lab: Unity): This week
- **Project Plan** (Week 4,6,8,10): Weekly review & update
- **Project Deliverable D** (Conceptual Design): Feb. 9
- **Client Meet 2** (Sketches & Questions): Feb. 11, 12 & 14
- **Project Deliverable E** (Project schedule & Cost): Feb. 16
- **Peer Feedback & Team Dynamics 1**: Feb. 16
- What is your summary of **Lecture 8**?
  - Ideation in engineering design
  - Documentation Tools for conceptual design
  - Brainstorming process & How to Do it?
  - Difference between conceptualization & brainstorming

Comments on Quiz 2

- 41 attendees, **83%** passed , **17%** failed
- Highest mark: **9.75/10**, Lowest mark: **1.50/10**
- **Points to improve**
  - Best product from benchmarking data (**71% failed**)

Specification	Importance	 Squadra	 Cruiser	 Franco
Weight	4	57 lb (2) 8	65 lb (1) 4	40 lb (3) 12
Integrated safety	5	Non (1) 5	Oui (2) 10	Non (1) 5
	Total	8+5 = 13	4+10=14	12+5=17

  - Problem statement (**68% failed**)
    - ✓ Who? What? Scope of the final solution (concise, precise, sexy)

Create a dynamic, interactive, cost effective and easy-to-use learning experience to help students visually understand organic chemistry concepts through virtual reality technology.

Review Questions

1. What is **project management**? What is a **Gantt chart** used for?
2. Produce a Gantt chart of the project your GNG1103 course.
3. In the table below, indicate whether the statements are true or false?

#	Statement	True	False
1	Project management involves personal time management, organization and planning.		
2	Learning project management skills is only necessary for unorganized people		
3	Personal time management as well as project management requires effort and time.		
4	In order to save time in project management, it is highly recommended to work in multitasking mode.		
5	In project management, Gantt chart can help to visualize tasks duration.		
6	A to-do list is a valuable tool for project plan or schedule.		

What is a Project & Project Management?

Project (dictionary definition*): Specific plan or design ("scheme") or a Planned undertaking

- *Project* (our definition): A series of *temporary* tasks *requiring* planning and then also monitoring, once task execution starts. A project has a specific goal (product, service) and schedule (time) and requires resources (people, funds, materials, labor, etc.)
  - We define "project management" as the process of doing the **planning**, **execution** and **monitoring** of the tasks for a project. Planning or monitoring may or may not be done by the person actually executing those tasks.
- Many projects have significant time constraints
  - "time management" is most often used to describe techniques for personal/individual organization, especially when tasks need to be completed which have time constraints

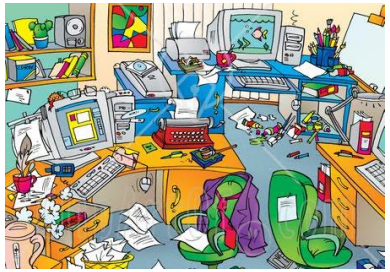
 * https://www.merriam-webster.com/dictionary/project

Are You Organized?

1. One set of people tend to be organized and methodical in how they work
   - They might find this lecture "interesting, but obvious"
2. Another set of people are more "chaotic"
   - They might find this lecture "useless" or view organizational effort as a "waste of time" or as "unnecessary overhead"

   ⇨ **This lecture IS FOR YOU!**
   - Your work will improve, if you make the effort to build organizational habits into your daily routine. It is worth it! It is. Really.
3. A third set of people might switch between these two behaviour types (organized and chaotic)
   - Hopefully, this lecture will help you stay more in category 1

Personal Time Management



http://corinesmiles.blogspot.ca/2010/09/family-routine-from-chaos-to-order.html

- Being organized **takes effort**
  - People have different inherent (or learned!) skill levels!
  - Your work quality *and* quantity will be greater, if you are 'organized'
- Being organized **takes time**
  - While it may *seem* like no work is being done, the **important** work *will* get done first, if you are organized!
  - Like putting marbles (important stuff) and sand in a jar... **More** marbles!
- **"To Do" list** (that lists ***all*** of the things that you need to do)
  - Might be a piece of paper or a file on a computer or a phone app or…
  - ~~You cross things off the list when they are done~~ and add new items
- Use an agenda or a planner to write down **what** you have to do (from your "To Do" list) **when** it must be finished and also an indication of each task's priority/**importance**

Multi-tasking Wastes Time

- Multi-tasking: Multiple tasks are done in parallel by a single person, who switches between them
  - This is how a single-core computer processor works too!
  - Switching between jobs incurs **context switching** *overhead* (where intermediate results are recorded, ready for next time, when the job is resumed… *overhead* means non-productive effort here!)

- *Context-switching wastes time* on a computer and wastes time when people do it too*
  - Multi-tasking gives the ***illusion*** that more work is being done! Actually, ***less*** work is being done and results may be poorer!
  - People (and computers!) are more efficient (i.e. they actually get ***more*** done in a specific time period) when they **do one job at a time**
  - **DON'T** multitask driving & using your cell phone! **$1000** fine now**! ****

* https://www.apa.org/research/action/multitask.aspx
** https://www.cbc.ca/news/canada/thunder-bay/distracted-driving-penalty-increase-1.4916615

Context-Switching Overhead … continued

- Reduce work 'inbox' count by reducing: the number of different email accounts, the number of social networking applications that you check, the number of devices you use, the number of physical piles of work you make, etc…
- Clear your desk and reduce distractions: Throw away material and only keep things, ***only*** if you are *planning* to look at them again
  - Clear **all** unnecessary objects from your desk!
  - Work in front of a **blank** wall

- Focus on one thing at a time
  - Having ***a*** 'To Do' list helps with this, since this helps avoid wasting time thinking about 'other' things (i.e. brain multi-tasking!)

Exercise (5 min.): Context Switching Overhead

C	O	N	T	E	X	T		S	W	I	T	C	H	I	N	G
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

(*Time yourself, for each method, using a watch or a smart phone timer*):

Draw the box, text and numbers shown above using **two** different methods:

1. Write the *entire* first line of text, spaced neatly, *then* write the numbers directly below that line in such a way that the numbers line up directly with the corresponding letter, as above. Finally, draw the required boxes around the text and numbers.
2. Immediately after writing *each* letter, draw the corresponding number below that letter and also draw the box around the word and corresponding numbers for that word, once each word is complete (everything must still be spaced neatly and the numbers ***must*** still line up with the letters!)

Q: Which of the two methods took more time?

Q: Which result looks better?

Working in Teams: Time Management

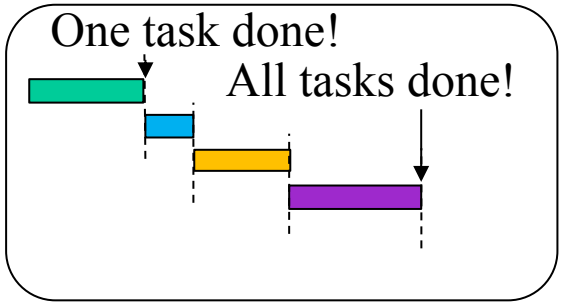
- Designing or working in a team environment is *different* from designing or working by yourself
- We have already learned:
  - Diverse teams often generate better conceptual designs
  - Design teams may have challenges with conflict management
- Time management is important for individuals, but it is even ***more*** important when working in a team
  - This is because of the dependencies that can exist when tasks are being done by different people

Q: How should we work *differently*, when other people depend on our work outputs?

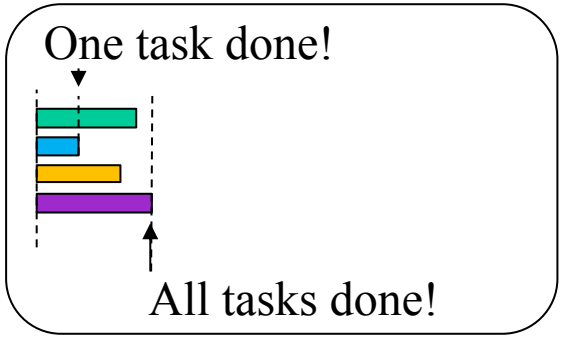
Task Dependencies:

Sequential, Parallel, Coupled Tasks

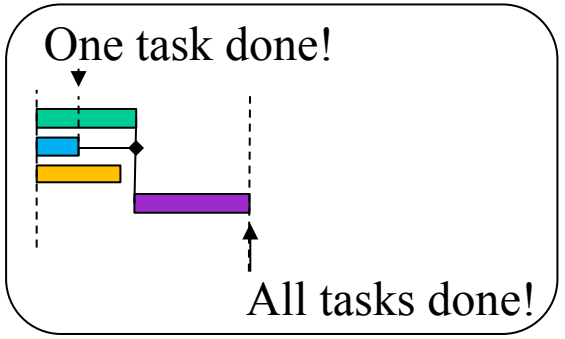
1. **Individual effort**: 4 tasks done by 1 person has task dependencies, in that the tasks must be done in **series**, since only one person is available). The exact time required depends on the complexity of *each* task … for that person



2. **Group effort (no dependencies)**: With 4 people, all tasks can now be done in **parallel.** The time for each task varies with the task *and* with the skill of the person doing that particular task (i.e. are they novices or experts for the task!)



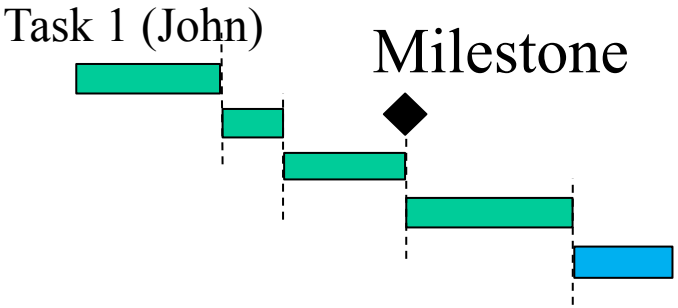
3. **Group effort (with dependencies)**: If the last task requires both the first and second tasks to be finished before it can be started, the total time to complete all tasks goes up! This gets worse if there are still more dependencies (e.g. the second task depends on one of the other tasks!). We have a combination of series and parallel tasks (**coupled** tasks)



Rules for Working in Teams

- **Do what you say you will do**!
  - Do your **fair share** and **get stuff done**
  - **Ask for help**, if you **can't** get it done!
- Do it **on time**, especially if other people *depend* on your work outputs!
  - Get better at **task time estimation**
  - **Don't** take on **too much work**. Tell people **early**, if you are falling behind with what you took on, and ask for help!
- Do it ***in style***!
  - People *remember* when you do a **great** job
  - People also *remember* when you do a **bad** job

Terms: Tasks and Milestones



- **Task**: Activity with a duration and an owner (prime) who is responsible for making sure that the task is completed "on time"
- **Milestone**: A significant event (with a duration of zero) with a date when the deliverable is required/available
- It is important to make a list of ***all*** of the required tasks and milestones for your project
  - **Review this with your team** to make sure that you haven't forgotten something
  - ***Assume*** that you have forgotten something, when checking the list, because you probably have!

Creating a Schedule

- A schedule is a listing of project's tasks, milestones and deliverables telling us *when* a project will start and finish (i.e. on time?). It is often represented by a **Gantt chart** (a timeline that illustrates when each activity starts, how long it continues, and when it ends).

- We need to know:
  - **WHAT?** Define **all** the required **tasks** and **all** required **milestones**
    - You may also need to break big tasks down into **sub-tasks**
  - **HOW LONG?** Estimate task **durations**
  - **WHO** owns what**?** **Assign** each sub-task/task to a **specific** person
  - Determine **dependencies** between different sub-tasks/tasks (and analyze ways to remove or reduce these dependencies)

  ⇒ With this, we can create a simple Gantt chart (see lab 1) and verify that all milestones will be met on time. If not, then:
    - do fewer tasks by eliminating less important deliverables
    - work more in parallel (i.e. reduce dependencies)
    - find people with expertise, who can do tasks faster

Image: https://pixabay.com/en/agenda-gantt-gantt-chart-project-153555/

Task Duration Estimation

- Time taken for a task depends on:
  - A person's Level of expertise
  - Existing levels of work (i.e. how busy people already are!)
  - How motivated or interested people are in their assigned task (really good engineers can get something done, whether or not they are interested, but even *they* will work harder on tasks of interest to them
  - Dependencies on other people or the completion of other tasks or on availability of specific resources or raw material
- Estimates for a task will be more accurate, if:
  - Tasks have been done before under similar conditions
  - Previous durations are remembered (**you** should **record** this data, yourselves, so that you know it for next time!)
  - Things that went well or badly before (and why) were also recorded

Image: https://rubygarage.org/blog/3-reasons-to-estimate-with-story-points

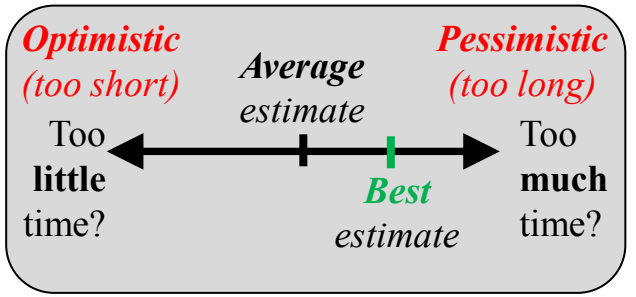
Course Attendance: Registration

- Use your smartphone or laptop to **register/notify** your attendance in this lecture
- Allow **geo location** in the attendance site
- Accept **cookies** from third parties applications
- Log in using only your **Uottawa** account at the link below

  https://attendance.azarm.ca/attendancerecord/gng1103f

- Your attendance must be registered only **during the lecture** and at the **time specified by the professor**
- You can also use the **QR code** below, to register quickly

Task Duration Estimation



- ***Most*** people under-estimate the time that is required to complete a task, because they ignore the variability inherent with the duration of any real-world task and assume that everything will go well
  - This results in a "best case" schedule (optimistic)
  - Competitive industries usually can't tolerate "worst-case" schedules (pessimistic) , either, so *something in the middle is required*

⇨ We should estimate task duration to be **half way** between the average and the worst (pessimistic). This will minimize the failure rate (10%) in contrast to 50% failure rate produced by the **average estimate**.

$$\textbf{Best Estimated Duration} = \frac{\textbf{3 Pessimistic Duration} + \textbf{Optimistic Duration}}{\textbf{4}}$$

What if I really Have *NO* Idea How Long?

- Task duration uncertainty is basically schedule **risk**
- There are two basic approaches to reduce schedule risk and both of them require extra tasks, which weren't in the schedule before the risk was identified:
  - **Do** part of the task: Create a basic prototype or "first stab" to give you a better idea or even do the *most* uncertain part of the 'risky' task immediately (i.e. add de-risking activities)
  - Estimate the task duration **better**: This usually involves talking to people with more expertise than you have. You need to prepare well for this, so that you don't waste the expert's time

Q: Are there techniques to estimate task duration?

Task Duration Estimation: Planning Poker

- Used for planning software projects (e.g. Agile framework)
  - Game-based estimation process, designed to avoid the problem of "groupthink", where everyone thinks the same (**wrong!**) thing
- Each group member has a set of playing cards with 'work unit' numbers on one side of them (nothing on other side)
  - 'work unit' numbers often based on something like a Fibonacci sequence (higher uncertainties when estimating longer tasks):

    1, 2, 3, 5, 8, 13, 21, 34, 55, 89, …
  - 'work units' are just a measure of task complexity and are *different for different teams* (but they can also be days, weeks, etc.)
  - As a team works, these 'work units' will become more team-specific and might not correspond to actual time units

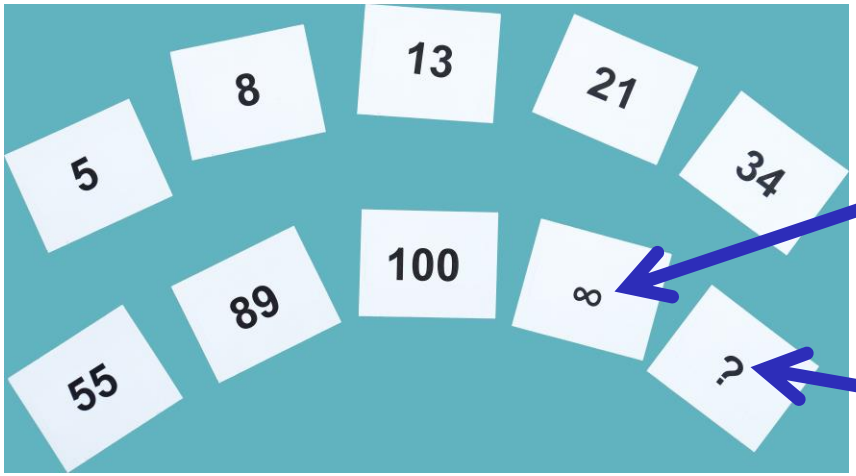
Planning Poker: How it Works

- Task duration estimation is done in rounds, for each 'user story' (i.e. each task) with a timer run by a facilitator, who also initially explains the 'user story' being considered and who keeps the activity on track

1. ***Without any discussion*** (to avoid groupthink), each person plays the 'work unit' card (face down) that they think is the most likely duration for the task
2. When *all* cards have been played, they are all turned face-up and the highest and lowest card owners are given a "soap box" to explain the rationale for their estimates, with the entire group listening (and commenting, only if *absolutely* necessary!)
3. Steps (1) and (2) are then repeated, until a group consensus is reached or until facilitator declares 'time expired"

"Planning Poker" Playing Cards

Every person needs a set of planning poker cards like this (blank on the other side of the card)



Play this when you think it's **more than 100**

Play this when you **don't know**

- Planning poker cards are available from various sources (https://www.planitpoker.com/) but we will use our own custom set of cards for this exercise
  - On **ONE** side of a 2.5" x 3" card attach one of the following label numbers (the long side of the label is lined up with the long side of the card) to make your poker set:

5, 8, 13, 21, 34, 55, 89, 100, ∞, ?

Exercise (8 minutes): Task Duration Estimation ("Early-morning Class")

- **User Story**: *Estimate how long it takes an average engineering student to arrive to an 8:30 Monday morning class, starting from the time when the alarm first sounds*
- **Work unit**: *We* don't have enough time to establish group-specific 'norms' for the 'work unit', so we will use ***minutes***
- With your planning poker cards, in your project groups (of (~5 people), you:
  - Nominate a facilitator to keep the whole process working smoothly and on time
  - Play planning poker to derive a group consensus for the task duration estimate for the user story described above

Task Assignment Strategies (Task Ownership)

- Tasks may be assigned in different ways, and the choice of who is given a task may be affected by:
  - The expertise of the individuals available
  - The availability/readiness of the individuals to do more work
  - The interests of the individuals
  - Dependencies on specific resources or facilities or dependencies on other assigned tasks
- If possible, dependent tasks should be assigned to the same person to minimize or eliminate task dependencies and context switching overhead
  - May require tasks to be re-defined into smaller, more manageable sub-tasks

Exercise (8 minutes): Your Project Plan

- Create Gantt chart **project plan** using the blank MS Project worksheet handout (template in BrightSpace too!):
  - **milestones** have been added already for you, but you are encouraged to create and add more of your own milestones!
  - Electronic plans are *easier* to adjust and edit (e.g. when you discover dependencies or when you want to add missing tasks, paper is not so convenient or clear).
  - You don't need to use MS Project (e.g. you could use MS Excel or any other graphical tool that you like)
- **Execute** your project plan, using a logging tool, to keep you on track with your new plan
  - Logging tool helps you to check that you are *always* on track (course milestones don't move! Design Day date will not change)

Project Group Exercise: Project Plan
What, How Long?, Who?

- **WHAT?**: List **all** of the required tasks and milestones (all required due dates for the milestones correct?).
  - Review this carefully in your group
  - Add any missing tasks that you have determined need to be there
- **HOW LONG?**: Estimate durations for each task and discuss realism
  - Use planning poker or other methods to refine, if required
  - If you really have ***no*** idea at all, then you will need to create tasks to get better estimates since this is a high-risk element
- **WHO?:** Assign resources (e.g. people) to each task based on some criteria (e.g. interest, availability, expertise, dependencies)
- Analyze and record all dependencies between tasks (this might depend on your particular task definitions too)
  - Fewer dependencies are better!

What Else?
Resources and Risk and Contingency Plans

- Once a basic project schedule has been created, the feasibility and accuracy of the schedule must be analyzed
  - Note any significant resources that are required (*besides* people) such as prototyping material or tools that need to be purchased
  - May be necessary to order material in advance, if there are significant purchasing or shipping delays associated with them
- Create a **RISK** list and what happens if those risks prove to be real and a "poor outcome" results
  - Quantify the **severity** of each poor outcome
  - Quantify the **likelihood** of each poor outcome
  - Derive mitigating or **contingency plans** and related activities for **all** poor outcomes that are deemed to be both severe ***and*** likely

Project Cost

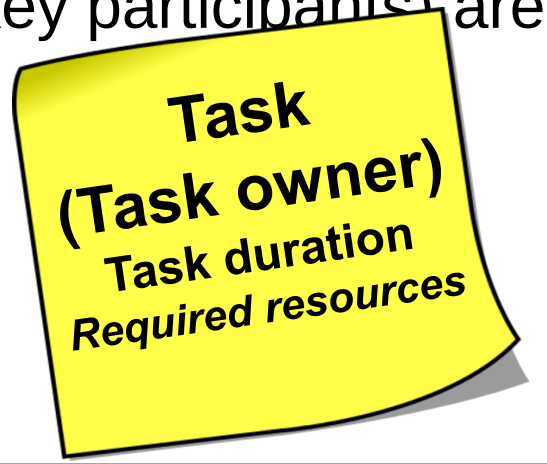
- A mentioned earlier, a project has a start and end date and a cost constraint. The cost is the monetary value expressed in dollars or another currency required in exchange to a product or a service. The project cost is the overall costs associated to a project. It is comprised of **material** costs, **labor** costs and **overhead** costs (costs other than material and labor cost).

- In the case of your course project, you will focus on material cost represented by a **bill of materials (BOM),** which is a list of all components needed for the realization of your product. Even if you use a free material, also include it in your BOM.

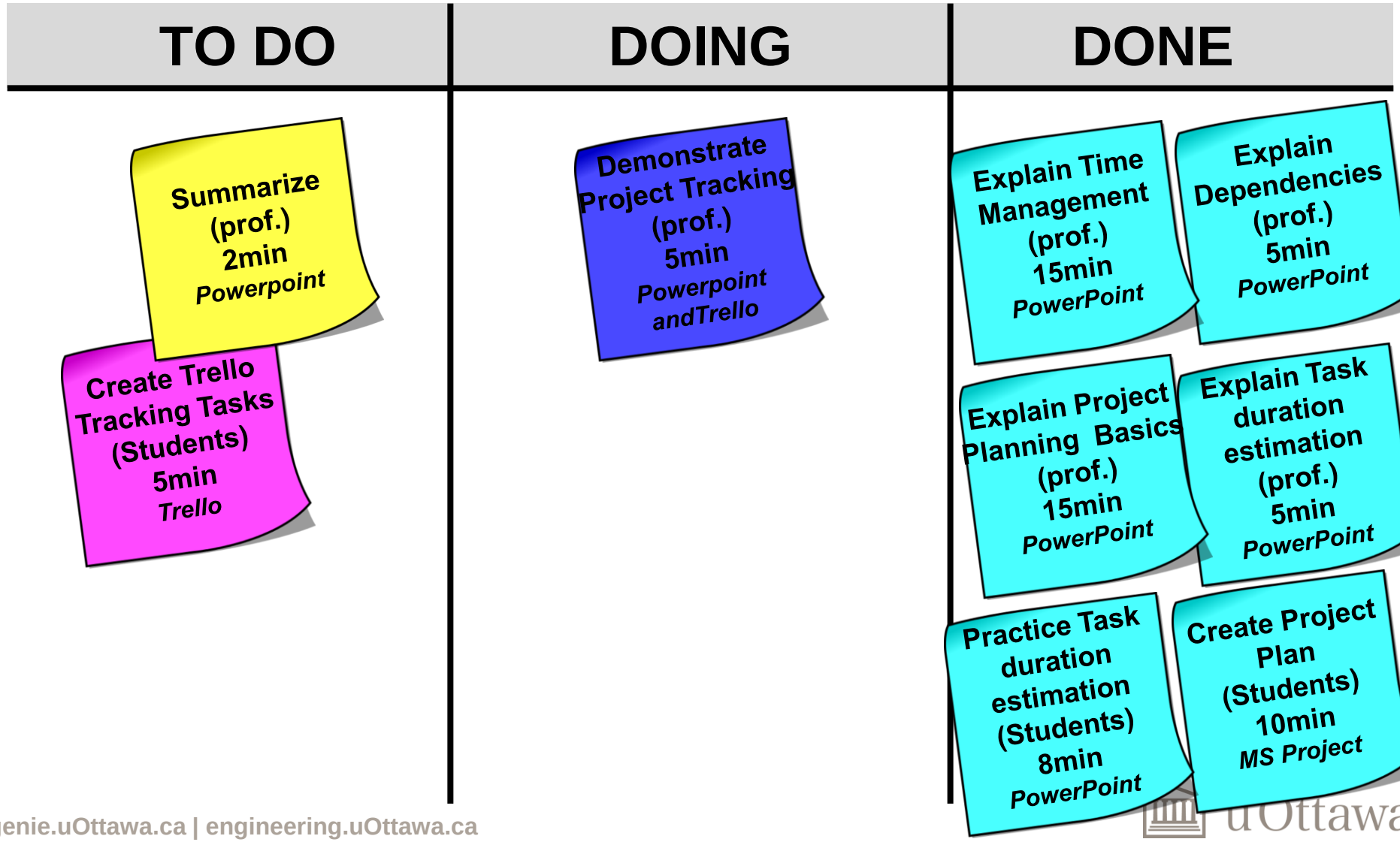
Bill of Materials				
Item #	**Item Description**	**Quantity**	**Unit Price**	**Amount**
1	LED-lamp 6V – 4W	2	$4.5	$9
2	DC-motor 6V – 10W	1	$15	$15
3	Battery 6V – 4A	1	free	$0
			Total	**$24**

Project Execution: What, Who, How long and What else?

- Information comes *initially* from the project plan, but needs to be kept up to date (and realistic!) as project is executed
  - **What?:** Task list of all tasks required to complete the project
  - **Who?:** Task owners, those responsible for completing the task
  - **What else?:** Projected resources (e.g. equipment, tooling, etc.), risks, mitigating plan, dependencies
- Communications mechanisms (e.g. email addresses and phone numbers of key participants) are important!

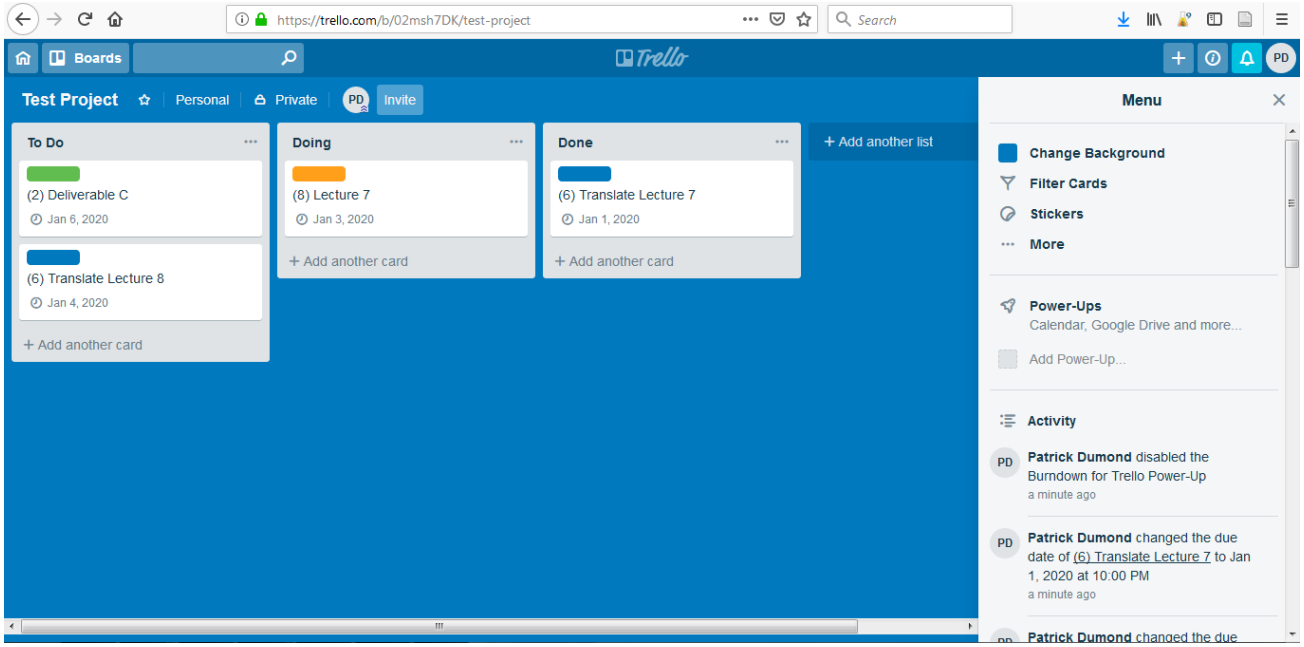


Project Tracking: Keeping Things up to Date
Example: Trello Board for this Lecture



Project Management/Tracking Tool Demonstration

- ***Trello:*** online tool for tracking project tasks
  - You will do this, weekly, from now on and review it with your TA/PM
- Available free for basic users: https://trello.com/
- **To learn:** go to https://youtu.be/xky48zyL9iA

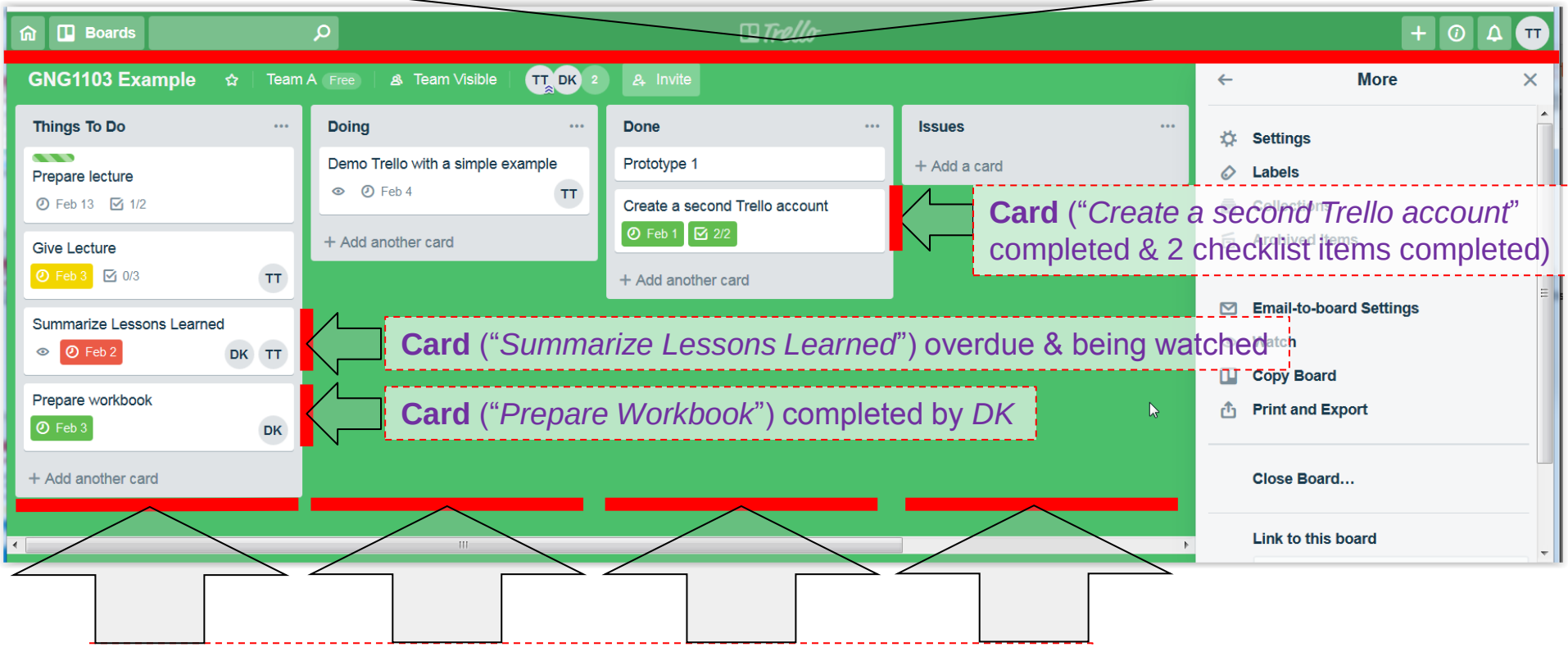


Basic Trello Setup Steps

- Go to www.trello.com and *sign up* with an email address
- *Create first board* and name it (e.g. "Food Measurer")
- Create a team with all of your team's email addresses
  - Make the board editable by the "team" that you've just defined (rather than keeping it as "private", which is the default)
- "To Do"/ "Doing"/"Done" default list names are probably fine
  - Maybe you might want to add an "Issues" list too on the far right
- You can add cards (tasks) within each list
  - You can include multiple checklist items within each card to note subtasks or dependencies and you can "watch" specific cards to get change notifications
  - Define the prime for each card (it is best to have a single owner)
  - You can use labels with colours to group and organize your tasks too
  - Please give each card a due date, based on your estimated task duration (colour will change to orange nearer the due date and then red, once past it)

Example: Trello Board

single **Board** ("*GNG1103 Example*") accessible to *Team A* (*team* members are: *TT* and *DK*; *now* logged in as *TT*)



Four different **Lists** ("*Things to Do*", "*Doing*", "*Done*", "*Issues*")

Summary

- Time management takes time but improves work **quality** and **quantity**
  - Have a "To Do" list (or use Trello) or a **project plan** to show prioritized deliverables and the dates that they are required
  - Avoid multi-tasking and the resulting context switching overhead that comes with it
- Projects with any complexity need to be planned
  - List **all the tasks**, durations and their dependencies and assign 'owners' for each task to produce a **schedule** (e.g. a Gantt chart)
  - Use tools like Planning Poker to estimate task durations in groups
  - Perform a **risk analysis** and create contingency plans, for any risks that are both significant *and* reasonably likely
  - Keep your plan **up to date** each week!