# Mathematical methods for economics
# MAPSS and MACSS
# Organization and syllabus

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THE UNIVERSITY OF CHICAGO

*Math Camp - Masters*

September 2020

# The instructors

- Takuma (Tak) Habu and Thomas Bourany (me) are the instructors for the econ math camp and Levi Crews will be TA
- All of us : in the PhD program in the Economics Department
- Thomas : Rising third year (former MAPSS student), works on quantitative macroeconomics
- Tak : Rising fourth year, works on microeconomic theory
- Levi : Rising fourth year, works on quantitative urban economics

# Schedule of the math camp

- Monday, August 31, 2020, and will last for three weeks.
- The meeting will be :
- Morning lecture (9.30-12 :00am, chicago time)
  https://chicagobooth.zoom.us/j/98119065629?pwd=a3JqUDBGQ01sU1hzOTBveUVLYkJRdz09
  Meeting ID : 981 1906 5629 Passcode : mathcamp

- Afternoon lecture (13 :00-15 :00, i.e. 1-3pm, chicago time)
  https://chicagobooth.zoom.us/j/92870062716?pwd=N0pkbS9PUUhVcHlEZk1nZko0V3hmdz09
  Meeting ID : 928 7006 2716 Passcode : mathcamp

- TA session (15 :30-14 :30, i.e. 3 :30-4 :30pm, chicago time)
  https://chicagobooth.zoom.us/j/93056654885?pwd=VkU5RzdCTXNKSXNWbEk2V1BYMnNHUT09
  Meeting ID : 930 5665 4885 Passcode : mathcamp

# Schedule of the math camp

- All the lectures and TA sessions will be recorded. Recording will be provided on canvas when we get one page (hopefully in one or 2 days).
- Not compulsory to attend the lectures (like none of your future classes)
- Try to watch the recording less than 1 or 2 day after the actual lecture (if not : high risk of dropping out !)
- If you attend : try to engage as much as possible : switch your camera *on*, (but your microphone *off* !)
- Don't hesitate to ask questions of clarification (even if I moved on the next topic, there might be a couples of seconds between when I speak and when you hear it) don't hesitate, because an interactive class tend to be less boring.
- Workload : see below

# Syllabus

- Broad syllabus :
  - A Foundation : real analysis, linear algebra, calculus (differentiation and integration)
  - B Optimization and first micro models
  - C Probability theory and stochastic processes
  - D Control theory and model simulations
- Meant to be taught sequentially, but . . .
- this year, we're teaching 2 classes at the same time, so we will teach you in reverse order :
  - I'll start with probability theory and cover C and D (which are probably the heaviest in terms of number of new concepts)
  - Tak will follow with part A and B (and a bit of C), which is longer but start from the very beginning and is backed by very comprehensive notes.
  - I'll assume you know a lot, but I'll try to provide intuitions more than showing the proofs and I may not introduce all the concept in the most rigorous way.

# Workload for you

- Sadly the content of the mathcamp includes all the difficult concepts of the full year of the core sequence in economics (which is really heavy).
- The workload really depends on you :

1 Your prerequisite !

- If your background is strong (more than 8-9 classes in maths department) it won't be too hard for you to follow.
- But nobody can pretends that he knows all these topics (except if you have a master in mathematics maybe)
- Some topics in the mathcamp might be well-known (e.g. optimization/proba/stats) but requires a careful treatment to be able to build on it for more advanced extensions.
- Diversity of topics meant to bring you to the frontier :
  - Economics is becoming more and more formalized mathematically (with increasing use of abstract/quantitative/computational models).
  - The math camp tries to reach this frontier (hence the feeling that it might go too fast or cover too advanced topics).

# Workload for you

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- The workload really depends on you :

1. Your prerequisite !
2. Your motivation !
   - Many ways to engage with the material (lecture notes/exercises/homeworks)
   - Discuss the lectures with your classmates to digest some of the most difficult topics
   - Remember that the math camp is meant to help you

# Homework and TA sessions

- A priori : 2 homeworks
  - One on the foundation : matrix algebra, optimization and proba theory
  - One (longer) on the macroeconomic model :
    - Standard Consumption/Saving models in 3 settings with increasing difficulty
    - An (important !) exercise on stochastic process meant to recap the basics definitions
    - A computational part

# TA sessions

- Levi Crews will be the TA and will cover concepts related to the lectures and the homework
  - Exact content to be determined very soon, maybe :
  1. Computational models for macro (dynamic programming, maybe in Matlab)
  2. Computational methods for structural metrics (maybe stochastic processes and/or GMM) in R or Python
  3. Some ODE/continuous time models that I won't have time to cover
  4. Some data analysis and econometrics methods (maybe skipped given your background)

# Short term - my part in the next days

- The first 2 days we will talk about probability theory
  - introduction to measure theory
  - random variables
  - convergence theorems
  - conditional expectations
- The material we will provide is self contained and you don't need to use any textbook a priori.

# Office hours - my part

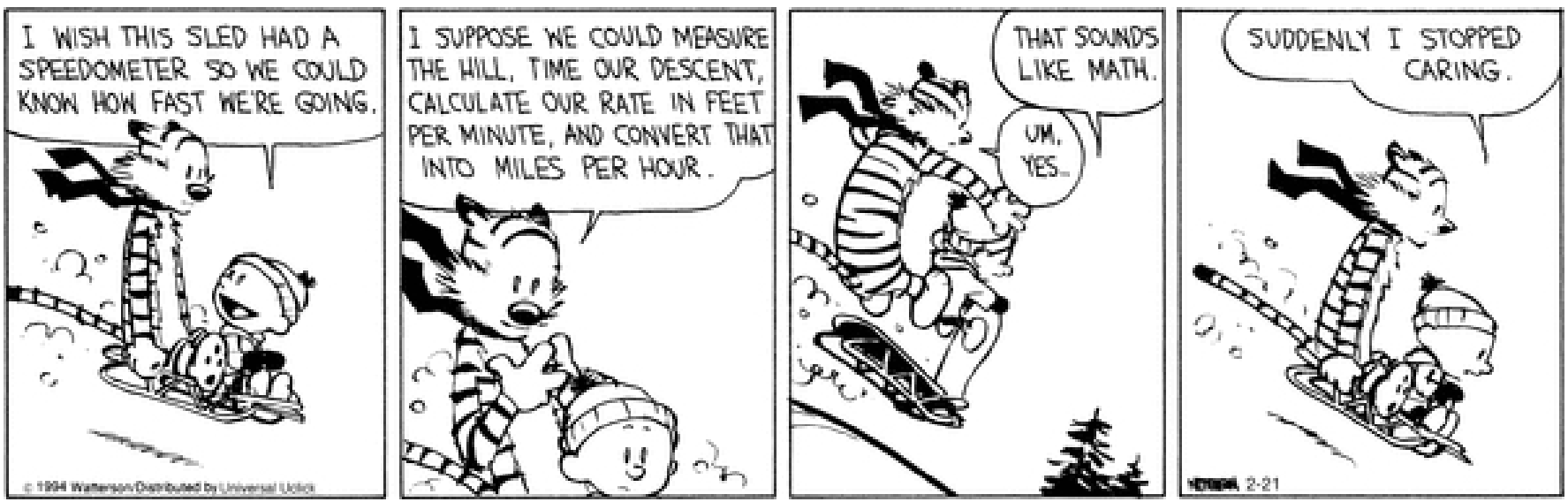
- New program remotely can be stressful and worrisome
- ”Informal office hour” to ask questions about the program : Tuesday at 8 :30am
- I’ll try to hold office hours at 9am to give a chance of students in Europe and Asia to ask questions

# Questions

- Any question ?

# Math meme thread

- We are very nerd, and we love memes (and maths !)
- We'll try to send some math-related memes to lighten the atmosphere
- Send some to me and I'll share to the class !
- First one for today :



# Ready ?

- Let's start !