Requirements Analysis of US-03 (Co-op Compliant Course Sequence)

This is the document that shows the Requirement Analysis of Co-op Compliant Course Sequence (Feature 3). Final version of this document resolves issue this issue below
https://github.com/iKozay/TrackMyDegree/issues/248

1 CONTEXT AND USER GOAL

The Co-op Compliant Course Sequence is a feature designed to help students plan an academic course sequence that is compliant with mandatory co-op work terms, degree requirements, and institutional constraints. It can also take into account the students current standing and overall background.

Primary User: Student
Secondary Users: Academic Advisors, System Administrators

User Goal:
“As a student, I want the system to generate a course sequence that automatically complies with all co-op regulations, so that it can be easily approved by Co-op directors.”

2 DESIGN

We allow the user to generate a **Default Sequence***
We allow the user to modify the default sequence and validate it
We allow the user to create a sequence from scratch and validate it

***Default Sequence**: The default sequence is the designated work-study sequence available for all departments in Gina Cody School. By default, these sequences are co-op compliant irrespective of a student's progress/background. List of all default sequences for Co-op are given below:

Aerospace Engineering: Option A, Option B, Option C
Building Engineering: General & Co-op Sequence
Chemical Engineering: Winter Entry Co-op Sequence, Fall Entry Co-op Sequence
Civil Engineering: General & Co-op Sequence
Computer Engineering: General & Co-op Sequence

Electrical Engineering: General & Co-op Sequence
Industrial Engineering: Fall Entry Co-op Sequence
Mechanical Engineering: Fall Entry Co-op Sequence
Software Engineering: General & Co-op Sequence
Computer Science: General & Co-op Sequence

When the user chooses to modify the default sequence generated for them in accordance to their deficiencies, current academic standing and overall profile, they will have an option to **validate their modifications**.

Validation will work such that:

- The modified sequence will be validated if all Co-op rules are met.
- If at least one rule fails (e.g final term is modified to a work term), an error will be displayed and all the rules that are not satisfied will be shown to the user.
- Rules that cannot be validated (e.g students refusing an accepted internship offer) will be displayed as warning.

3 OFFICIAL CO-OP RULES

Official Co-op rules that are general to all GCS students. These rules will justify and validate the modifications (if made) by students.

3.1 ACADEMIC STANDING

Eligibility to remain in Co-op and core requirements are listed below.

- **Minimum CGPA**: Co-op students must maintain a **minimum cumulative GPA of 2.50** (faculty/department can require higher). (Concordia University)

- **Gina Cody Co-op continuation conditions (calendar)** include:
    - Maintain **CGPA ≥ 2.50**.
    - Receive **Pass** for each of the three work-term courses (CWTE/CWTC / CWT-coded work term courses).
    - **Remain in the designated work-study sequence**; deviations require **prior approval** by the Institute (and consultation as specified).

3.2 SEQUENCE STRUCTURE RULES

This can be validated from the user's planned/modified terms. From the **Institute/Calendar** + **GCS Co-op forms**:

- Must **begin and end the degree with a study term**. (Concordia University)
- Undergraduate Co-op students complete **three work terms**.
- Must complete **at least 2 study terms prior to the first work term** (GCS Co-op).
- Must **return to school for a full-time study term after each work term**, including the last work term (GCS Co-op forms).
- **Cannot end** the university journey on an internship / last semester cannot be internship (Institute policy page).
- **All three work terms cannot be scheduled in the summer term** (Institute "what to expect").
- GCS-specific constraints shown on the application/process docs:
    - Must have **3 work terms prior to the final study term**.
    - **Cannot schedule a work term while taking capstone**.
    - Must do **at least one work term in a semester other than summer**.

3.3 FULL TIME STATUS EXCEPTIONS

These rules can be partially validated depending on the resultant data model/

- Co-op alternates **full-time study (minimum 12 credits)** and work terms. (Concordia University)
- GCS-specific note: until the final work term is completed, students must **maintain full-time status (12 credits minimum) during study terms** (department quick tips).
- During **work terms**, students are considered **full-time** students at the University.

3.4 INTERNSHIP (WORK TERM) CRITERIA

From the Institute's Undergraduate Co-op criteria:

- Internships must be **paid**, **full-time (min 35 hrs/week)**, relevant to program. (Concordia University)
- Start in **September, January, or May**, last **12 - 17 weeks**.
- Must respect workplace safety standards; cannot be supervised by a family member.
- The **Institute must approve** internships and employers before acceptance.
- Institute employer-facing page also describes a typical co-op internship as **35 hours/week for 12–17 weeks** (and mentions possibility of extending to an 8-month commitment which is important as a potential edge case).

3.5 RULES DURING A WORK TERM

Can be displayed as warnings only, partially sequence checkable.

- Students may take **maximum one course during the internship term**, requires approvals (sequence approval + employer permission, and it must not conflict with work hours). (Concordia University)
- Students **cannot renege** on an accepted internship offer; refusal leads to withdrawal and a **Fail** on the work term course (policy page).

3.6 WORK TERM EVALUATIONS / COMPLETION REQUIREMENTS

These rules can be displayed only and cannot be made such that they can validate.

- Work term is graded **Pass/Fail**; evaluation involves employer evaluation + work term report/presentation (calendar). (Concordia University)
- Failure on work term / failure to meet Institute requirements can lead to **dismissal from the Institute**.
- Reflective learning course exists alongside work terms (the public “what to expect” mentions it as part of evaluation; the calendar also describes CWT reflective learning courses as pass/fail extension courses).

3.7 IMPORTANT SPECIAL CASES

These can potentially change the validation system

- **Starting Summer 2026**, the Institute policy page says GCS/FAS students scheduled for a **co-op study term** in summer may choose **full-time, part-time, or take summer off** (this affects the “must be full-time every study term” rule if your app targets future terms). (Concordia University)
- **International students**: the same page notes they must be registered **full-time during academic terms regardless of the above policies**. (Concordia University)

4 CONSTRAINTS AND EDGE CASES

These are the things that typically break “simple” validation and should be captured up front during implementation:

Sequence representation edge cases

- **Summer structure ambiguity**: If we treat summer as one term, while Concordia sometimes has Summer 1 / Summer 2, our rules like “at least one work term not in summer” and “not all 3 in summer” depend on what “summer” means in the current model.
- **Work term length variations**: standard is 12–17 weeks (Concordia University), but extensions to **8 months** are mentioned. Decide:
    - Do we support multi-term internships?
    - If yes, does it count as 1 or 2 work terms for “3 work terms” validation (likely needs official clarification).

Rules that require more than just “term type”

If the planner only stores “Study vs Work” per term, we can’t fully validate:

- **12 credits full-time** on study terms But this can be calculated from timeline page and the way it is designed or even from the transcript). (Concordia University)
- **ENCS 282 prior to first work term** (again from the transcript or timeline).
- **Capstone conflict** (needs capstone term/course data from timeline or transcript).
- **Max one course during internship term** (needs course-registration data).
- **CGPA ≥ 2.50** (needs GPA data which we will have from transcript or if the user is logged in).

Student-status edge cases

- **International student override**: full-time requirement may be stricter. (Concordia University)
- **Summer 2026 policy change** (GCS/FAS summer study term flexibility).
- **Approved deviations**: rules say sequence deviations require approval so we need to decide how the app handles this:
    - “We can’t validate approved exceptions” (show warning), or
    - Add an “Approved deviation” flag requiring proof/reference.
- Student switches from co-op to non-co-op (future consideration).

Academic progress edge cases

- Failed course / repeated course causing delayed prerequisites → student may need to resequence; the app should handle “non-standard but valid with approval” cases.
- Transfer credits / advanced standing: recommended sequences don’t account for them; our planner shouldn’t assume the default sequences are always applicable (GCS pages mention sequences vary by deficiencies/standing). (Concordia University)
- Student has already completed one or more co-op terms.
- No valid sequence exists at all under current constraints.

Presentation / UX edge cases (important since we will show errors + "always-show" rules)

- Multiple violated rules at once → show **all** violations, not just the first.
- Conflicting rules priority (e.g., summer flexibility vs "full-time every study term") — define precedence using effective dates and student status.

5 ASSUMPTIONS

To keep implementation realistic and avoid false "invalid" sequences, common assumptions are:

- Scope is **Gina Cody undergraduate Co-op only** (not JMSB/FAS rules at the moment), and rules are based on the **public Undergraduate Calendar + Institute policies** at the time of implementation. (Concordia University)
- The sequence planner validates **structure** (Study/Work ordering + term placements). Requirements needing GPA, credits, course completions (ENCS 282, capstone) are either:
    - validated only if TrackMyDegree has that data, or
    - shown as **"cannot be automatically checked"**.
- "Summer term" will be defined explicitly in the product (either one summer term or split), and validation depends on that definition.
- Approved exceptions ("director approval", employer permission for courses during internship) are out of scope for automatic validation unless the system supports an "exception" flag + evidence.
- The planner generates plans only and does not perform course registration.

6 FUNCTIONAL REQUIREMENTS

FR-1: Generate Co-op-Compliant Sequences
The system shall generate at least one valid academic sequence that includes all required courses and co-op work terms while respecting institutional rules.

FR-2: Enforce Co-op Rules
The system shall ensure that co-op work terms:

- Occur only in allowed academic terms
- Are properly spaced according to co-op regulations
- Do not overlap with academic terms

FR-3: Enforce Course Prerequisites
The system shall prevent courses from being scheduled before their prerequisites are completed. Mutually exclusive courses must not appear together in the same sequence. (if not validated on US-02 already)

FR-4: Credit Load Validation
The system shall enforce minimum and maximum credit limits for each academic term. (if not validated on US-02 already)

FR-5: Conflict Detection and Feedback
The system shall detect invalid sequences and clearly report:

- Prerequisite violations
- Credit overloads
- Invalid co-op placements
  Error messages must explain the reason for invalidity in a user-friendly manner.

FR-6: Multiple Valid Sequences (Optional)
When more than one valid sequence exists, the system may present alternative sequences for comparison based on criteria such as workload balance or time to graduation.

7 NON-FUNCTIONAL REQUIREMENTS

Performance:

- Sequence generation should complete within a few seconds for typical degree programs.

Reliability:

- The system must always return either a valid sequence or a clear explanation when no valid sequence is possible.

Security and Privacy:

- Student academic data must be protected.
- Only authorized users may access or modify sequence plans.

Usability and Accessibility:

- Output must be clearly structured and easy to understand.

- Error messages must be non-technical and actionable.
- The interface should follow accessibility standards where applicable.

8 RISKS AND CONSIDERATIONS

- Complex prerequisite structures may impact performance.
- Incomplete or incorrect course data may lead to invalid sequences.
- Some edge cases may require manual advisor intervention.

9 SOME REFERENCES

- Concordia **Undergraduate Calendar – Section 24** (Institute for Co-operative Education, incl. begin/end study term, work-term course coding, GPA baseline). (Concordia University)
- Concordia **Undergraduate Calendar – Section 71.10.8** (Gina Cody Co-op requirements). (Concordia University)
- Institute **Undergraduate Co-op policies/criteria page** (full-time definitions, max course during internship, reneging rule, approvals, summer 2026 change, international note, internship criteria). (Concordia University)
- GCS Co-op **application/process PDFs** for GCS-specific sequencing constraints (ENCS 282 before first work term, capstone restriction, “one non-summer work term”, etc.). (Concordia University)