# SYDE 533 Conflict Resolution

## Introduction and Overview

Amanda Garcia

Department of Systems Design Engineering
University of Waterloo

September 12, 2016

# Course Information

## Instructional Team

**Instructor:** Amanda Garcia
Email: a9garcia@uwaterloo.ca
Office hours: after class or by appointment

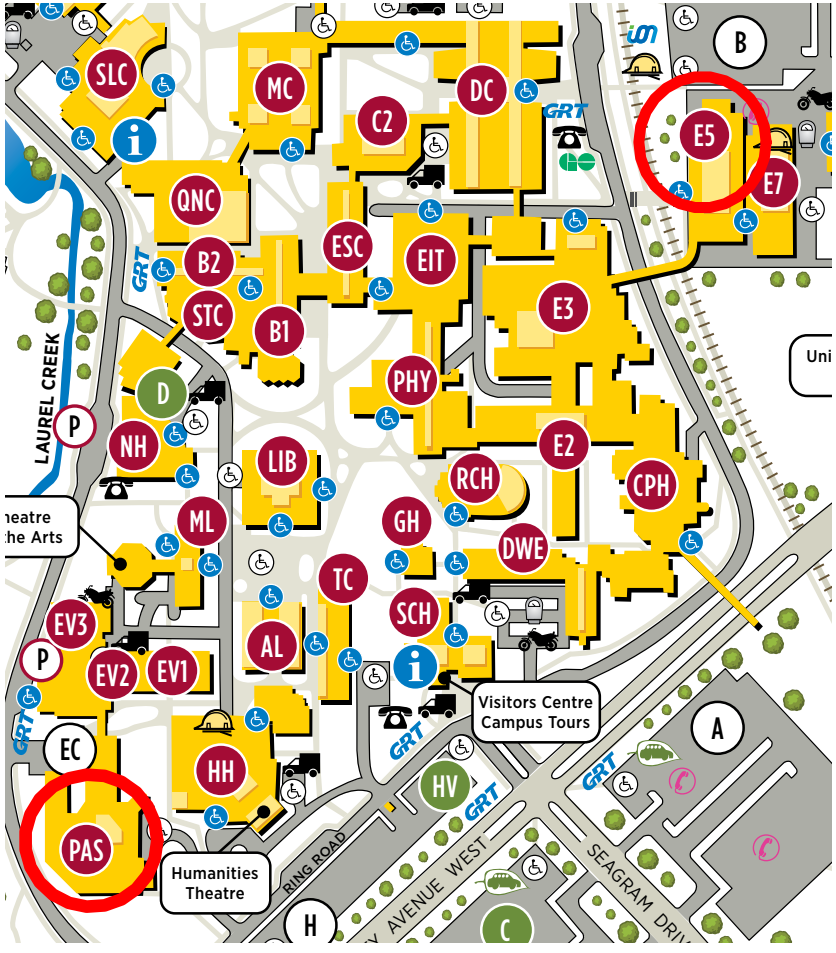
**TAs:** Yasir Aljefri & Yi Xiao
Email: yaljefri@uwaterloo.ca & x4yi@uwaterloo.ca
Office hours: by appointment

# Course Information

## Class Time and Place

**Lectures:** Mondays, 9:00am - 10:20am in E5 6006 and Wednesdays, 10:00am - 11:20am in PAS 1229

**Tutorial:** Mondays, 10:30am - 11:20am in E5 6006



# Course Information

## Prerequisites

There are no prerequisites for this course.

We will cover and review the mathematical topics needed in class.

Previous experience with university mathematics courses is preferable but not necessary.

Please see the instructor if you have not taken any university mathematics courses.

# Course Information

## Course Description

Formal methods for studying engineering decision making problems involving multiple participants and multiple objectives. Topics include the graph model for conflict resolution, normal game form, metagame analysis, games with misperceptions, preference elicitation, human behaviour under conflict, evolution of a conflict, decision making under uncertainty, sensitivity analyses, multiple criteria decision analysis, group decision and negotiation, coalition analysis, decision support systems, and real-world applications of the foregoing concepts.

Additional topics and/or guest lectures are reserved for the end of the term.

# Course Information

## Purpose

Conflict resolution is of significance to engineers because of the great importance of social and political influences in engineering decision making.

The purpose of SYDE 533 is to present techniques for systematically studying a conflict so that possible resolutions to the problem can be determined and sound decisions can be made.

# Course Information

## Required Texts and Materials

The course package is available at media.doc MC, located on the second floor of the Mathematics and Computing building.

Additional materials will be posted on LEARN throughout the term.

# Course Information

## Class Policies

**Email:**

- The instructor and the TA will only use @uwaterloo.ca email accounts to communicate with you.
- Please include "SYDE 533" in your email subject line to ensure that your email is read.
- You can expect a reply within 24 hours during the usual business hours. Emails received outside of business hours will be answered by the next business day.

**LEARN:**

- Group messages and announcements will be posted on LEARN.
- It is your responsibility to ensure that the proper email notification system is set up on LEARN.

# Course Information

## Class Policies

**Participation:**

- During lectures, the instructor may organize activities or games designed to complement the course material.
- You are expected to participate in these class activities and to collaborate with your peers in a respectful manner.

**Socrative:**

- Throughout the term, the instructor and TA will use Socrative, an online classroom app designed to informally assess student learning and understanding.
- The app can be downloaded from the AppStore, the Chrome Web Store, or Google Play; you can also access the app online.
- The room number for the course is "SYDE533".

# Course Information

## University Policies

**Unclaimed Tests:**

- Unclaimed tests will be retained until one month after term grades become official in Quest. After that time, they will be destroyed in compliance with UW's confidential shredding procedures.

**Academic Integrity:**

- Members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility.
- Students are expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for their actions.

# Course Information

## University Policies

**AccessAbility:**

- The AccessAbility Office is located in Needles Hall, Room 1132, and collaborates with all academic departments to arrange appropriate accommodations for students with disabilities.
- If you require academic accommodations to lessen the impact of your disability, please register with the AccessAbility Office at the beginning of each academic term.

# Course Information

## University Policies

**Mental Health:**

- The University of Waterloo and our Departments consider students' well-being to be extremely important. We recognize that throughout the term students may face health challenges - physical and / or emotional. Please note that help is available.
- Counselling Services is an inclusive, non-judgmental, and confidential space for anyone to seek support: `http://www.uwaterloo.ca/counselling-services`

**Religious Observances:**

- Students need to inform the instructor at the beginning of term if special accommodations need to be made for religious observances that are not otherwise accounted for in the scheduling of classes and assignments.

# Course Information

## Evaluation

Assignments: 2 @ 10%
Tests: 2 @ 20%
Project: 40%

Assignment dates: October 5th and November 14th. Assignments must be submitted in the appropriate dropbox via LEARN; no hard-copy assignments will be accepted. Late assignments will be accepted up to 24 hours after the due date and will be penalized by 30%.

Test dates: Monday, October 17th from 9:00am to 10:30am and Wednesday, November 23rd from 10:00am to 11:20am. The tests will cover material from weeks 1 to 5 and weeks 6 to 11, respectively.

# Course Information

## Evaluation - Project

Project: 40% of final grade

- Background report: 10%, due October 14th
- Final report 20%, due December 5th
- Presentation 10%, from November 28th to December 5th

The course project is conducted in teams of one to three students. You will select a conflict, either historical or current, for which sufficient information is available for a comprehensive study to be performed. No two groups may select the same conflict; topics are first come, first served.

# Course Information

## Evaluation - Project Timeline

**September 21st:** In a one page typed submission, clearly identify your conflict, provide a list of all team members, and explain at what point(s) in time you plan to model and analyse the dispute.

**October 14th:** Using extensive referencing, describe the history of the conflict that is relevant for the point(s) in time at which you are conducting your analysis. Clearly identify the decision makers and options in your conflict. There should be sufficient written material for outlining the main preferences of each decision maker. The background report should be double spaced and the content should not exceed seven pages.

# Course Information

## Evaluation - Project Timeline

**November 26, 28, and December 5:** Project presentations, 15 minutes in length, including 3 minutes for responding to questions from the audience. Summarize the history of the conflict, the analysis approach, and main results. Direct the presentation to the interesting aspects of your project rather than a review of the detailed methodology. Use visual aids wherever necessary.

**December 5th:** The final report should be typed using double spacing with the main body not exceeding 20 pages. The decision support system of your choice (GMCRII or GMCR+) can be used to carry out stability analyses. See handout for more specific instructions regarding the report contents.

# Break

Please download/access Socrative - we will be testing it after the break.

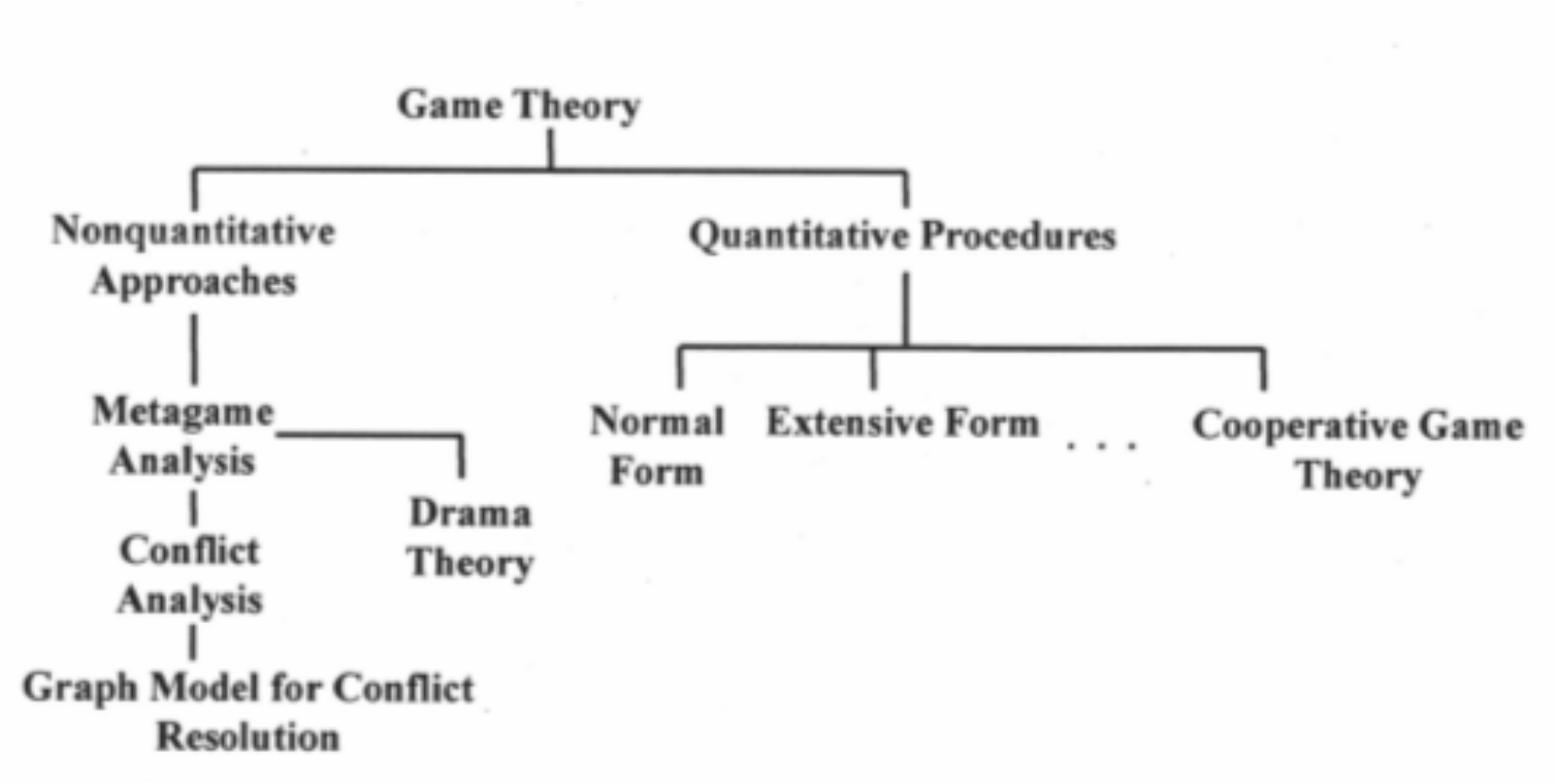
- Go to `https://b.socrative.com/login/student/` or find it in your app store.
- Enter class name "SYDE533"
- Log in using your first and last name


# Quick Student Survey

Take a few minutes to answer the questions posted in our online classroom.

For those unable to access the online tool, the questions will remain open until 10pm today.

# Genealogy of Formal Conflict Models



# Genealogy of Formal Conflict Models

## Nonquantitative vs Quantitative Approaches

Quantitative: I like tea 2.78 times better than coffee $\rightarrow$ Classical game theory (von Neuman, Morgenstern)

Non-quantitative: I like tea better than coffee $\rightarrow$ Metagame analysis (Howard)

The focus of this course is on non-quantitative models and methods, in particular the Graph Model for Conflict Resolution

# Building a Conflict Model

## Ingredients

- Decision-makers
- States
- Preferences

# Building a Conflict Model

## Ingredients - Decision-makers

- Participants
- Players
- Stakeholders

# Building a Conflict Model

## Ingredients - States

- A state is made up of a combination of each DM's options
- For a conflict with $n$ total options, each of which can be selected or not, there is a total of $2^n$ possible states
- Infeasible states are removed by the modeller before analysis

| **Decision-makers and Options** | **Example State** |
|---|---|
| **Canada** | |
| (1) Increase stumpage fee | N |
| (2) Voluntary quota | N |
| **Commerce Department** | |
| (3) Impose duty | N |
| (4) Reject petition | N |
| **U.S. Congress** | |
| (5) Legislation | N |
| (6) Political pressure to administration | N |
| **U.S. Industry** | N |
| (7) Maintain petition | Y |

# Building a Conflict Model

## Ingredients - Preferences

The Graph Model for Conflict Resolution can handle the following types of preferences:

- Ordinal: states ranked from most to least preferred, equalities allowed
- Strict ordinal: states ranked from most to least preferred, no equalities allowed
- Transitive: if $p$ is preferred to $q$ and $q$ is preferred to $r$, then $p$ is preferred to $r$
- Intransitive: $p$ is preferred to $q$ and $q$ is preferred to $r$ but $r$ is preferred to $p$

# Analysing a Conflict Model

Once the model has been built, move to the analysis stage:

- Check for individual stability
- Check for equilibria
- Interpret the results
- Conduct sensitivity analysis

# Analysing a Conflict Model

## Check for individual stability

A state is stable for a particular DM if it is not advantageous for them to move away from it

There are many types of stability concepts (also called solutions concepts) which we will study over the course of the term

# Analysing a Conflict Model

## Check for equilibria

An equilibrium is a state that is stable under a particular solution concept for all DMs

# Analysing a Conflict Model

## Conduct sensitivity analysis

Determine how meaningful changes in the model parameters can influence the stability results:

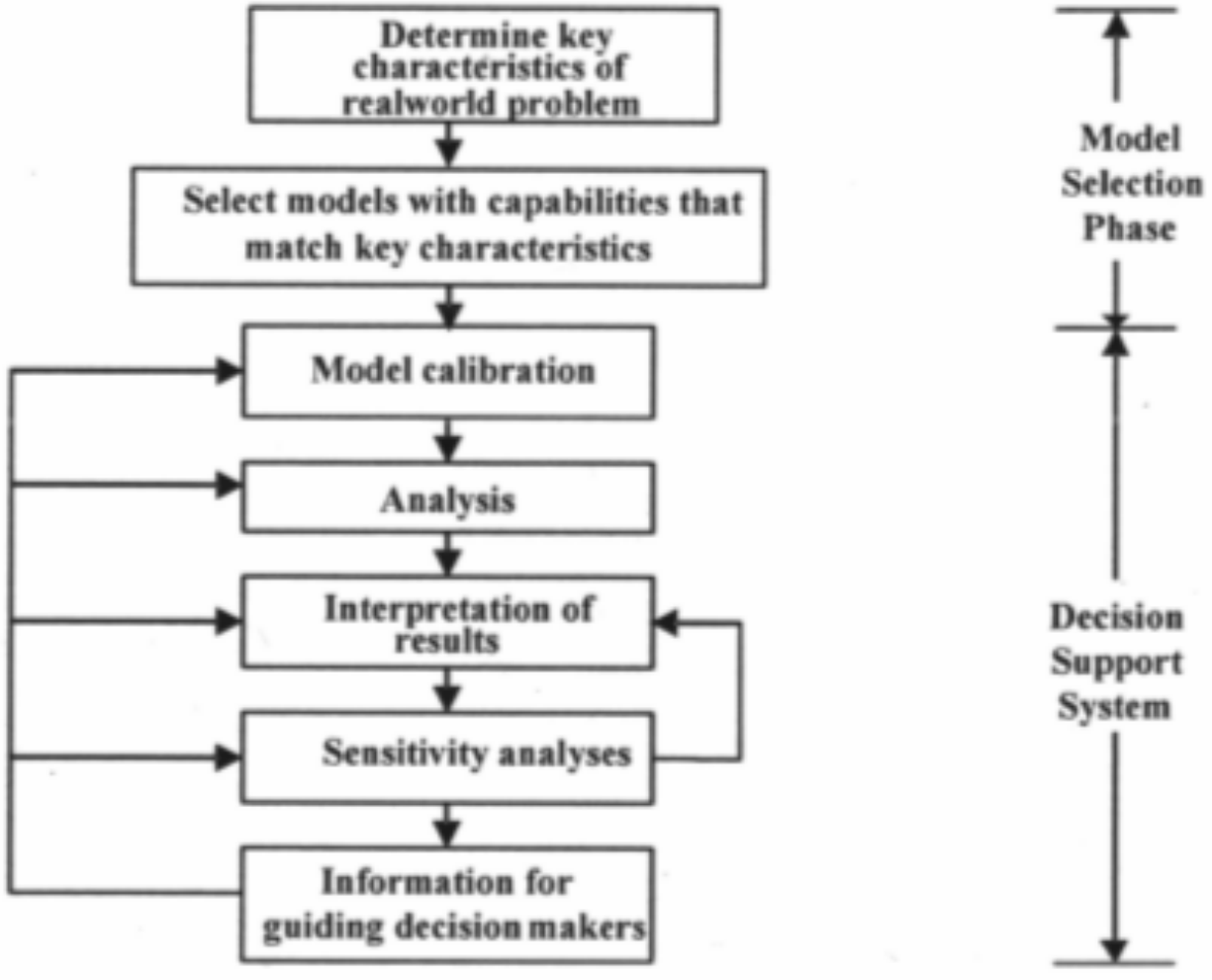
- Preference changes
- Option modification or expansion
- Adding DMs
- Additional solution concepts
- Coalitions
- Misunderstandings (hypergames)

# Analysing a Conflict Model

## Interpret the results

- What insights did your model provide?
- What are the most likely equilibria and why?
- What information could be used to assist DMs?

# Model Application Overview



# Next Lecture

- Basics of 2-DM models
- Tutorials start on Sept 19th
- Don't forget the online survey until 10pm tonight
- Think about project groups and topics - first come, first served