# Project Summary

*Short summary of the project setting.*

* User identification – we will have an initial long message to start (including emojis) and we will have to identify which user sent the message based on our set constraints of each user
* Using predicate logic, we will be able to narrow down which user has sent the message, based on the propositions generated from the message given, as well as the constraints we generated for each user.

# Propositions

#### Properties:

*Our propositions (properties) are simply characteristics that a user can take on. If the users message includes keywords such as “play soccer”, or “student at queens”, then we know the characteristic is True, otherwise, we can conclude that the proposition (characteristic) is False.*

* **S**: Plays soccer
* **T**: Plays soccer intramurals
* **B**: Plays music
* **G:** plays guitar
* **D:** Student
* **Q**: Student at Queen’s
* **C**: In a school club
* **F:** Taking a specialization
* **P:** classes in-person
* **A**: 1st year student
* **R**: Living on-residence

#### Users:

*The users we have ‘generated’ are also propositions of a separate class. These Users can take on characteristics from our Properties class.*

* NG: Nicholas
* AM: Amanda
* VU: Vanshita
* AC: Adam
* JR: Jimmy
* MP: Moira
* GG: Gary

# Constraints

*List of constraint types used in the model and their (English) interpretation.*

#### User Constraints:

*These are simply constraints which conclude which properties each user has.*

* NG → S ∧ D ∧ Q ∧ F ∧ P
  + Nick plays soccer, is a student at queens, is taking a specialization, and has classes in person
* AM → S ∧ T ∧ D ∧ Q, ∧ C ∧ F ∧ P
* VU → B ∧ D ∧ Q ∧ C ∧ F ∧ P
* AC à S ∧ T ∧ D ∧ Q ∧ F ∧ P
* JR → S ∧ G ∧ B ∧ D ∧ C ∧ A ∧ R
* MP → S ∧ T ∧ B ∧ P ∧ D ∧ C
* GG → G ∧ B ∧ S

#### Property Constraints:

*These help us simplify more general properties, and help us conclude which properties are also true based on assumptions.*

* T ∨ Q ∨ C ∨ F ∨ P ∨ A ∨ R à D
  + If user plays soccer intramurals, student at queens, in a school club, taking a specialization, has classes in-person, first-year student, or living on res, then this implies the user is a student
* Q ∧ Aà R
  + If user is a student at queens and they are in first year, then they live on res
* T à (S ∧ D)
  + If the user plays soccer intramurals, then we know the user plays soccer, and is a student
* F à A
  + if the user is taking a specialization, then we know the user is not a first-year
* B à G
  + If the user does not play any instrument, then they must not play guitar
* G à B
  + If the user plays guitar, then this implies they play an instrument
* C à D
  + In a school club implies the user is a student

#### Property-to-User Constraints:

*Show us which users apply to each individual characteristic property*

* S à NG ∨ AM ∨ AC ∨ JR ∨ MP
  + If the user plays soccer, then the user can possibly be Nick or Amanda or Adam, or Jimmy, or Moira
* T à AM ∨ AC ∨ JR ∨ MP
* B à VU ∨ JR ∨ MP ∨ GG
* G à JR ∨ GG
* D à NG ∨ AM ∨ VU ∨ AC ∨ JR ∨ MP
* Q à NG ∨ AM ∨ VU ∨ AC
* C à AM ∨ VU ∨ ∨ JR ∨ MP
* F à NG ∨ AM ∨ VU ∨ AC
* P à NG ∨ AM ∨ VU ∨ AC ∨ MP
* A à JR
* R à JR

# Model Exploration

*List all the ways that you have explored your model – not only the final version, but intermediate versions as well. See (C3) in the project description for ideas.*

# *Current Idea*

* Given a specific message (sent from one of the 7 users), we will conclude which user(s) sent this message based on the given constraints each user has.
  + This might look something like this:
    - “I play soccer intramurals, and I am a student at Queens, and I am taking a specialization.”
    - From this, using python and our jape proofs, we will be able to conclude that this message could have been sent from: Amanda, or Adam

#### Previously Explored Ideas:

* Given a specific message, once again, sent from one of the 7 users, we would generate a response using emojis.
  + Our response would be generated through reactions that included agreement/disagreement, laughter/crying, and celebration.
  + *How does this differ from our current idea?*
    - Instead of generating a response with emojis, we are now simply going to conclude which user sent the message that was given to us.

# First-Order Extension

*Describe how you might extend your model to a predicate logic setting, including how both the propositions and constraints would be updated.* ***There is no need to implement this extension!***

#### Jape Proofs:

1. Our first proof is simply proving a constraint. Our main goal here is to build up propositions in order to match a user to the total propositions at the end of our main premise (which would be the message sent). This is simply one step, which allows us to conclude that when the user plays soccer intramurals, we know the user is also a student and they play soccer.

![Table

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1. Here we have another basic constraint proof which simply allows us to conclude that a student living on residence is also a first-year student and a student at Queen’s.

![A picture containing table

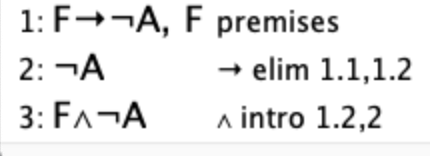
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1. In the following jape proof, we show that if we know the user is a Queen’s student, and they do not live on residence and they are not a first year, then they are a Queen’s student and they are taking a specialization.

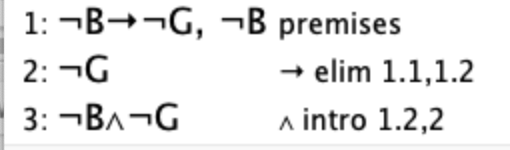
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Description automatically generated

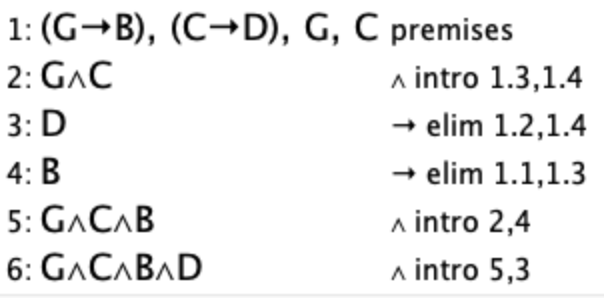
1. In this next proof, it illustrates that given our constraints; F(Taking a specialization) implies that ¬A(1st year student). Then if a given user is taking a specialization we can conclude that they are taking a specialization(F) and(∧) they are not a first year student(¬A).



1. Another constraint we’ve listed is the limitation that a user that does not play music (¬B) implies (à) they also do not play guitar(¬G) and thus, we can conclude that the message must have been sent by a user that does not play music (¬B) and(∧) they don’t play guitar (¬G).



1. Finally, the following proof combines two simple constraints; a user that plays guitar(G) implies (à) they play music(B), a user that is in a school club(C) implies (à) they are a student(D). Therefore, given a user that plays guitar(G) and is in a school club(C) we can prove that the user plays guitar(G) and(∧) they play music(B) and(∧) they are in a school club(C) and(∧) they are a student.



#### Python Implementation:

* We set up our propositions in different classes, one of them being properties, and the other being users
* We will have some sort of user-input based library that will read through given properties from any user
* Using our constraints and more thorough jape proofs, we will be able to come to conclusions of which user it ‘could’ be
  + Basically a “matching to user” concept