Excellent.
Below is the **complete, detailed execution document for Person 3**, written with the **same structure, rigor, and integration discipline** as Person 1 and Person 2.

This document is:

- ✅ Fully consistent with `context.md`
- ✅ Perfectly aligned with Person 1 (Ontology/KG) and Person 2 (NLP)
- ✅ Focused on **symbolic reasoning, causality, explainability, ranking, and safety**
- ✅ Detailed enough to execute independently
- ✅ Explicit about inputs, outputs, checks, dependencies, and integration flow

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📄 Person 3 Execution Document

Role: Reasoning, Causal Explanation & Safety Engineer

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1. Role Overview

Primary Responsibility

You are responsible for the **intellectual core** of the system:

- symbolic inference using **SWRL**
- knowledge graph materialization using **SPARQL**
- **causal "WHY" explanations**
- **intervention ranking & uncertainty**
- **safety and escalation policies**
- **auditability and traceability**

You decide **how conclusions are reached**, **why they are justified**, and **when reasoning must be overridden for safety**.

You do **not** design the ontology or perform NLP extraction.

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2. What You Are Building (High-Level)

You will deliver:

1. A **SWRL rule base** for mental-health risk inference
2. **SPARQL materialization & explanation queries**
3. A **reasoning pipeline** over session graphs
4. A **causal explanation engine (WHY-answers)**
5. **Ranking & uncertainty logic** (post-inference)
6. **Safety & escalation layer** (hard overrides)
7. **Audit trail & provenance tracking**

This is the system's **formal reasoning brain**.

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3. Inputs You Need Before Starting

Required Inputs

- Final `context.md`
- Final ontology (`.owl` / `.ttl`) from **Person 1**
- Base knowledge graph
- Evidence format from **Person 2**

You Should NOT Start Until

- Ontology classes & properties are stable
- Evidence schema is agreed (integration contract)

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4. Phase-by-Phase Task Plan

PHASE 1 — Reasoning Framework Setup

Objective

Prepare the environment for symbolic reasoning.

Tasks

1. Reasoning Stack Setup

- Configure:
  - RDFLib
  - Owlready2
- Load ontology + base graph
- Enable OWL reasoner (Pellet or HermiT)

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2. Rule Infrastructure

- Define:
  - rule directory structure
  - naming convention
  - rule metadata schema

Example:

```
R_Anxiety_01:
  description: "Insomnia + Stress → AnxietyRisk"
  intent: risk-inference
  priority: high
```

Checks

- Reasoner runs without inconsistency
- Ontology remains unchanged

PHASE 2 — SWRL Rule Design (Primary Inference)

Objective

Infer mental-health risk states using **explicit symbolic rules**.

Tasks

3. Core Risk Rules

Implement SWRL rules for:

- AcademicStress
- AnxietyRisk
- BurnoutRisk
- PanicRisk

Rules must use:

- symptoms
- emotions
- triggers
- persistence (from graph)

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4. Rule Properties

Each rule must have:

- unique ID
- human-readable description
- priority level
- clear intent

Checks

- No probabilistic logic
- No dataset-driven inference
- Rules are deterministic and inspectable

PHASE 3 — SPARQL Materialization & Querying

Objective

Operationalize reasoning results without replacing logic.

Tasks

5. Materialization Queries

Write SPARQL `CONSTRUCT` / `INSERT` queries to:

- add inferred triples to session graph
- tag inferred states

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6. Explanation Queries

Write SPARQL `SELECT` queries to retrieve:

- evidence triples
- rule-trigger paths
- causal chains

Checks

- SPARQL does not infer truth
- All inferences originate from SWRL

PHASE 4 — Causal Explanation Engine (WHY-Answers)

Objective

Explain *why* each inference or recommendation was made.

Tasks

7. Explanation Schema

Define an internal explanation format:

```
{
  "riskState": "AnxietyRisk",
  "confidence": 0.72,
  "rulesFired": ["R_Anxiety_01"],
  "evidence": [...],
  "causalChain": [...],
  "uncertaintyDrivers": [...]
}
```

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8. Explanation Generator

Implement logic to:

- traverse KG
- extract rule paths
- format human-readable explanations

Checks

- Every inference has a traceable explanation
- Explanations map to ontology terms

PHASE 5 — Ranking & Uncertainty (Post-Inference)

Objective

Rank interventions and communicate uncertainty **without affecting inference**.

Tasks

9. Ranking Logic

Implement deterministic ranking using:

- rule priority
- evidence count
- persistence
- ontology `causalStrength` annotation

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10. Confidence Aggregation

Combine:

- NLP confidence (from Person 2)
- number of fired rules
- persistence

Output:

- numeric confidence
- Low / Medium / High label

Checks

- Ranking never triggers rules
- Confidence never suppresses safety

PHASE 6 — Safety & Escalation Policies

Objective

Protect users through **hard overrides**, not reasoning.

Tasks

11. Hard Escalation

Detect:

- self-harm
- suicidal ideation

Actions:

- bypass reasoning
- present emergency resources
- log event

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12. Soft Escalation

Trigger when:

- multiple severe risks inferred
- high persistence

Actions:

- recommend professional support
- preserve autonomy

13. Escalation Logging

Log:

- trigger phrase
- bypass reason
- timestamp

Checks

- Safety overrides all ranking & inference
- No ontology rule handles self-harm

PHASE 7 — Audit Trail & Provenance

Objective

Ensure accountability and inspectability.

Tasks

14. Rule Provenance Logging

Log:

- rule IDs fired
- evidence used
- explanation generated

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15. Session Audit Record

Maintain per-session audit object:

- inferences
- explanations
- escalations

Checks

- Logs are complete
- Logs are readable and exportable

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5. Integration With Other Members

What You Provide

To **Person 1**:

- required properties for rules
- feedback on ontology expressiveness

To **Person 2**:

- expected evidence schema
- confidence aggregation rules

What You Need From Others

From **Person 1**:

- final ontology freeze
- base graph

From **Person 2**:

- clean symbolic evidence
- extraction confidence & persistence

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6. Project Flow — Your Involvement

You are active in:

1. Rule design phase
2. Integration & pipeline assembly
3. Explanation validation
4. Safety testing
5. Final demo & report reasoning sections

You are the **last dependency before system validation**.

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7. Final Deliverables Checklist

- ☐ SWRL rule set
- ☐ SPARQL materialization queries
- ☐ Explanation engine
- ☐ Ranking & confidence module
- ☐ Safety & escalation layer
- ☐ Audit trail logic

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8. Success Criteria

Your work is successful if:

- Inference is symbolic and explainable
- Every output has a "why"
- Safety overrides work flawlessly
- Explanations satisfy KRR scrutiny

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9. Important Boundaries (Do Not Cross)

❌ Do not modify ontology structure
❌ Do not perform NLP extraction
❌ Do not add ML inference
❌ Do not bypass safety rules

Your role is **reasoning, not representation or perception**.

Final Note

This role defines whether the project is **truly KRR** or "just another chatbot".

If your reasoning is:

- explicit
- traceable

- safe
- explainable

...the project will stand out immediately.
