

# DATA-DRIVEN BUSINESS AND BEHAVIOUR ANALYTICS



THE UNIVERSITY  
*of* EDINBURGH

ACADEMIC YEAR 2024/2025



# TEAM

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# MATERIAL AND INFO

LEARN ULTRA

<https://opencourse.inf.ed.ac.uk/dbba>



# TUTORIALS

Weekly tutorials from week 3 - **in person**

Students are expected to attempt the exercises  
**before attending the tutorial**



# COURSEWORK

**Two** assignments (25% each of final marks)

First assignment issued on week 4, deadline week 7

Second assignment issued on week 7, deadline week 11

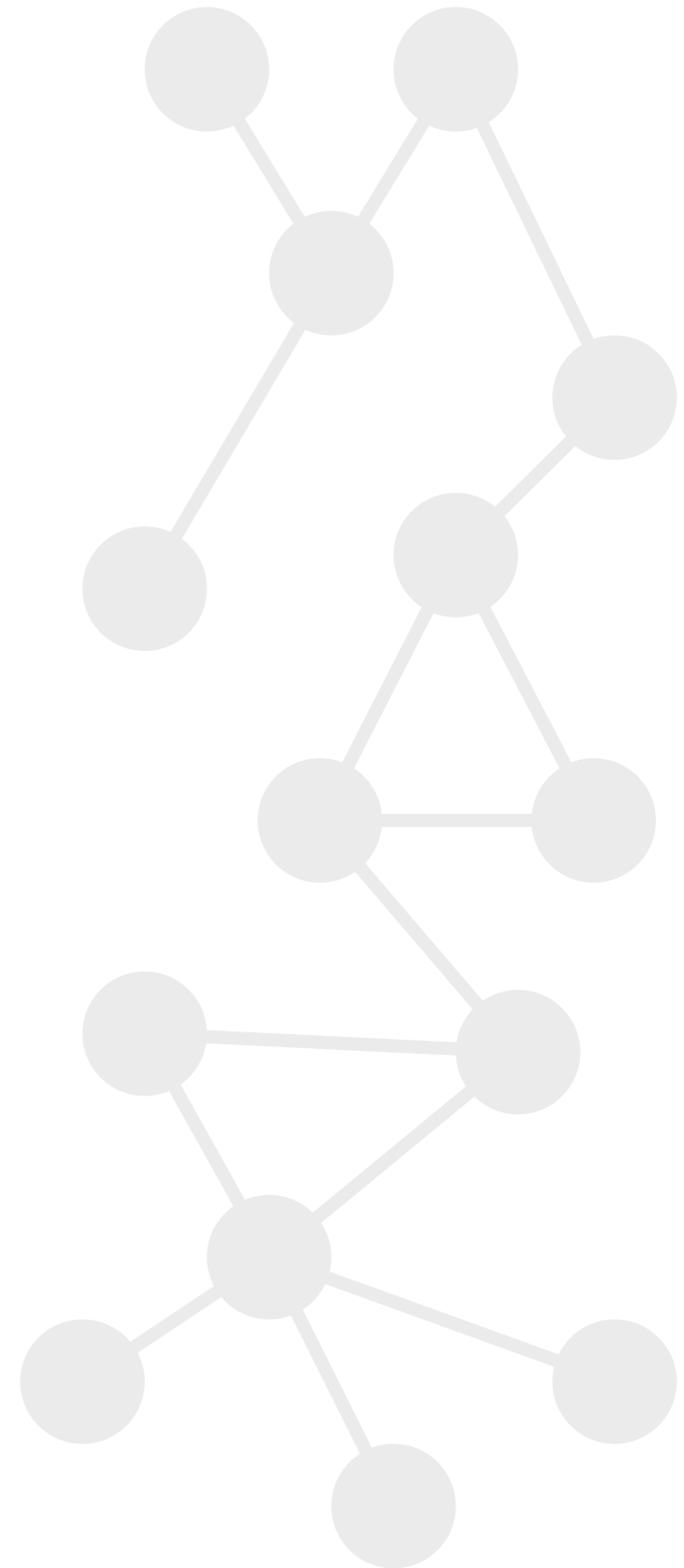
Exact dates will be available on the websites

# EXAM

50% of final marks

Exam diet: december

More details later this term



# MATERIAL



## **Main textbook for the first part:**

Menczer, Fortunato, Davies - A first course in network science

## **Another good book is:**

Barabasi - Network Science (Available for free at [www.networksciencebook.com](http://www.networksciencebook.com))

## **Main textbook for the second part:**

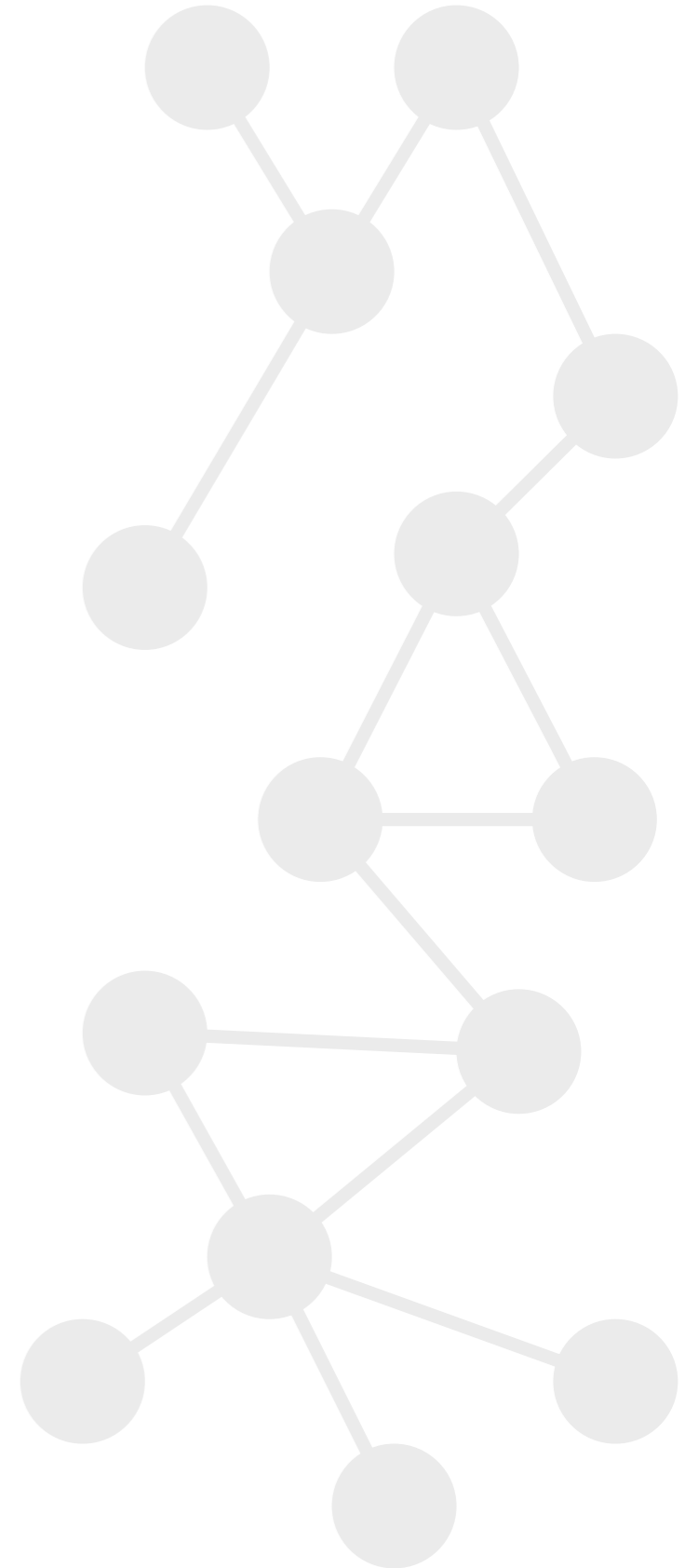
Delli Gatti et al. - Agent-Based Models for Economics: a Toolkit

Supplementary material will be provided when needed

# PIAZZA

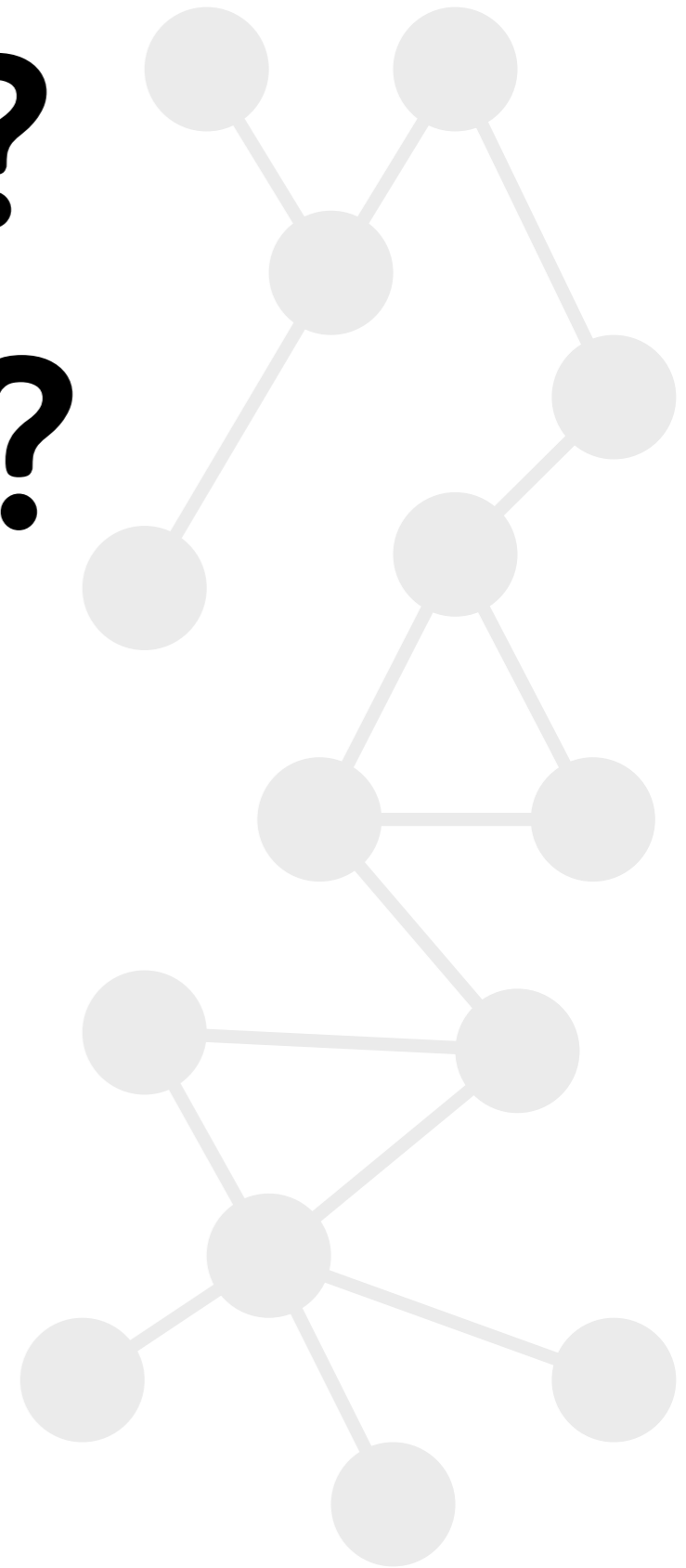
Accessible from:  
LEARN and opencourse

**Primary use:** Discussion for students



# PROBLEMS? QUESTIONS?

If about current lecture, ask in class

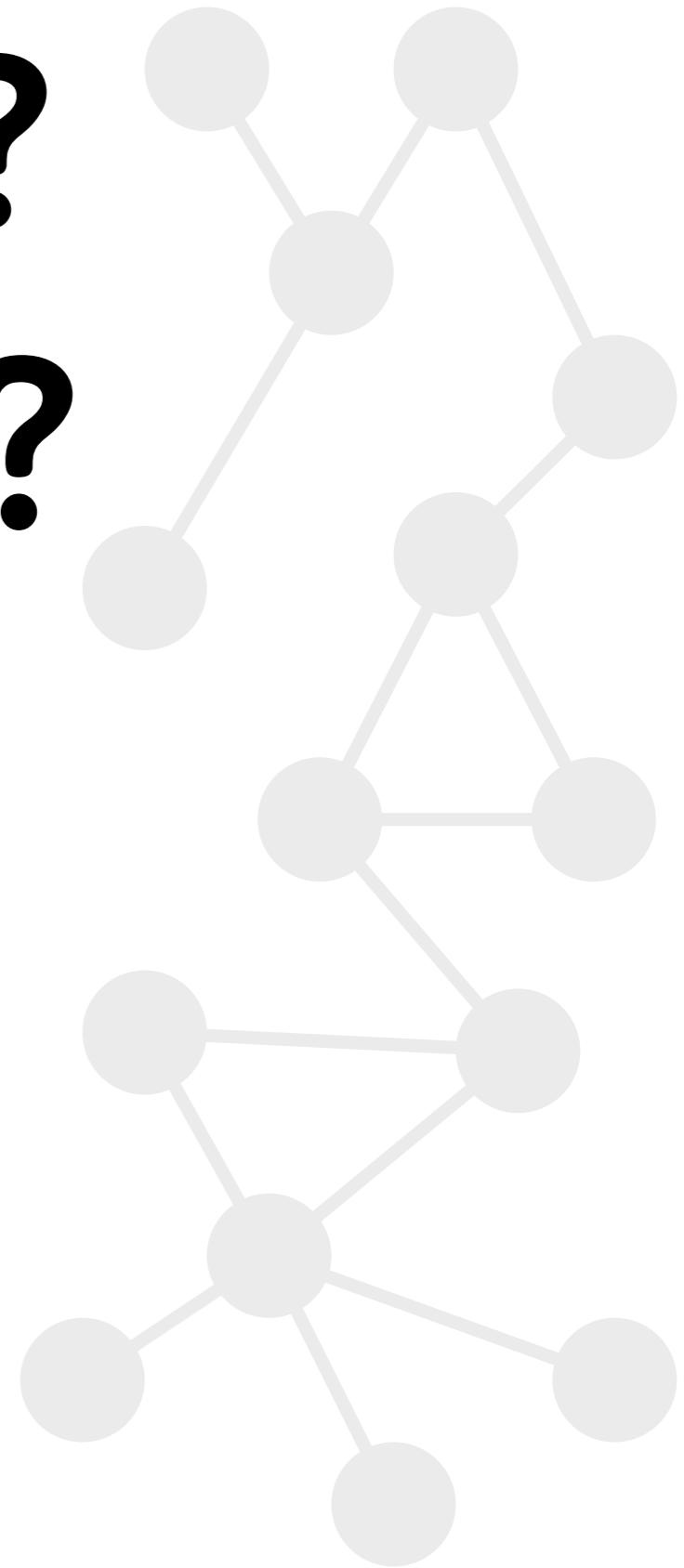




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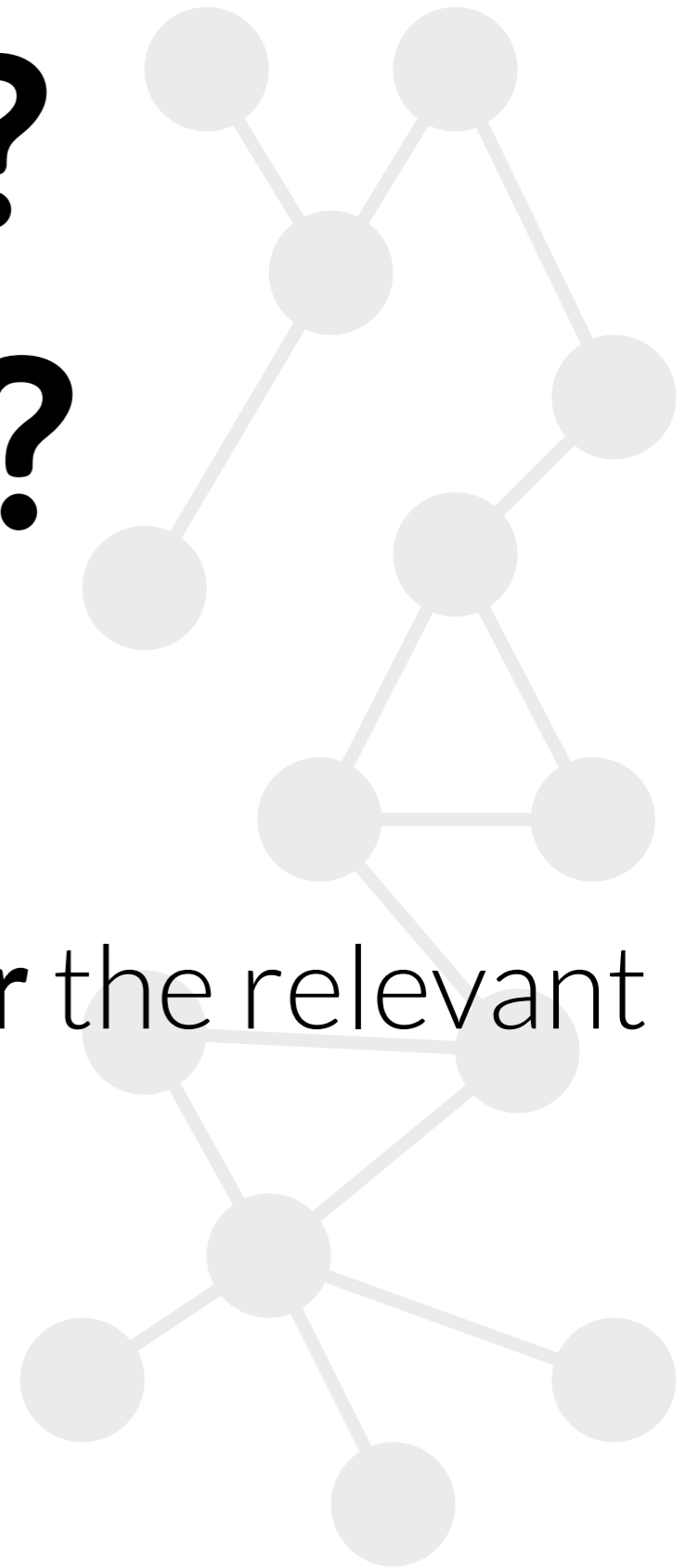


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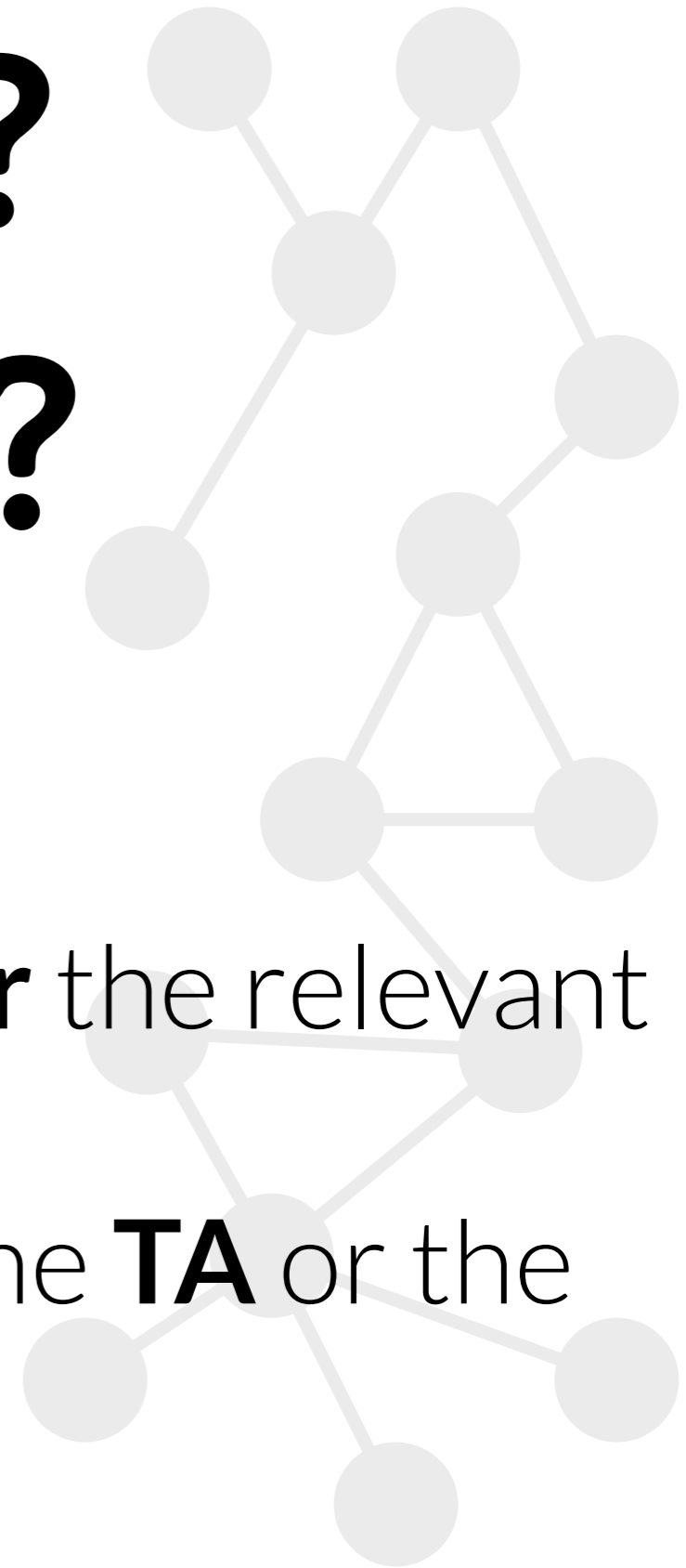
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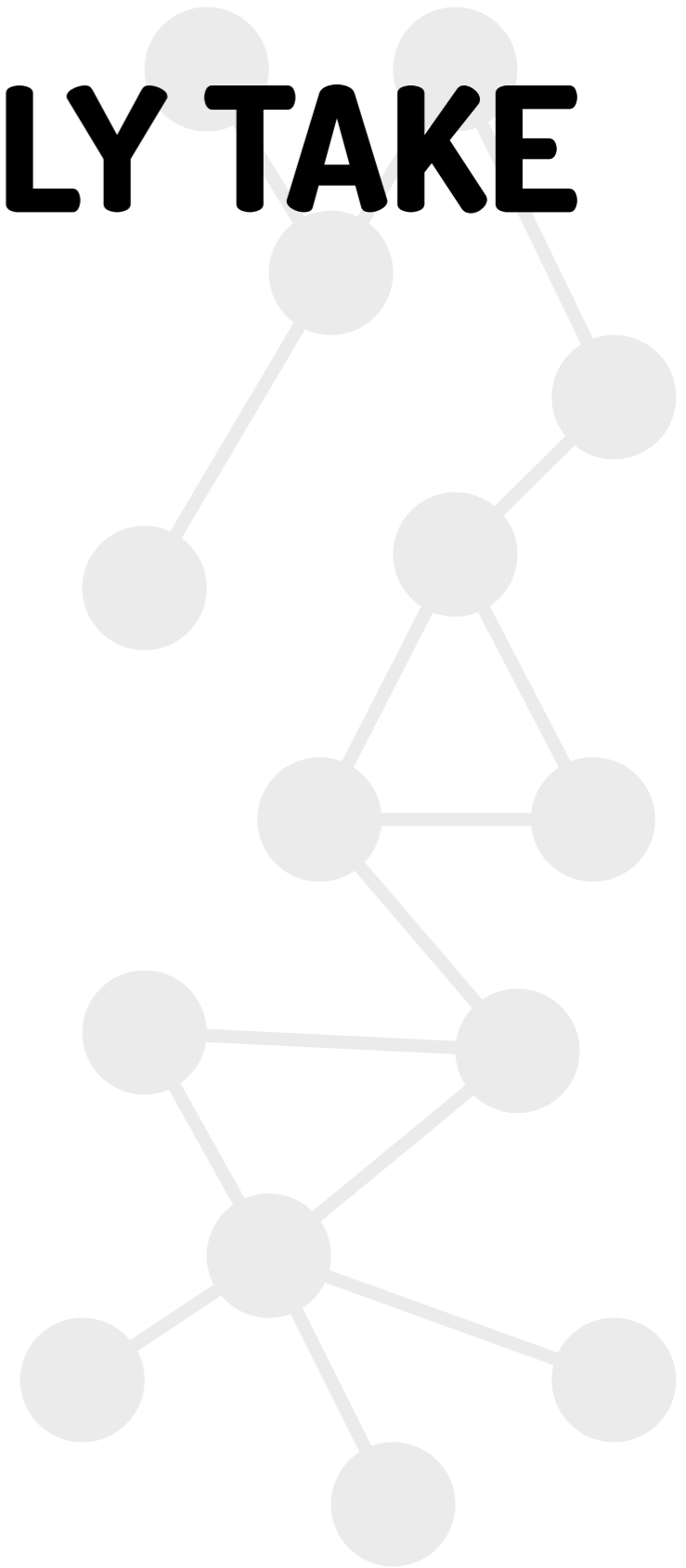
If about exercises, ask on Piazza **after** the relevant tutorial

If about coursework: ask on Piazza, the **TA** or the **lecturer** will answer



# HOW TO SUCCESSFULLY TAKE THIS COURSE

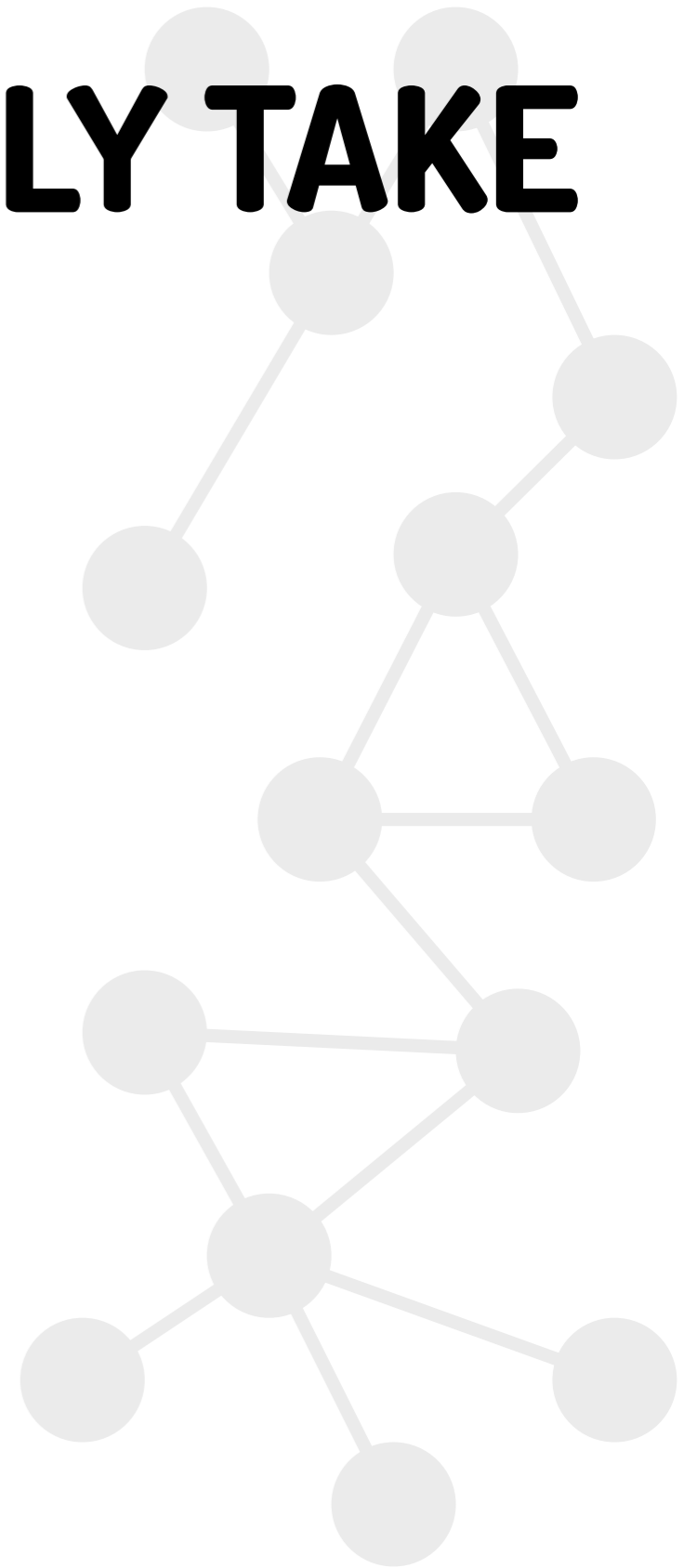
Engage during lectures



# HOW TO SUCCESSFULLY TAKE THIS COURSE

Engage during lectures

Interact with other students

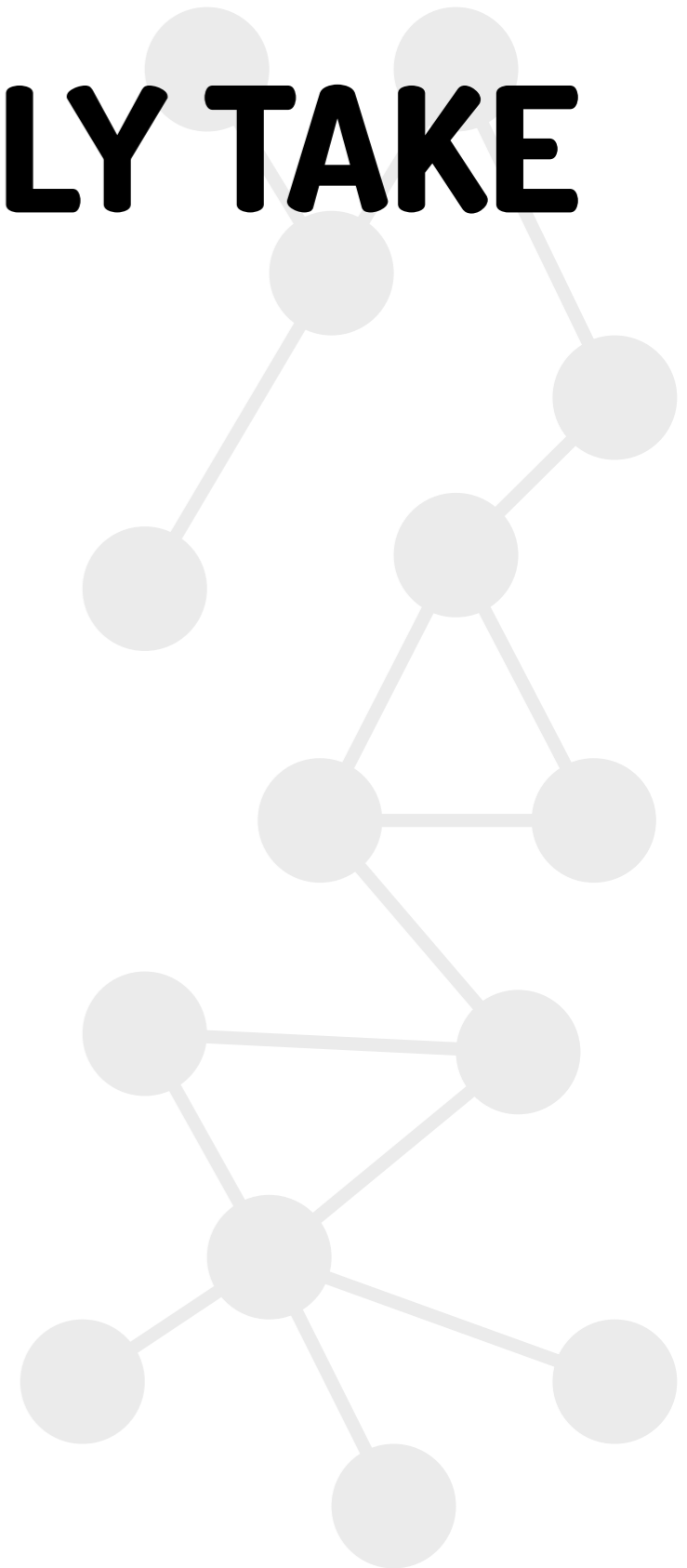


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Engage during lectures

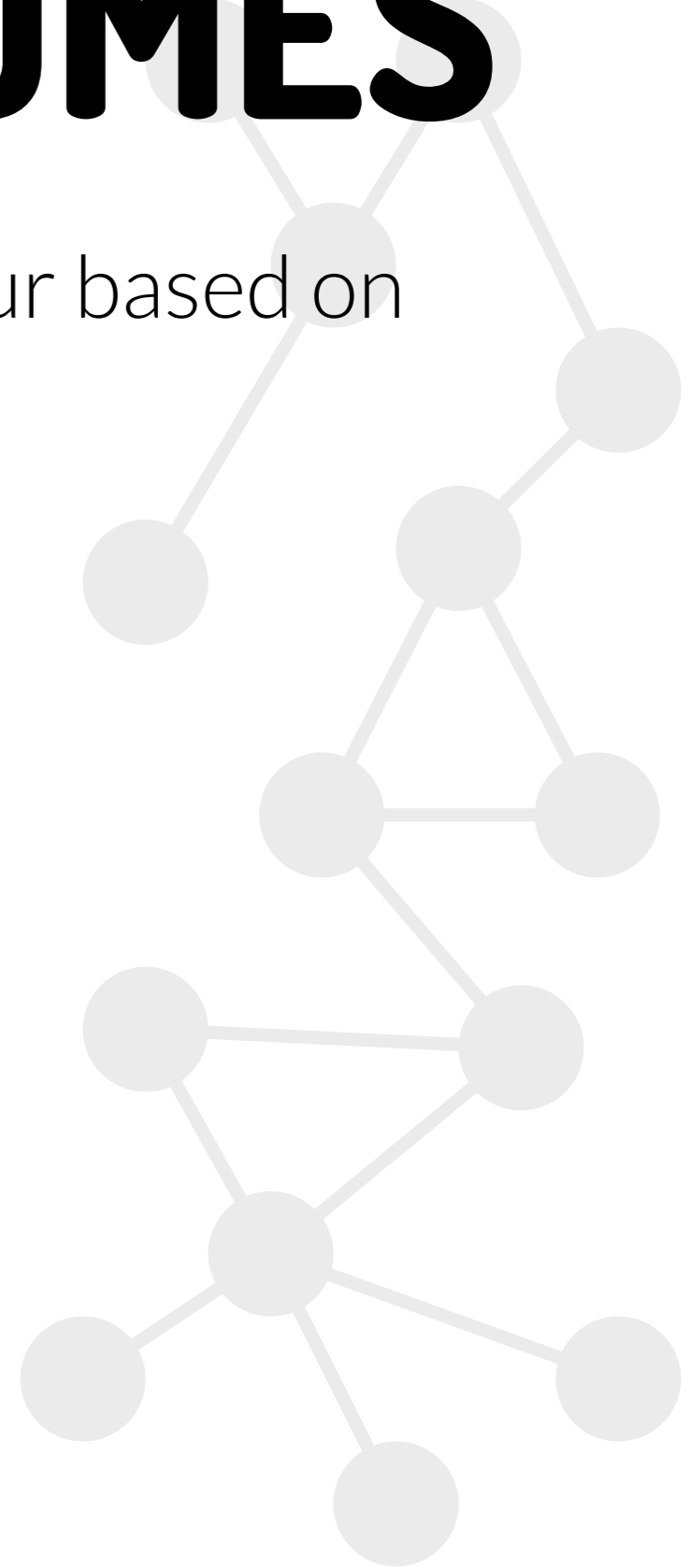
Interact with other students

Learn how to solve problems



# LEARNING OUTCOMES

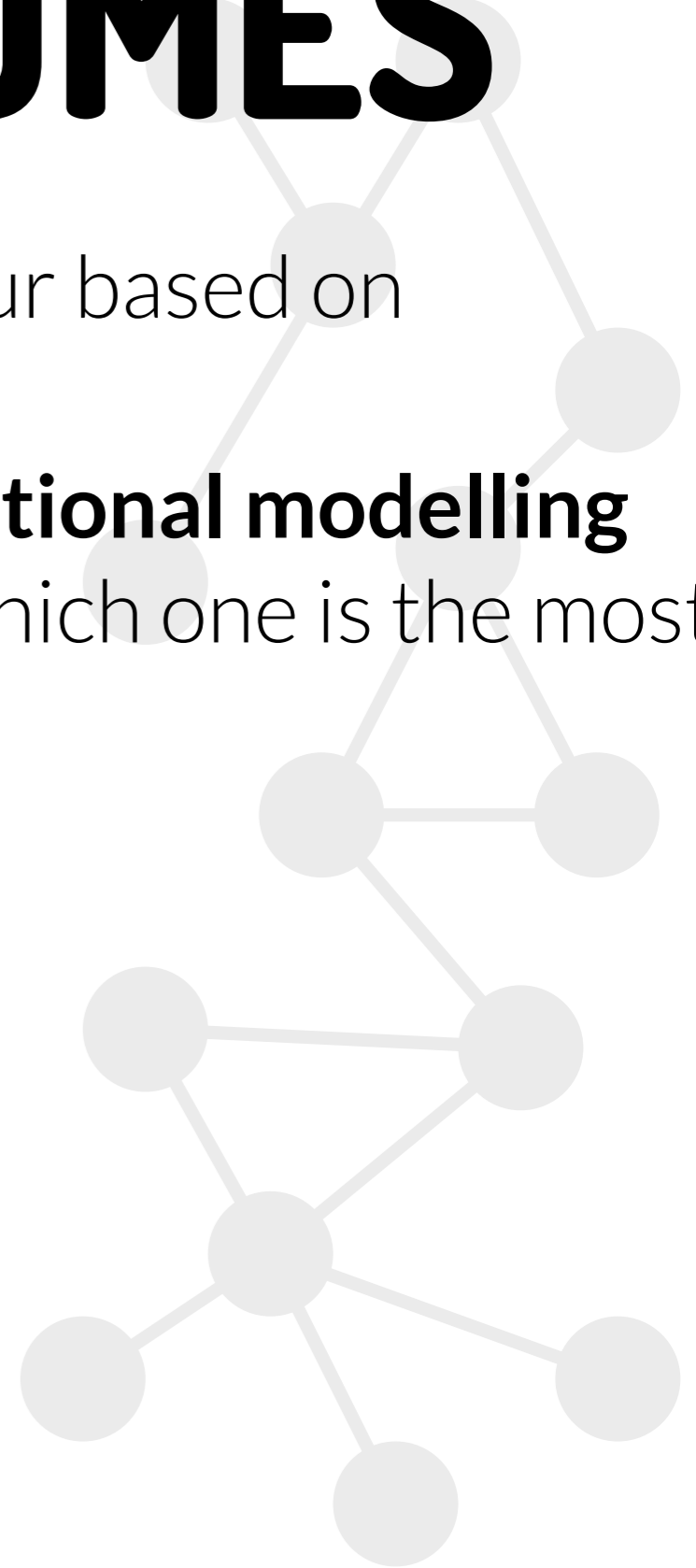
1) **Critically** analyse and explain human behaviour based on empirical observations.



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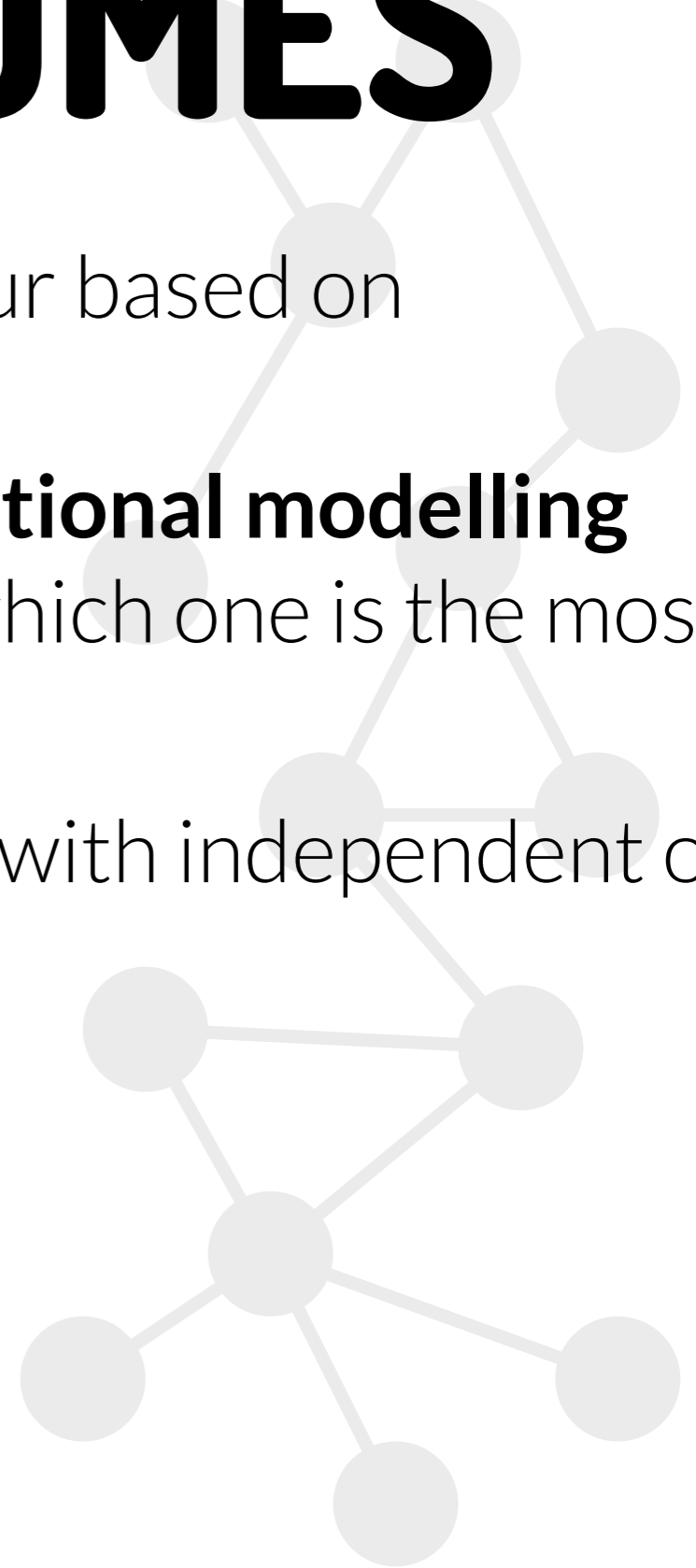
2) Apply **a range of mathematical and computational modelling techniques** to human-related data and decide which one is the most appropriate for a specific task.





# LEARNING OUTCOMES

- 1) **Critically** analyse and explain human behaviour based on empirical observations.
- 2) Apply **a range of mathematical and computational modelling techniques** to human-related data and **decide** which one is the most appropriate for a specific task.
- 3) **Model and simulate realistic social systems** with independent or interacting individuals.



# LEARNING OUTCOMES



- 1) **Critically** analyse and explain human behaviour based on empirical observations.
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- 4) Discuss the legal and **ethical implications** of working with human-related data.

# LEARNING OUTCOMES



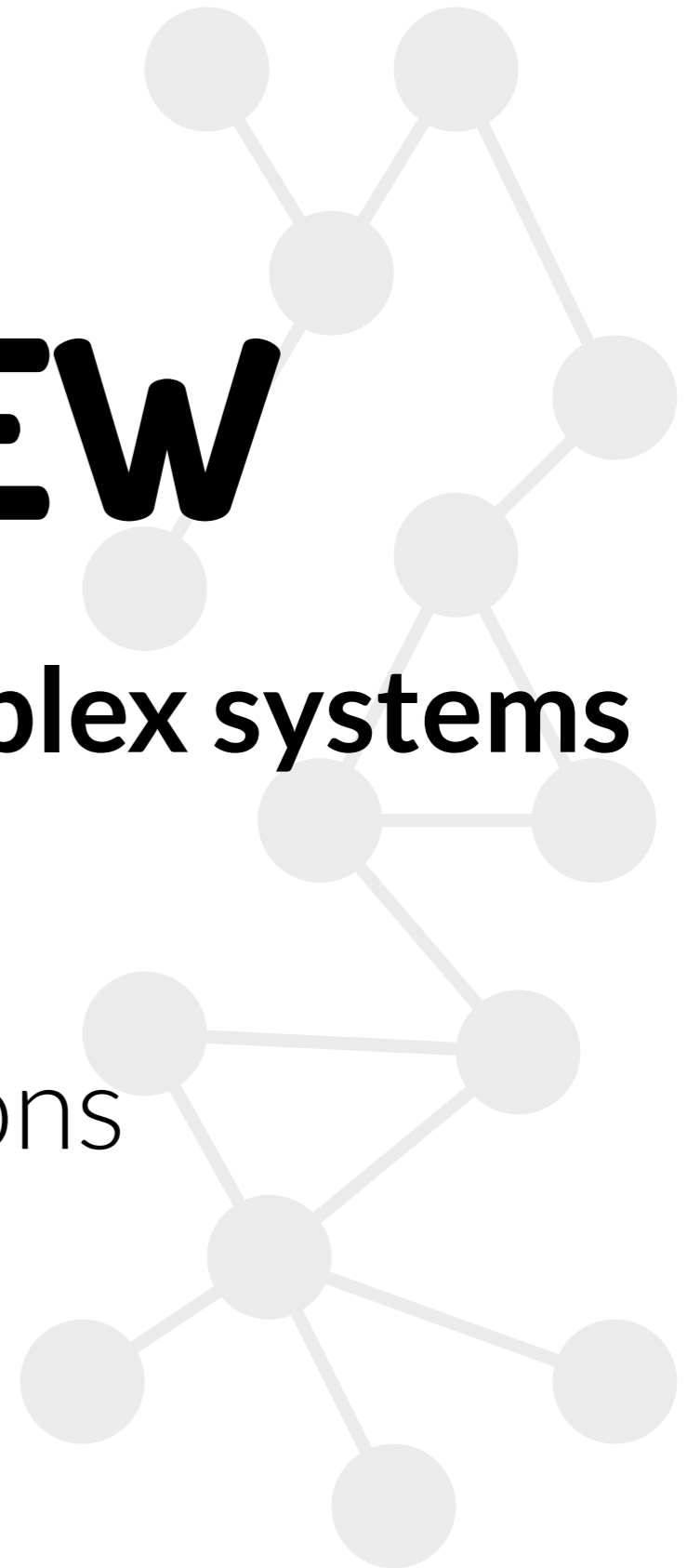
- 1) **Critically** analyse and explain human behaviour based on empirical observations.
- 2) Apply **a range of mathematical and computational modelling techniques** to human-related data and decide which one is the most appropriate for a specific task.
- 3) **Model and simulate realistic social systems** with independent or interacting individuals.
- 4) Discuss the legal and **ethical implications** of working with human-related data.
- 5) **Present** (written/oral) **highly interdisciplinary work** in an understandable and comprehensive manner to people with different backgrounds.

# COURSE OVERVIEW

Learn about (socio-economic) **complex systems**

**Networks** and social networks

**Agent-based models** and simulations



**OOOOH....**

**I'M READY, ARE YOU READY?**

memegenerator.net

# COMPLEX SYSTEMS

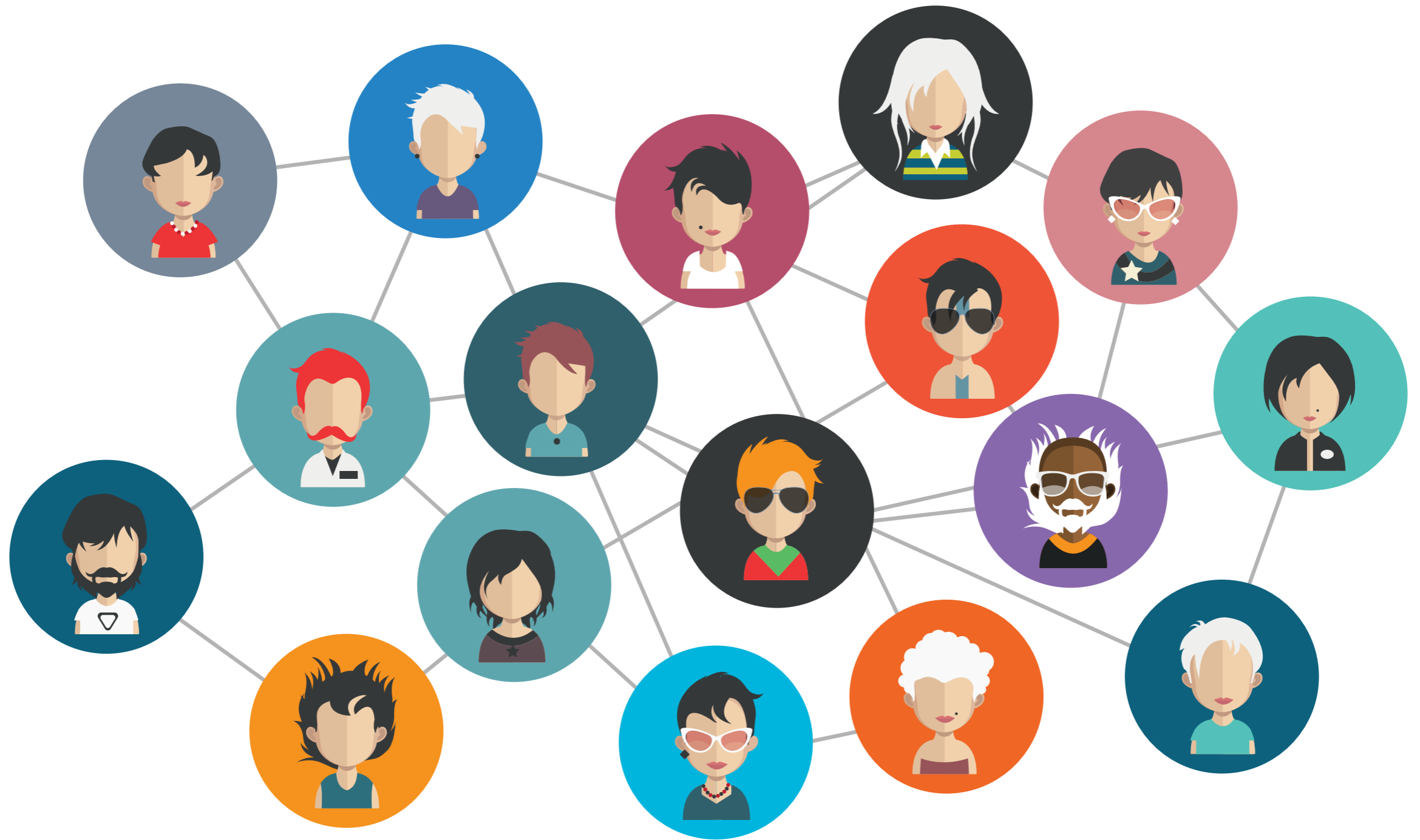
**“I THINK THIS CENTURY WILL BE THE CENTURY OF COMPLEXITY.”**

**STEPHEN HAWKING**

# WHAT ARE COMPLEX SYSTEMS?



# SOCIO-ECONOMIC COMPLEX SYSTEMS





# TWO APPROACHES

**Describe the system**

**Describe the elements**

**TOP-DOWN APPROACH**

**BOTTOM-UP APPROACH**

**MODEL MACRO BEHAVIOUR**

**MODEL MICRO BEHAVIOUR**

**DESCRIPTIVE ANALYSIS**

**EMERGING PATTERNS**

# **DESCRIBE THE SYSTEM**

**Network science**

**INTERACTION BETWEEN ELEMENTS**

**UNVEIL PROPERTIES OF A SYSTEM WITH ANALYSIS**

**RELATED TO DATA SCIENCE**

# **WHEN TO USE**

## **Network science**

**WE DON'T KNOW THE BEHAVIOUR OF ELEMENTS  
OR IT IS TOO COMPLICATED TO MODEL**

**WE HAVE DATA ON THE BEHAVIOUR OF THE SYSTEM**

**WE DON'T NEED TO KNOW WHY ELEMENTS  
BEHAVE IN A PARTICULAR WAY**

# **EXAMPLES IN BUSINESS**

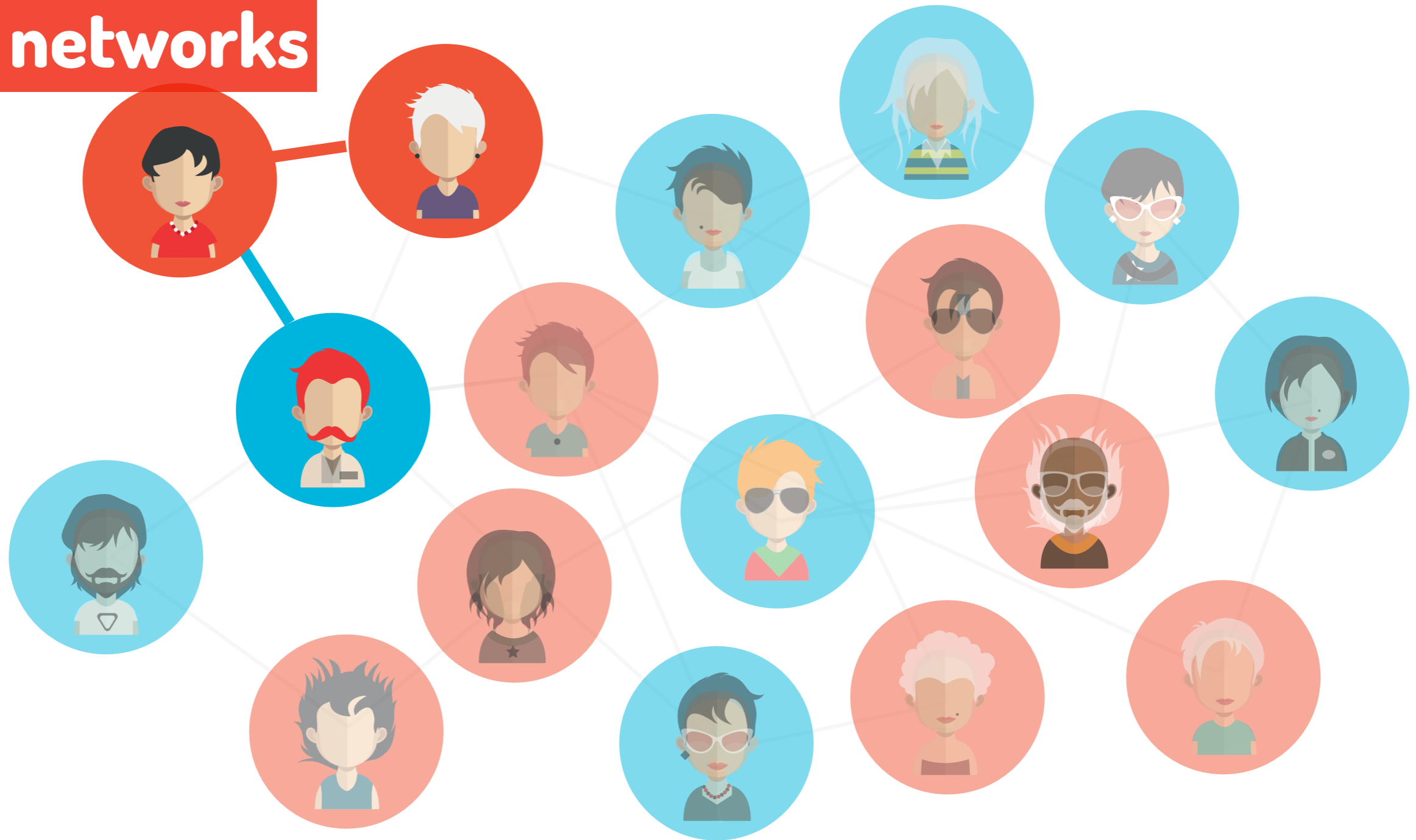
**SOCIAL NETWORKS**

**INTERBANK NETWORKS**

**OPINIONS ON MARKETS**

# EXAMPLES IN BUSINESS

## Social networks



# EXAMPLES IN BUSINESS

Interbank networks



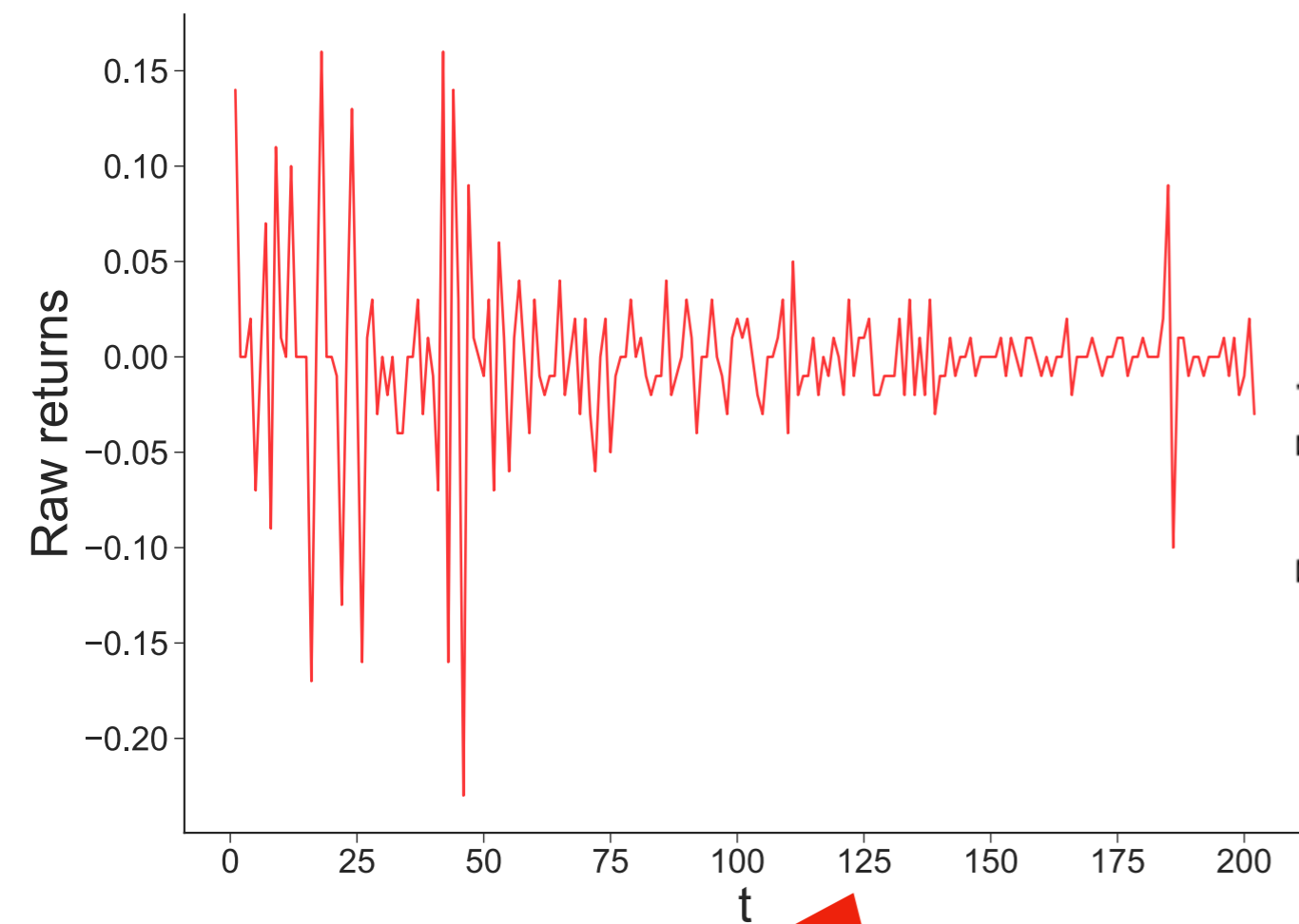
**Disbelief, and a punter reach**

The plunging market yesterday dealt a new blow to investors' confidence, as the government decided to inject HK\$1 million into counselling services for losers in the financial crisis.

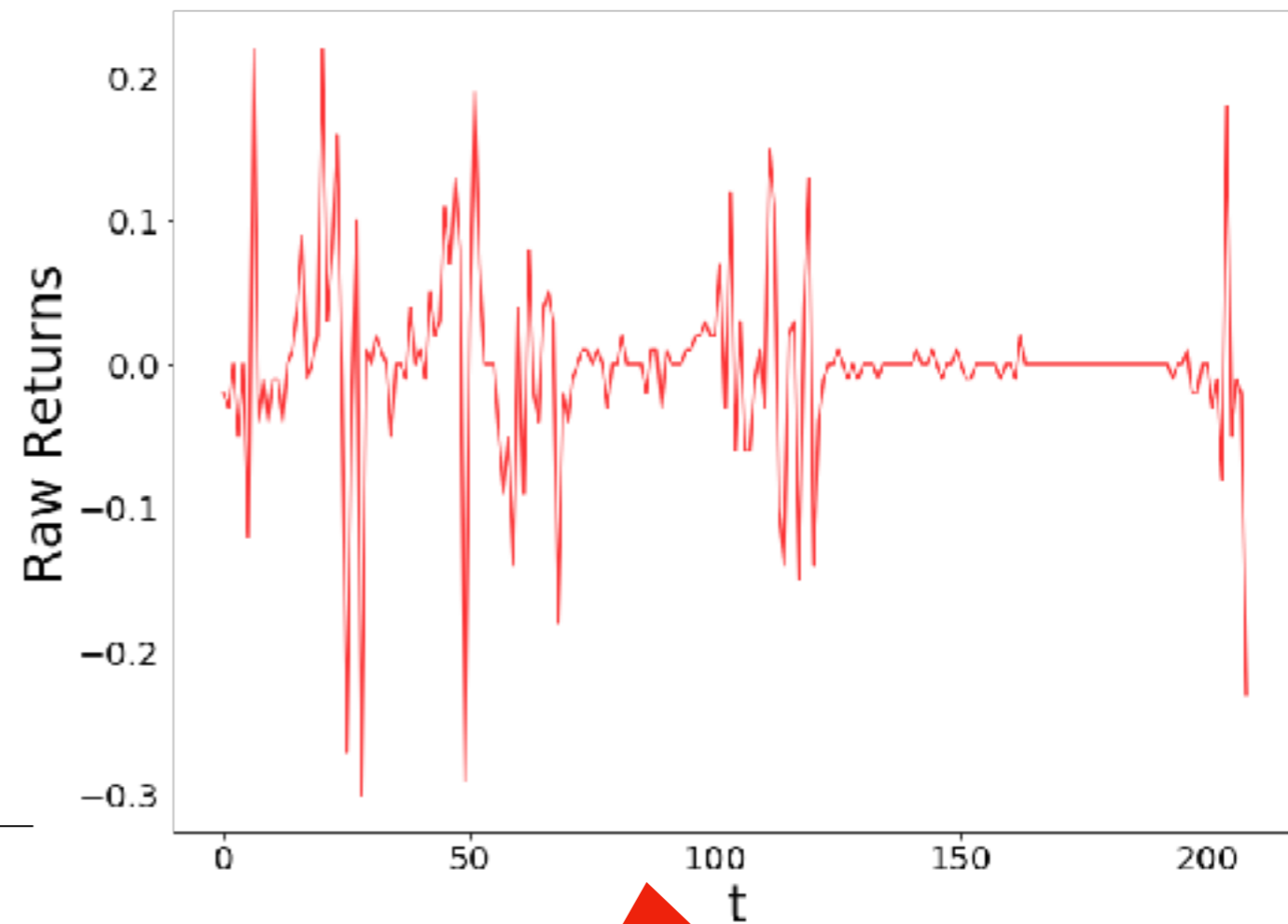
Retail investors expressed disbelief at the Central Bank's move.

# EXAMPLE IN BUSINESS

## Opinions on markets



Historical



Simulated

# **DESCRIBE THE ELEMENTS**

**Agent-based modelling**

**MAY OR MAY NOT HAVE INTERACTIONS BETWEEN ELEMENTS**

**DESCRIBE THE BEHAVIOUR OF ELEMENTS**

**SOCIAL SCIENCE AND PSYCHOLOGY**



# **WHEN TO USE**

## **Agent-based modelling**

**WE DON'T KNOW THE BEHAVIOUR OF THE SYSTEM  
OR IT IS TOO COMPLICATED TO MODEL**

**WE HAVE DATA (OR THEORIES) ON THE BEHAVIOUR OF THE ELEMENTS**

**WE NEED TO KNOW WHY THE SYSTEM  
BEHAVES IN A PARTICULAR WAY**

# EXAMPLES IN BUSINESS

**TRADERS IN THE MARKET**

**CREDIT RISK**

**MARKETING**

The background of the image is a complex financial data visualization. It features a grid of numbers in various colors (blue, green, red, yellow) and several overlapping line graphs in red, green, and yellow. The numbers appear to be stock prices or market indices, with some showing positive and some negative changes. A prominent red banner is overlaid across the middle of the image, containing the text 'EXAMPLES IN BUSINESS' in white, bold, sans-serif font.

# EXAMPLES IN BUSINESS

A horizontal red banner with a white border, containing the text 'Traders in the market' in white, bold, sans-serif font.

**Traders in the market**

# EXAMPLES IN BUSINESS

**Economics focus**

## **Agents of change**

**Conventional economic models failed to foresee the financial crisis. Could agent-based modelling do better?**



**The  
Economist**

**Credit risk**

# EXAMPLES IN BUSINESS

## Marketing



# **WHY IS THIS COURSE USEFUL?**

**MANY FINANCIAL INSTITUTIONS AND BUSINESSES  
HAVE LOADS OF PERSONAL DATA**

**SUCH INSTITUTIONS DON'T KNOW HOW TO USE THESE DATA**

**THEY NEED EXPERTS TO DO SO BUT CAN'T FIND THEM!**

**WHY IS THIS COURSE  
USEFUL?**

**YOU WILL BE THOSE  
EXPERTS!**

SUCH INSTITUTIONS DON'T KNOW HOW TO USE THESE DATA

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# **WATCH THIS**

**The hidden networks of everything**

**<https://www.youtube.com/watch?v=RfgjHoVCZwU>**

**Connected: the power of six degrees**

**<https://www.youtube.com/watch?v=2rzxAyY7D7k>**