CRICOS PROVIDER 00123M

Problem Solving and Software Development

Cognitive Strategies to Get Good at Software Development (and also other things).

adelaide.edu.au

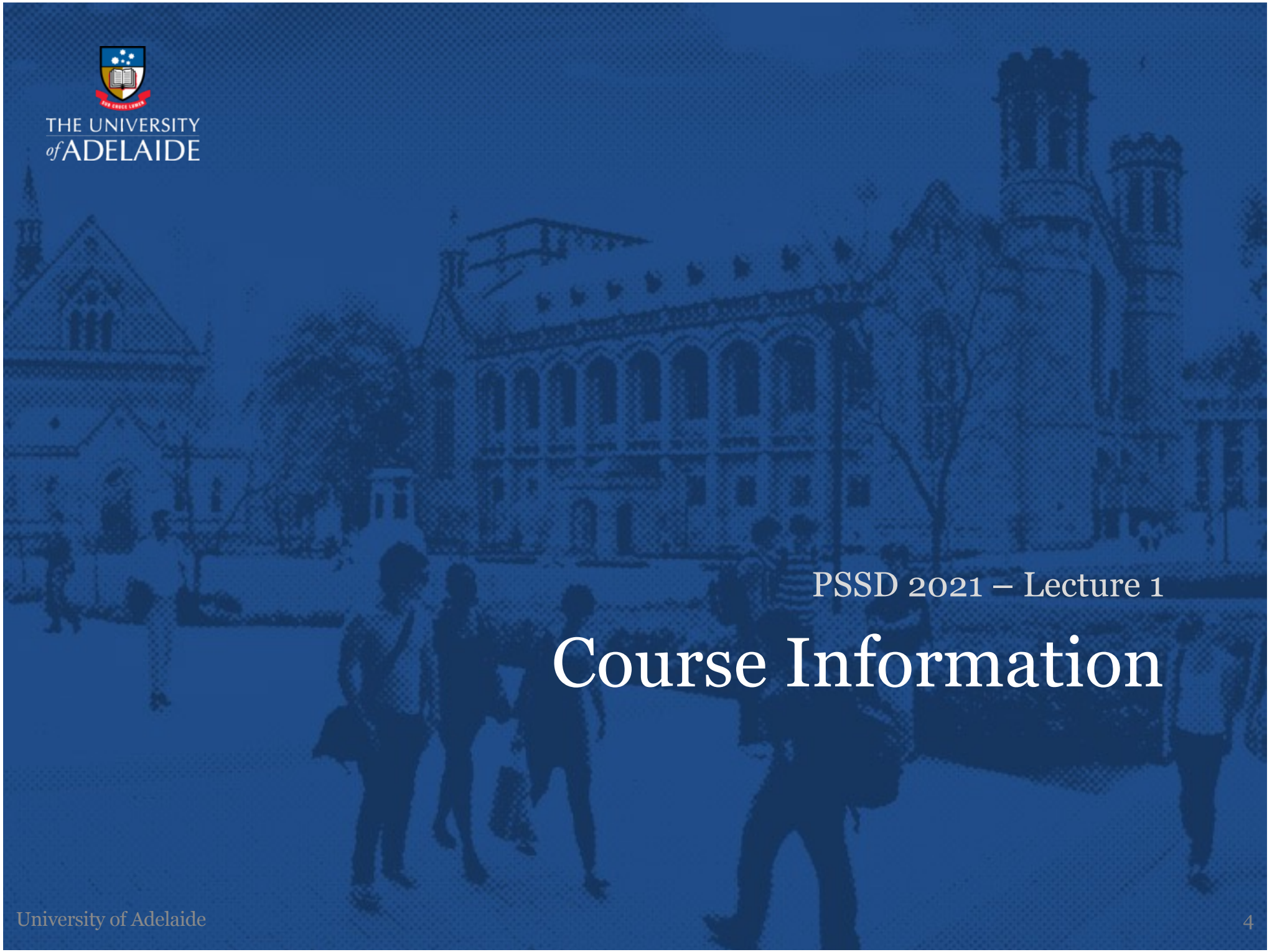
seekLIGHT

Acknowledgement of Country

We acknowledge and pay our respects to the Kaurna people, the traditional custodians whose ancestral lands we gather on. We acknowledge the deep feelings of attachment and relationship of the Kaurna people to country and we respect and value their past, present and ongoing connection to the land and cultural beliefs.

Course Contacts

- Me – Cruz Izu
  - Lecturer and Course Coordinator
- Tutors
  - Max Ward
  - Chris Whalley



THE UNIVERSITY of ADELAIDE

PSSD 2021 – Lecture 1

Course Information

Course Information

See the Course outline

- This is what I will use to guide the assessment.

You should check it to see what is needed

- I duplicated and elaborated on this in the forums but if there are conflicts (hopefully not) the course outline wins.

Assessment Summary

- Solve 4/5 problems per week (30%)
  - one problem per day
  - Practice is key to improve code fluency and problem solving
  - key preparation for practical exams
  - Each problem should be documented in the logbook - we will see a rubric for this part
- 3 Practical Exams on weeks 4,8,12 (44%)
- One optimization assignment (12%)
- Lab participation (8%)
- Quizzes (6%)
  - 4 reflection quizzes
  - Other quizzes as bonus to top up this mark

Lectures (Tuesday)

- Previously 2 hour lecture structured as
  - Approximately 1 hour lecture
  - 1 hour problem solving on paper (bring paper and pen)
- This year
  - 1 hour lecture streamed
  - For the second hour we will attempt new problems and revise the “one-week only” problems. We will also different class activities either online/offline (feedback is welcome)

Practicals (Thursday)

- 2-hour lab to practice problem solving
- This session give you a chance to work with peers solving a problem (can only code together 1 problem/week)
  - Tutors can help and provide feedback
  - Can discuss other problems at high level
  - Get familiar with web submission scripts and choices.
- Exams are scheduled in this slot
  - Week2 Diagnostic 0% marks, mock exam
  - Week4 PracExam 1 worth 12%
  - Week8 PracExam 2 worth 12%
  - Week12 PracExam 3 worth 20%
- Must attend exam in person unless studying remotely

Weekly practice format

- Need to solve 4/5 problems per week (500 points)
- Week one due Monday of week 3
  - Will show you in first lab session how to submit
  - Problem score is % of test passed. 100 when complete
- One problem can be solved with peers , all other individually
- Very important to read the problems carefully and design and document the ideas in logbook before coding
- Wide choice of problems –ask for help if don't know what to choose.

Logbook (10%)

PSSD Logbook rubric

	Weight	Excellent (HD-D)	Competent(D-CR)	Developing(P)	Undeveloped (F)
Design thinking	40%	All problems are brainstormed before coding, problem type and strategy identified	Student explains their understanding of the problems with some brainstorming or design ideas reported	some attempt to discuss problem comprehension and ideas	No entries or only descriptive entries of problem description (or code)
Troubleshooting	20%	All non-trivial corrections are noted and reflected as needed	Non-trivial errors are noted.	A partial description of errors founds and fixed	the reason for multiple submissions are not documented
Reflection	40%	Weekly insightful reflection of problems attempted and progress made. Key problems are reflected individually.	Weekly reflection shows some insights gained from practice. Some problems are cited or reflected briefly.	Some attempt to reflect on their practice beyond outcomes.	No reflection or just a report of weekly performance.

Practical exams

- You need to solve one problem to pass the exam – this is quite doable in 1:45 minutes
- The practical exam test both problem solving and code fluency.
  - format updated in 2019 to provide more choice and less problems to get high marks
- Note exam time is short, so you need to learn to manage it and do not either rush or take it too easy
  - Timing yourself during weekly practice could help
  - Give yourself 5 minutes to read and select problems
  - Try to solve a problem fully before moving to the next

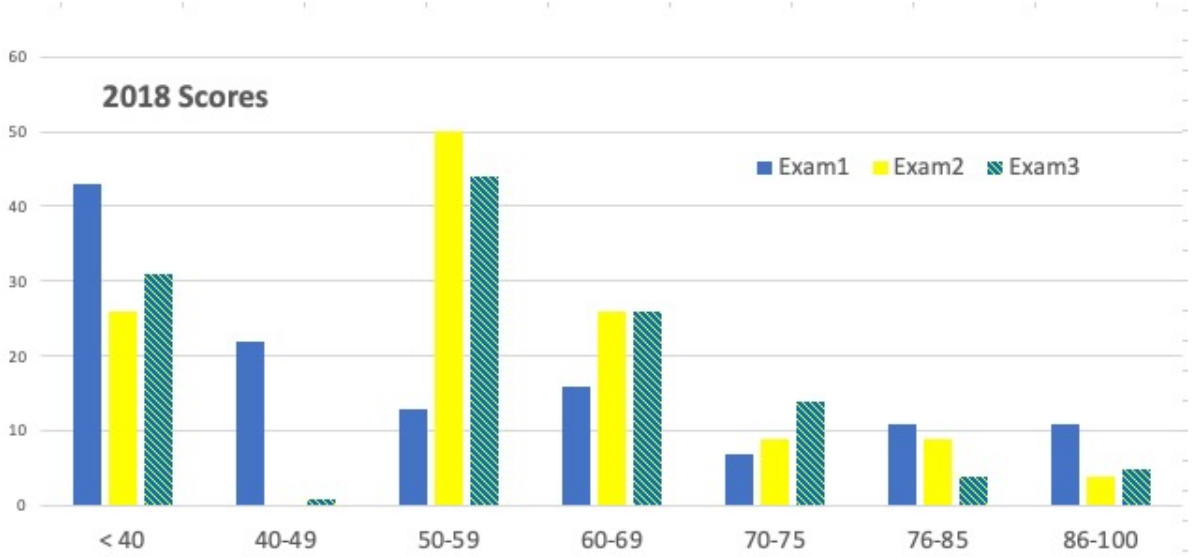
Practical exam

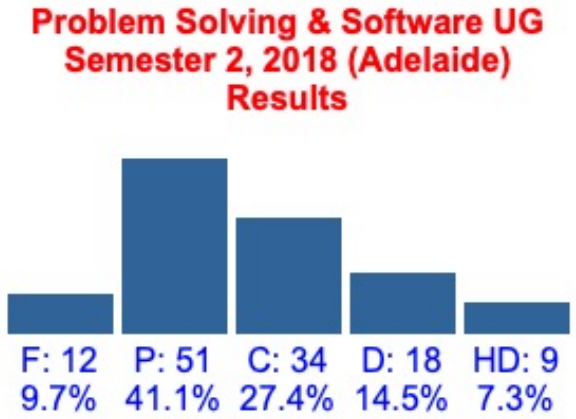
Q	Best Weight	Second Weight	Third Weight
A1	50%	25%	15%
A2	50%	25%	15%
B1	60%	40%	---
B2	60%	40%	---

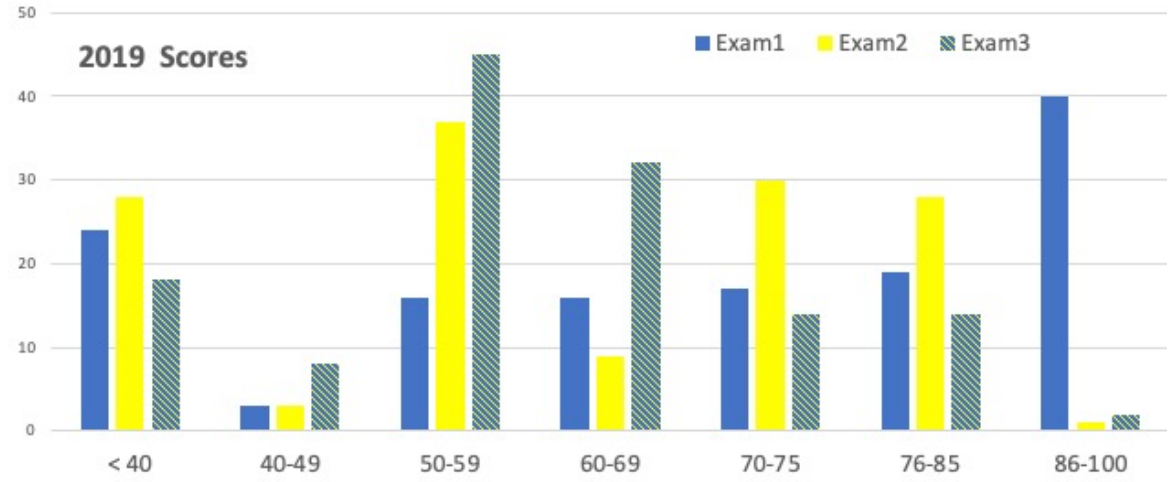
- A-questions are simple type: covered in weeks 1-3
- B-questions are types covered from week 4 onwards
  - They are likely to be harder

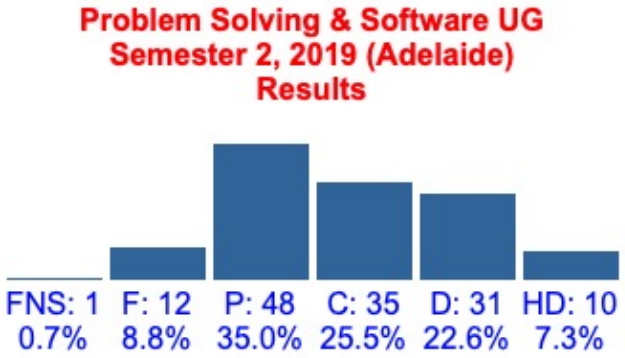
- Examples
  - You solve A1 and 80% of B1 — 100*0.5 + 80*0.4 = 82
  - You solve A1 and A2 — 100*0.5 + 100*0.25 = 75
  - You solve B1 and A1 — 100*0.6 + 100*0.25 = 85
  - You solve B1 and B2 — 100*0.6 + 100*0.4 = 100
  - You solve B1, A1 and A2 — 100*(0.6 + 0.25 + 0.15) = 100

Exams and final scores









Practical exam

Q	Best Weight	Second Weight	Third Weight
A1	50%	25%	15%
A2	50%	25%	15%
B1	60%	40%	---
B2	60%	40%	---

- A-questions are simple type: covered in weeks 1-3
- B-questions are types covered from week 4 onwards
  - They are likely to be harder

- Examples
  - You solve A1 and 80% of B1 — 100*0.5 + 80*0.4 = 82
  - You solve A1 and A2 — 100*0.5 + 100*0.25 = 75
  - You solve B1 and A1 — 100*0.6 + 100*0.25 = 85
  - You solve B1 and B2 — 100*0.6 + 100*0.4 = 100
  - You solve B1, A1 and A2 — 100*(0.6 + 0.25 + 0.15) = 100

Summary of course expectations

- Solve 4/5 problems per week (22%)
- Document problem solving in logbook (10%)
- 3 Practical Exams on weeks 4,8,12 (44%)
- One optimization assignment (12%)
- Quizzes (12%)

THE UNIVERSITY of ADELAIDE

PSSD 2021 – Lecture 1

Cognitive Strategies

Talent?

- There are two opposing views of skills and talents, either:

1. Skills are inherent and innate: You are either good at a skill or you are not.
2. Skills can be acquired through learning and practice.

What to make of Mistakes?

- The view of talent that you, personally, believe in most has a bearing on how you view mistakes.
- If you view talent as inherent then mistakes are confirmation that you are no good.
- If you view talent as acquired then you will view mistakes as a part of learning
- So which is true?

Inherent or Acquired

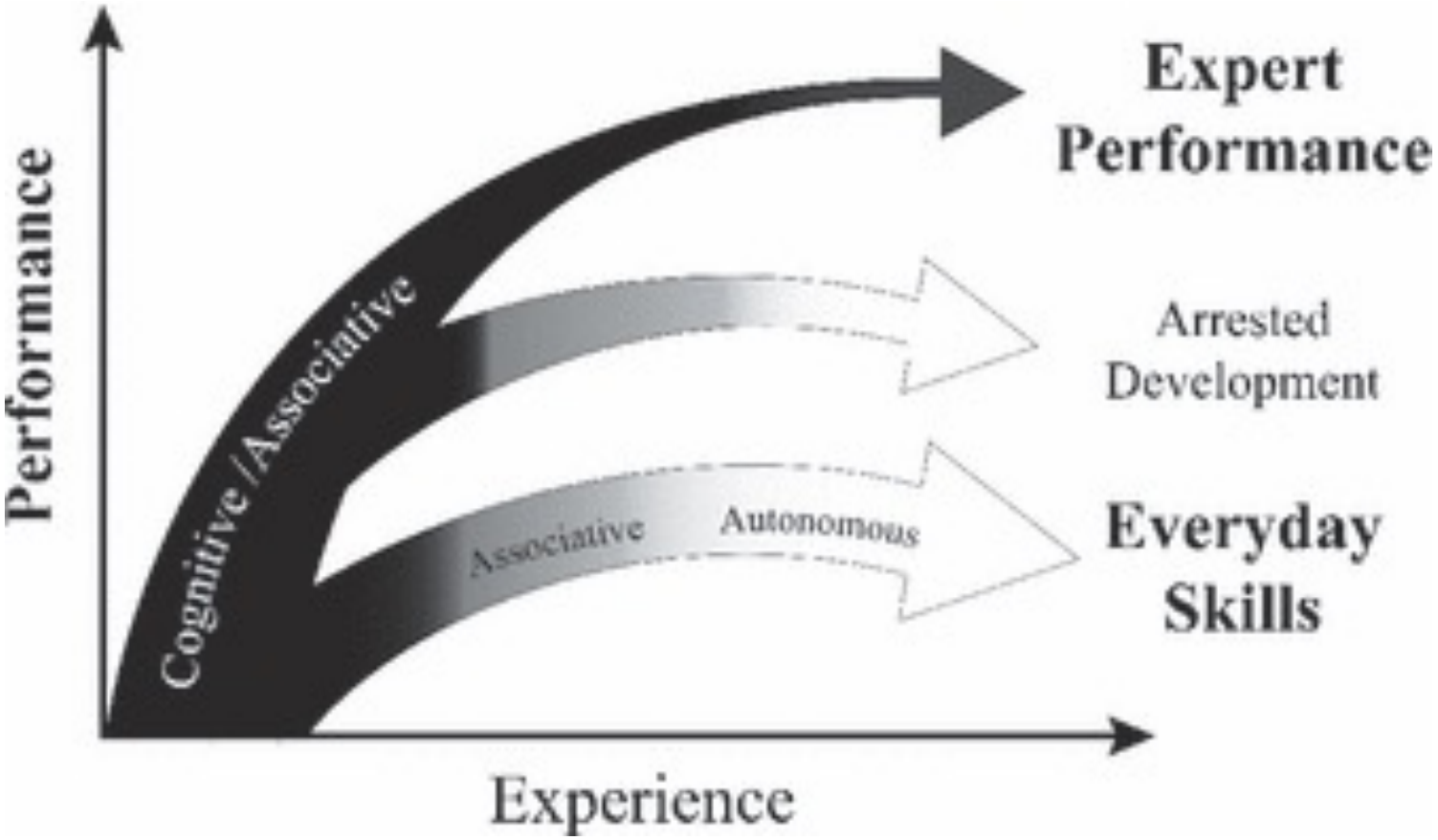
- In the 19th century Galton considered talent in a field to be innate and inherent.
  - Some others measures such as IQ have also been considered to be stable

- However, recently studies have shown, a primary predictor of high levels of skill is **Hours of Deliberate Practice**.
  - High level skills can be **acquired!**, they're **not innate**.

Deliberate Practice

- So, again, the biggest predictor of high-level performance is Hours of Deliberate Practice
- What is Deliberate Practice?
  - Repeated exercises by the individual where the aim, each time, is to improve an individual skill.
- Deliberate practice involves:
  - Design of exercises.
  - Extracting feedback on exercises
  - Reflection on the exercises

Meta-Cognition



- From: **Deliberate Practice and Acquisition of Expert Performance: A General Overview**

Meta-Cognition

- When you design your practice you need to think about how you work
  - What went well!
  - What mistakes were made
    - How to avoid them next time.
- Basically, you have to think about what works for you
  - And, most importantly, **why**.
  - Keep revisiting the **why** – false attribution can hold you back so you must keep checking.

Practice Do's

- Do practice at least 4-5 days a week – usually < 2 hours
  - but even 20-30 minutes is worthwhile.
- Do think while you are practicing
  - Alternate between thinking about the problem and thinking about your approach to the problem.
- Do choose problems hard enough to be effortful.
  - But do reward yourself with an easier problem sometimes so you can see how far you've come!
- Do get some sleep – top performers in every field sleep more than average!

Practice Don’ts

- Don’t choose exercises that are too hard right now.
- Don’t choose exercises that are too easy
  - Unless you are practicing for speed!
- Above all don’t do your practice in pre-deadline practice binges
  - Binge work is big, scary and unpleasant
  - People avoid big scary and unpleasant things.

How to think about practice

- It is **not helpful** to think about practice as the most important thing in the world, a cure for all the worlds troubles, or something that should mostly be enjoyable.

How to think about practice

- It **is not helpful** to think about practice as the most important thing in the world, a cure for all the worlds troubles, or something that should mostly be enjoyable.
- Some evidence to say that practice should be thought of as a daily nuisance, sometimes grudgingly done.
  - Think: brushing teeth or walking the dog – but with more conscious effort

Reflection and Writing

- Deliberate practice requires reflection
  - Post mortems, planning, thinking about thinking
- When you reflect you must **write**!
  - In this course you write into the logbook
  - This will make your ideas concrete.
- It gives you an artifact you can reflect on
  - And we, the lecturers, can see - and give some feedback on.
- It also lets you see how far you have come…

No, Really… Write!!!

- Write for yourself but use sources that may help you.
- Stuck on a Dynamic Programming problem?
  - Find a tutorial – write a quick primer on it in your own words.
- Something not clear? Write a question to yourself.
  - If no quick answer work on and come back.

And again..Write!!!

- Write Breadth-first
  - Do an outline in sketchy form.
  - Fill in the details to another level.
  - Only dig deep when the time comes to fill in the bits you don't have obvious answers for.
- Lastly:
  - It has been shown that 30-90 minutes of daily writing (as opposed to binge-writing) is an excellent predictor of academic success (Procrastination, Busyness and Bingeing, Robert Boice, Behavioural Research and Therapy, 1989).

Checking up on your practice

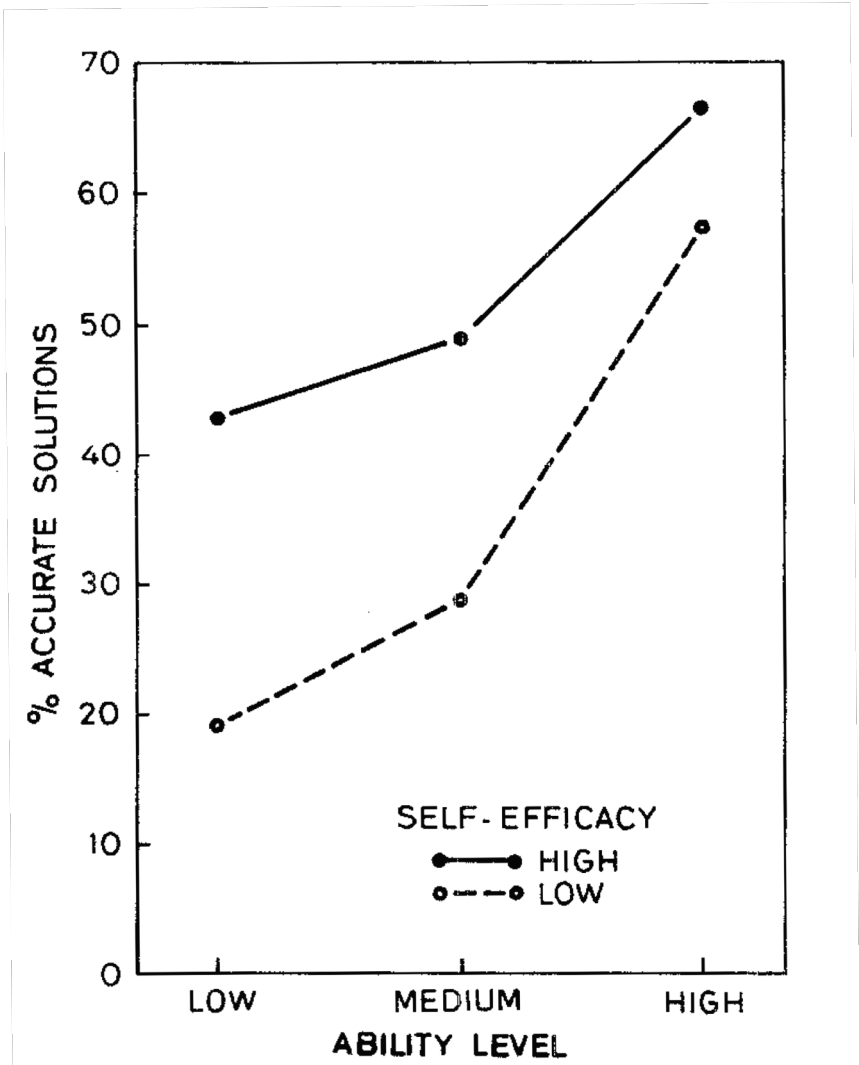
- We will watch you to see that you practice little and often
  - Also get your friends to check up on you.
  - Being watched really works!!

- Why?
  - Observer reactivity – knowing you are being watched makes you more likely to work as promised.
  - Helps overcome resistance and “give it a go”.

Self-Efficacy

- Self-Efficacy is the sense that you can do a task.
- Building up a sense of self efficacy will help with:
  - Motivation
  - Persistence and
  - Performance

Self-Efficacy and Performance



Performance of students of different abilities on Math problems – accounting for self-efficacy.

- From **Percieved Self-Efficacy in Cognitive Development and Functioning, Bandura, 1993, Educational Psychologist, 28(2)**.

Even-low ability students with high-self efficacy solved more problems, were more persistent and and were more prepared to discard unproductive approaches than medium level ability students with low self-efficacy.

Self-Efficacy and Beliefs about Talent

- Self-Efficacy is powerful but strongly related to personal beliefs about talent.
- If you think talent is innate then when you make mistakes your self-efficacy will drop.
  - You will not be motivated to pursue practice.
- If you think talent is acquired then you will see mistakes as learning
  - You will be motivated to practice.
- See https://www.perts.net

So remember…

- For all the skills that have been rigorously studied so far: talent is **acquired** - not innate.
- Hours of Deliberate Practice is the most reliable predictor of talent.
- Make it an (almost) daily habit.
- Take some time to look at how far you have come!!

Our first problem

- We are going to look at one simple problem – AimtoTen
- Get familiar with the topcoder format
- Discuss how to read a problem

What next

- This week you should
  - Read the page on reflection
  - Complete the growth mindset quiz
  - Attend first practical