# Jazz Hands for Autism

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# Project Roadmap

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# The Ask

## What does JHFA do?

A nonprofit that offers individualized training, coaching, and job placement for musicians on the autism spectrum.
One of their flagship programs involves personalized music instruction.

## Our Ask:

Build a scalable scheduling tool that:

- Automates the matching of students and instructors,
- Respects constraints (availability, subject expertise, etc.),
- Ensures equitable distribution of hours.

## The Scheduling Challenge

Each quarter, JHFA must schedule:

- 50+ students with varying needs and availability,
- 20+ instructors with unique skills and constraints,
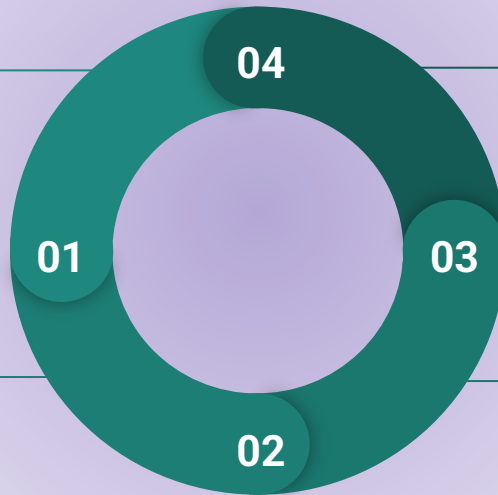- across limited weekly time slots and instructional hours

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# The Model - Constraints

**Instructor Availability Constraints**
- Specific classes they teach
- Must teach in person 2x
- Max work time of 30 hours
- Maximum of 5 students/class

**Student Availability Constraints**
- Specific time and class mode preferences
- Maximize block schedules

**Classroom & Location Constraints**
- No double booking locations
- Certain classrooms are reserved for specific instruments (piano, drums, dj equipment)

**Mode of Instruction Constraints**
- Balance in-person and online work for instructors & students
- Aim for an equitable distribution of work

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# The Model

We used Google OR-Tools to build a constraint programming model.

**Objective Function:**

*max*(total number of matched hours)

*subject to* (minimizing imbalances across instructors and unmet student needs)

```python
# === Objective: Maximize matches, minimize penalties ===
model.Maximize(
    sum(assignments[var] for var in assignments) -
    primary_instrument_penalty * sum(student_violations[student] for student in student_violations) -
    spread_penalty_weight * sum(spread_penalties)
)

# === Solve the model ===
solver = cp_model.CpSolver()
status = solver.Solve(model)
```

# Roadblocks

## 01 Constraint Overload
- The large number of constraints made the model slow and often infeasible.
- In some cases, OR-Tools couldn't find an optimal solution in reasonable time.

## 02 Greedy & Incomplete Solutions
- Some students weren't matched with any instructors.
- Some instructors got 30+ hours, others got 1–2.

## 03 Sparse overlap in availability
- Many students/instructors had narrow or non-overlapping availability windows.
- This severely limited feasible pairings.

## 04 Data Quality & Completeness
- Inconsistent or missing data on preferences/availability reduced the effectiveness of the model.

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# Results

**Final Deliverable:**
A prototype scheduling tool using OR-Tools that allows staff to input availability and preferences, and generates a recommended schedule.

**Impact:**

- Reduced manual scheduling time by 1 month every year!
- Improved initial matching rates (most students received at least 80% matching sessions)

**Next Steps:**

- Improve balancing logic for instructor hours and student class assignment
- Integrate a front-end UI for staff usability.

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```
Optimal Solution:
Schedule for Aaron :
  T: PIANO with Siv at 9 (Online)
  T: GUIDANCE COUNSELING with Em Smith at 10 (In-Person)
  T: MUSIC THEORY with Siv at 11 (Online)
  F: CAREER/JOB COACHING with Em Smith at 9 (In-Person)
  F: CONCERT REHEARSAL (Saturday Jam) with Rocco Matone at 12 (In-Person)
  Primary Instrument Hours: 1 hours
  ✅ Matched 5 out of 6 requested classes

Schedule for Brandi Pollard :
  M: VOICE with Alice Brutskaya-Stempkovskaya at 9 (None)
  M: GUIDANCE COUNSELING with Em Smith at 11 (Online)
  T: CHOIR with Evan O'Brien at 11 (Online)
  T: CAREER/JOB COACHING with Em Smith at 12 (In-Person)
  Th: ENSEMBLE (BAND) with Evan O'Brien at 9 (Online)
  Th: CONCERT REHEARSAL (Saturday Jam) with Rocco Matone at 11 (In-Person)
  Th: MUSIC THEORY with Siv at 12 (Online)
  Primary Instrument Hours: 1 hours
  ✅ Matched 7 out of 8 requested classes

Schedule for El Cid Catlin-Muñoz:
  T: GUITAR with Noah Donnelly at 9 (In-Person)
  T: ENSEMBLE (BAND) with Evan O'Brien at 12 (Online)
  W: CAREER/JOB COACHING with Em Smith at 9 (Online)
  W: CONCERT REHEARSAL (Saturday Jam) with Rocco Matone at 12 (In-Person)
  Th: GUIDANCE COUNSELING with Em Smith at 15 (In-Person)
  Th: MUSIC THEORY with Siv at 16 (Online)
  Primary Instrument Hours: 1 hours
  ✅ Matched 6 out of 7 requested classes
```

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Consulting