



Trisotech

Prompt Engineering for Laws and Regulations

Extracting Terms, Concepts, and Business Rules with Engineered Prompts

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Today's Program

- Compliance with regulations affects an organization's processes and decisions.
- A Knowledge Entity Model (KEM) is a capable tool for building regulatory compliance systems.
- Elements of the KEM include the vocabulary, concepts, and business rules
- LLM Prompts can build these elements from the text of the regulations with the chain of thought (CoT) and low-shot concepts
- Business rules can be modeled with prompts analysis.

Regulatory Compliance

- Regulations are the guidelines or restrictions on society's entities established through authority. They might be laws or authority passed to a governing entity.
- There must be a written description of the regulation that attempts to convey the constraint or guideline.
- Compliance aligns processes and decisions with an *interpretation* of the regulations or establishes policies and guidelines.
- Some regulations explicitly define processes and decisions, and regulations can ambiguously state that best practices or judgments should be followed.
- In all cases, the organization must precisely understand what is required to comply.

The compliance challenge

Title 12 / Chapter X / Part 1026 / Subpart E / § 1026.43 [Previous](#) / [Next](#) / [Top](#)

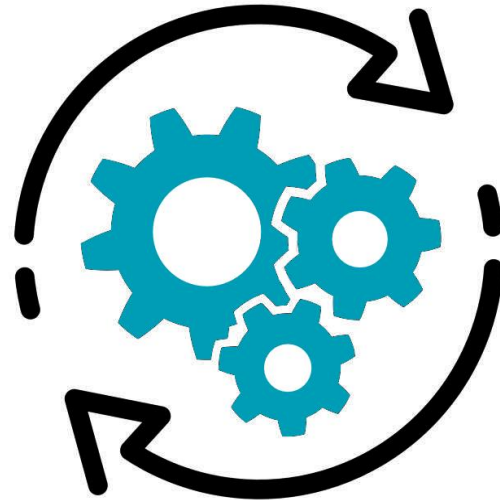
ECFR CONTENT

§ 1026.43 Minimum standards for transactions secured by a dwelling.

(a) **Scope.** This section applies to any consumer credit transaction that is secured by a dwelling, as defined in § 1026.2(a)(19), including any real property attached to a dwelling, other than:

- (1) A home equity line of credit subject to § 1026.40;
- (2) A mortgage transaction secured by a consumer's interest in a timeshare plan, as defined in 11 U.S.C. 101(53(D)); or
- (3) For purposes of paragraphs (c) through (f) of this section:
 - (i) A reverse mortgage subject to § 1026.33;
 - (ii) A temporary or "bridge" loan with a term of 12 months or less, such as a loan to finance the purchase of a new dwelling where the consumer plans to sell a current dwelling within 12 months or a loan to finance the initial construction of a dwelling;
 - (iii) A construction phase of 12 months or less of a construction-to-permanent loan;
 - (iv) An extension of credit made pursuant to a program administered by a Housing Finance Agency, as defined under 24 CFR 266.5;
 - (v) An extension of credit made by:
 - (A) A creditor designated as a Community Development Financial Institution, as defined under 12 CFR 1805.104(h);

Site Feedback



Uniform Residential Loan Application

This application is designed to be completed by the applicant(s) with the Lender's assistance. Applicants should complete this form as "Borrower" or "Co-Borrower," as applicable. Co-Borrower information must also be provided (and the appropriate box checked) when the income or assets of a person other than the "Borrower" (including the Borrower's spouse) will be used as a basis for loan qualification or the income or assets of the Borrower's spouse will not be used as a basis for loan qualification, but his or her liabilities must be considered because the Borrower resides in a community property state, the security property is located in a community property state, or the Borrower is relying on other property located in a community property state as a basis for repayment of the loan.

I. TYPE OF MORTGAGE AND TERMS OF LOAN

Mortgage Applied for: V.A. Conventional Other FHA Fannie

Agency Case Number: _____ Lender Case No: _____

Amount: \$ _____ Interest Rate: _____ % No. of Months: _____ Amortization Type: Fixed Rate Other (explain): _____

II. PROPERTY INFORMATION AND PURPOSE OF LOAN

Subject Property Address (street, city, state, & ZIP): _____ No. of Units: _____

Legal Description of Subject Property (attach description if necessary): _____ Year Built: _____

Purpose of Loan: Purchase Refinance Construction Construction Permanent Other (explain): _____

Property will be: Primary Residence Secondary Residence Investment

Complete this line if construction or construction-permanent loan.

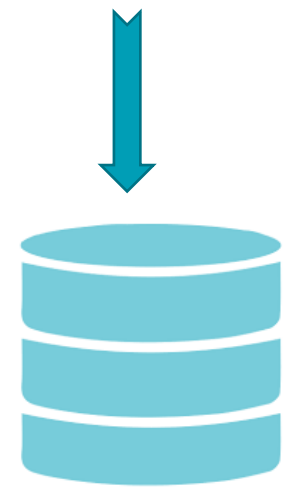
Year Lot Acquired	Original Cost	Amount Existing Liens	(a) Present Value of Lot	(b) Cost of Improvements	Total (a+b)
\$	\$	\$	\$	\$	\$

Complete this line if this is a refinance loan.

Year Acquired	Original Cost	Amount Existing Liens	Purpose of Refinance	Describe Improvements	Cost
\$	\$	\$		<input type="checkbox"/> made <input type="checkbox"/> to be made	\$

Title will be held in what Name(s): _____ Mortar in which Title will be held: Fee Simple Leasehold

Source of Down Payment, Settlement Charges and/or Subordinate Financing (explain): _____



Knowledge Entity Model(KEM)

A KEM is a concept model created by defining terms, connecting them through concept maps, and assembling business rules to model operational constraints.

The KEM is based on the Semantics Of Business Vocabulary And Business Rules Object Managment Group standard.

Knowledge Entity Model and Regulations

- Modeling regulations with a KEM provides a methodical and objective approach to building compliance systems.
- Moreover, the elements of the KEM, terms, concepts, and business rules can be extracted from the text of the regulations with natural language understanding.
- Natural Language Understanding (NLU) enables machines to interpret and generate human language meaningfully. It grasps nuances and context, allowing machines to interact with humans more intuitively by understanding sentiments and intentions.

Knowledge Entity Model and Regulations

- Large Language Models (LLM) are capable of the Natural Language Understanding needed to create a KEM from the text of the regulations.
- Prompts are the instructions, and engineered prompts can create a specific outcome.
- Several prompt extracts the vocabulary, concepts, and business rules from the text of the regulations
- Business rules can be further detailed with prompts.

Compliance Practices



- Core concepts:

- In the KEM, a vocabulary is a set of terms that are used in a particular business topic. For instance, a common compliance terms might include covered activities, allowable range.
- A concept model structures the terms of the vocabulary. A well-built concept model will convey the know-how of a problem domain. Most concept models have a central topic, and the terms articulate the details of the topic
- Business rules use the terms and the concepts to describe the logic that guides, and constrains behavior.



KEM Prompt: Terms



- Term is a singular noun or noun phrase with a unique meaning for a business area and is critical for understanding the regulation.
- The noun phrase might include a participle and a noun, an adjective and a noun, or a single noun
- The vocabulary is constructed by creating a definition of the term.
- Examples:
 - A **covered transaction** is a transaction in which a consumer applies for or obtains a loan secured by a dwelling...
 - A **higher-priced covered transaction** is a consumer credit transaction that is secured by the consumer's principal dwelling and...

KEM Prompt: Concepts

- A concept model describes the role, capability, or purpose of an entity within a business area or regulation
- The relationship between two terms generally defines elements of the concept model
- The concept model often suggests a canonical data model that can be used to design decision models that implement regulatory business rules.

KEM Prompt: Business Rules

- A business rule is an atomic statement that constrains some aspect of the business; the business rule controls or influences the behavior of the business.
- The business rule uses the terms developed in the concept model.
- The data type associated with the business rule is used in the constraint or calculation.
- Regulatory rules generally fall into three categories
 - Proscriptive: explicitly forbidding or restricting activities
 - Determinant: precisely defining certain metrics, dates, or measures
 - Interpretive: defining the objective or activities, leaving the precise meaning up to the target of the regulations.

Best Practices in Compliance: Business Rules

- (E) Up to two bona fide discount points paid by the consumer in connection with the transaction, if the interest rate without any discount does not exceed:
 - (1) The average prime offer rate, as defined in § 1026.35(a)(2), by more than one percentage point; or
 - (2) For purposes of paragraph (a)(1)(ii) of this section, for transactions that are secured by personal property, the average rate for a loan insured under Title I of the National Housing Act (12 U.S.C. 1702 et seq.) by more than one percentage point; and
- (F) If no discount points have been excluded under paragraph (b)(1)(i)(E) of this section, then up to one bona fide discount point paid by the consumer in connection with the transaction, if the interest rate without any discount does not exceed:
 - (1) The average prime offer rate, as defined in § 1026.35(a)(2), by more than two percentage points; or
 - (2) For purposes of paragraph (a)(1)(ii) of this section, for transactions that are secured by personal property, the average rate for a loan insured under Title I of the National Housing Act (12 U.S.C. 1702 et seq.) by more than two percentage points;

Best Practices in Compliance: Business Rules

Business Rules

12 CFR 1026.32(b)(1)(i)(E) & (F) Discount point rules

Attachment

12 CFR 1026.32(b)(1)(i)(E)

1 The number of discount points shall **not** exceed **2** if the interest rate **does not** exceed the average prime offer rate by **more than 1** percent

2 The number of discount points shall **not** exceed **1** if the interest rate **does not** exceed the average prime offer rate by **more than 2** percent

Engineered Prompts that Build the KEM



- Engineered prompts:
 - Extract the terms of the regulations: Term recognition prompts
 - Build concepts by identifying the important relationships between the terms
 - Create business rules that use the concepts that determine operationalization strategy

Engineered Prompt



- Designed questions or instruction given to large language models, to elicit a desired response or behavior. Engineering a prompt can be seen as guiding or "steering" the model towards a particular type of answer.
- In our case, we combine two concepts
 - Chain of thought (CoT) prompting
 - Low-Shot prompting

Chain of Thought Prompts



- CoT reasoning guides a language model with a sequence of reasoning steps that enhances its problem-solving ability
- This method improves performance in various reasoning tasks.

Low Shot



- Few-shot prompting allows for in-context learning by providing demonstrations in the prompt to improve performance. These demonstrations condition the model for subsequent examples.

Example, Regulatory Terms Prompt



Vertex AI

← Regulatory Terms

FREEFORM STRUCTURED

TOOLS

- Dashboard
- Model Garden
- Pipelines

NOTEBOOKS

- Colab Enterprise
- Workbench

GENERATIVE AI STUDIO

- Overview
- Language
- Vision
- Marketplace

Context

Regulations are guidelines or restrictions established by authority for society's entities. These guidelines are laws or authority passed down to a governing entity and must be documented to convey the constraint or guideline. Terms are important nouns or combinations of adjectives and nouns that convey the meaning of the regulations.

A term is a singular noun or noun phrase with a unique meaning for a regulation and is critical for understanding the regulation. The noun phrase might include a participle and a noun, an adjective, and a noun, or a single noun

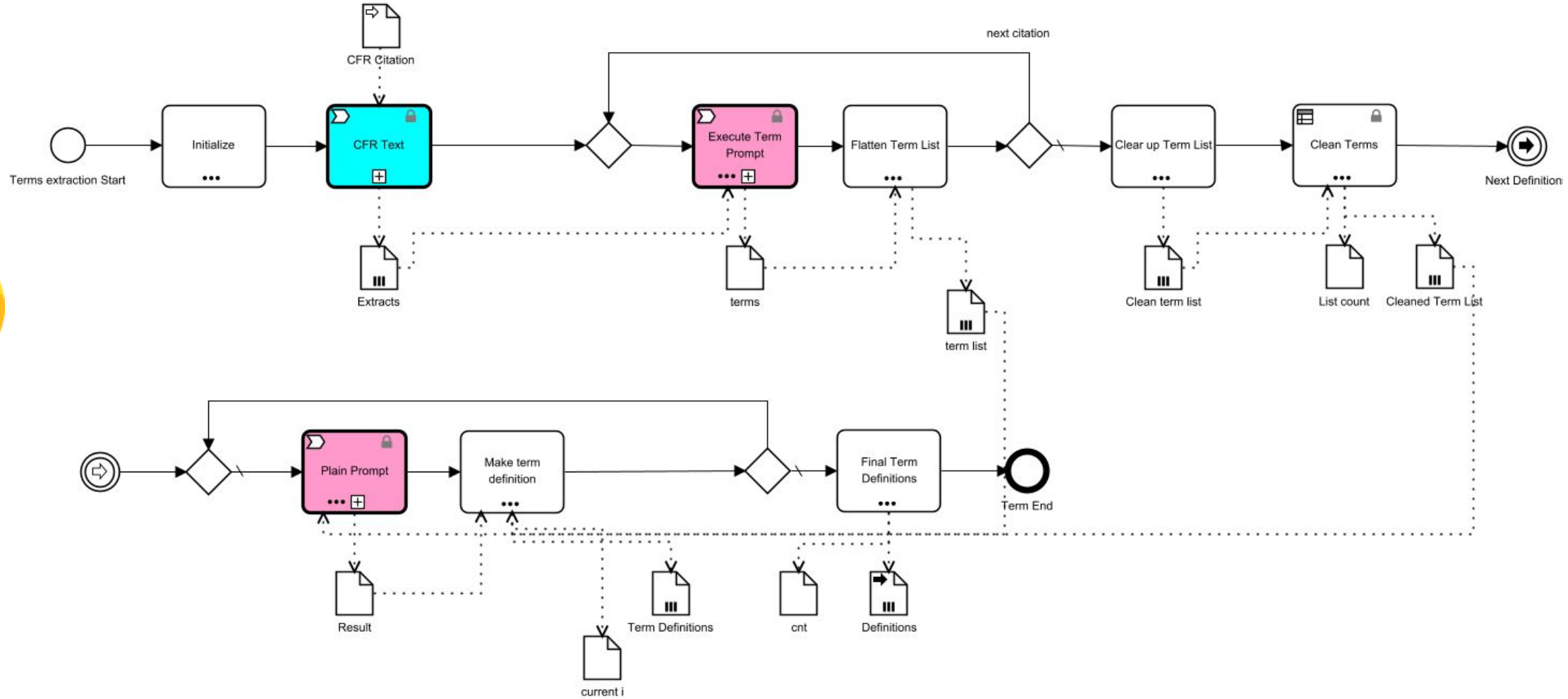
In regulatory paragraphs, there are important terms that convey the concept that is being described. A term is a noun phrase combining several nouns, a participial and a noun, a noun or a verb, or an adjective and a noun.

Examples

INPUT	OUTPUT
Add an input prefix	Add an output prefix
This section applies to any consumer credit transaction that is secured by a dwelling, as defined in § 1026.2(a)(19), including any real property attached to a dwelling, other than:	Consumer credit transaction, Dwelling, Real property



Term Extraction Process



Extracted Knowledge Entity Model



Knowledge Entity Modeler | Intelligent Digital Assistant | 1026 KEM

FILE HOME VIEW KNOWLEDGE ENTITY IMPORT-EXPORT TEAMWORK LEARN

Search

Terms Business Rules Diagram View

New term

Data Type Definition Relations Examples Notes Alternatives

Translate English (Main) Model Language Right Panels

A to determine the true cost of borrowing money.

B income or provide a store of value.

C

D **Community Housing Development Organization**

E **Type:** Any

F A private, nonprofit organization that meets the

G requirements of section 1026.43(a) of this part and is

H approved by HUD as a CHDO.

I

J

K

L

M

N

O **Creditor**

P **Type:** Any

Q A person or entity that extends credit to another person or

R entity. In the Truth in Lending Act (TILA) context, a creditor

S is defined as "a person or entity that regularly extends,

T renews, or arranges for the extension of consumer credit.

U

V

W

X

Y

Z

#

Consumer credit transaction

Type: Any

Any transaction in which credit is offered or extended to a consumer primarily for personal, family, or household purposes, and the annual percentage rate (APR) charged exceeds 10%.

Covered transaction

Type: Any

A covered transaction is a transaction in which a consumer applies for or obtains a loan secured by a dwelling, where the annual percentage rate may exceed the applicable usury ceiling set forth in section 803(a) of the Depository Institutions Deregulation and Monetary Control Act of 1980 (12 U.S.C. 1730a(a)).

Downpayment Assistance through Secondary Financing Provider

Type: Any

It is defined under 12 CFR 1026.43 as a loan or other financial assistance provided to a consumer by a secondary financing provider to assist the consumer in making a down payment on a dwelling. The term does not include: 1. A loan or other financial assistance provided by a government agency or a nonprofit organization; or 2. A loan or other financial assistance provided by a lender to a consumer in connection with a mortgage loan originated by the lender.

Dwelling

Type: Any

A residential structure (whether real or personal property) located in the United States and owned and occupied by a consumer primarily for personal, family, or household purposes and may include, without limitation, a manufactured home, mobile home, or trailer, if such dwelling is used as a residence.



Term Extraction Findings:

- LLMs and prompts.
 - The approach is very time-efficient
- KEM
 - Experts should review the results
 - The term discovery prompt identified more items than with human inspection.

Roles for Prompts in Decisions

- LLMs and prompts.
- Decisioning extended
 - Document Generation
 - Correspondence
 - Reporting
 - Explanations
 - Natural Language Understanding
 - Topic and Contextual
 - Entity Extraction
 - Business Objects
 - Process Catalysts and Events

Tables of information

- Prompts can incorporate tables of information into their responses.
- These tables can be nested.

- Example:

- Property, Square footage, Sales price, County
 - 12 Oak Street, 2800, 240000, Fairfax
 - 34 Slim Ct, 2700, 300000, Montgomery
 - 456 Woodlawn Ct, 3000, 260000, Alexandria
 - 45 Mobile Av, 2900, 250000, Montgomery
-
- Schools, Quality
 - Montgomery, Highest
 - Fairfax, Good
 - Alexandria, Very Good

The buyer has a budget of 290000 and prefers the best school. Which property should they purchase?

Deductive Reasoning

- Prompts can perform deductive reasoning

Farm animals are typically Cloven-hoofed animals, Birds, and horses. Cloven hoof animals include cows, sheep, goats, pigs, deer, llamas, alpacas, buffalo etc. Typical birds are chickens, geese, and turkeys.

The farm has 4 Rhode Island Reds, 5 Herford Hogs , 2 Mangalica, and a Gelbvieh

How many of these are Cloven-hoofed animals?

Logic Evaluation

- Prompts can apply the logic of statements from documents

For the regulations:

(E) Up to two bona fide discount points paid by the consumer in connection with the transaction, if the interest rate without any discount does not exceed:

(1) The average prime offer rate, as defined in § 1026.35(a)(2), by more than one percentage point; or

(2) For purposes of paragraph (a)(1)(ii) of this section, for transactions that are secured by personal property, the average rate for a loan insured under Title I of the National Housing Act (12 U.S.C. 1702 et seq.) by more than one percentage point; and

(F) If no discount points have been excluded under paragraph (b)(1)(i)(E) of this section, then up to one bona fide discount point paid by the consumer in connection with the transaction, if the interest rate without any discount does not exceed:

(1) The average prime offer rate, as defined in § 1026.35(a)(2), by more than two percentage points; or

(2) For purposes of paragraph (a)(1)(ii) of this section, for transactions that are secured by personal property, the average rate for a loan insured under Title I of the National Housing Act (12 U.S.C. 1702 et seq.) by more than two percentage points;

If the interest rate is 7.9 percent and the average prime offer rate is 7 percent can the customer pay 2 discount points?

Classifications/Chain of thought

■ Prompts can classify topics in text

A paragraph might describe the specific instance of a meeting event. Common types of meetings and their purposes include:

- Status Meetings: Providing updates on ongoing projects, tasks, or initiatives.
 - Planning Meetings: Outlining strategies, setting goals, allocating resources, and establishing timelines for upcoming projects or business initiatives.
 - Problem-Solving Meetings: Brainstorming potential solutions, analyzing alternatives, and making informed decisions to address complex issues or challenges.
 - Decision-Making Meetings: Discussing available options and reaching a consensus on significant choices, such as product launches or resource allocation.
 - Project Review Meetings: Evaluating results, identifying lessons learned, and making improvements after completing project phases or the entire project.
 - Cross-Functional Meetings: Collaborating on shared objectives or addressing interdepartmental issues to foster better coordination.
 - Training and Knowledge Sharing Meetings: Training employees on new processes, tools, or skills, and sharing valuable knowledge and expertise across the organization.
 - Performance Review Meetings: Discussing employee performance, providing feedback, setting goals, and addressing development needs.
 - Client or Stakeholder Meetings: Understanding requirements, addressing concerns, and building strong business relationships.
 - Innovation and Ideation Meetings: Encouraging creativity and idea generation for new products, services, or improvements to existing offerings.
 - Meetings ensure communication, driving decision-making, collaborating to solve problems, monitoring progress, aligning strategies, and sharing knowledge within the organization.
 - Human resources meetings: Discuss personnel actions and decide how to resolve staff conflicts.
- What type of meeting is described in the following paragraph:
- The project is now very late, and the situation is out of control, We should meet to discuss this and develop solutions. I propose a meeting date of August 12 at 02:00PM. The meeting attendees should include Jack Dripper, Bill Shudder and myself

Entity Extraction/Few-Shot

- Prompts can extract entities from text

A suspense date is the required completion date of a task. Using the following examples, extract the suspense date from the supplied paragraph:

Sentence, Date

The delivery of the product should be no later than September 12., September 12

We need this completed by October 5.,October 5

According to the regulations, the report must be completed within 5 business days, which is November 8., November 8

The report is needed by September 9. September 9,

What is the suspense date for the following paragraph?

We will conduct a market abuse investigation of Joe Smith's Transactions. The Lead Investigator is Charles Davis. Mary Jones will review the results. Richard Herd will approve the final report. The initial investigation report is available in system number CC0003. The results are due on October 23, 2023



Any questions?

THANKS!