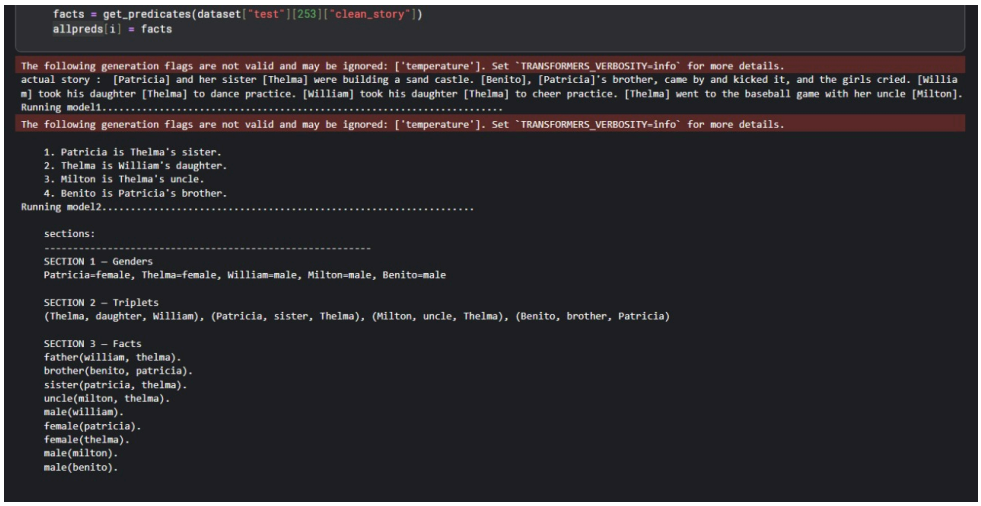
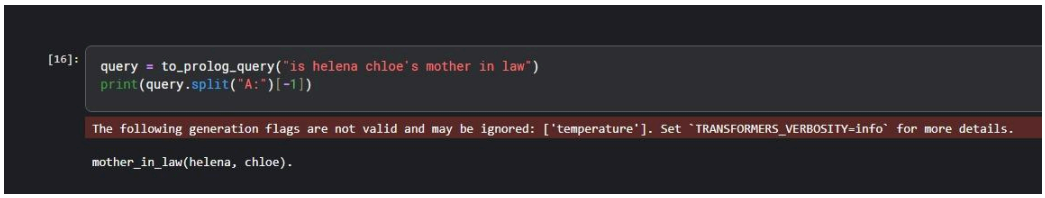
This document contains 5 fully worked CoT examples from unseen test stories.

The various components working:
(Examples start after images)

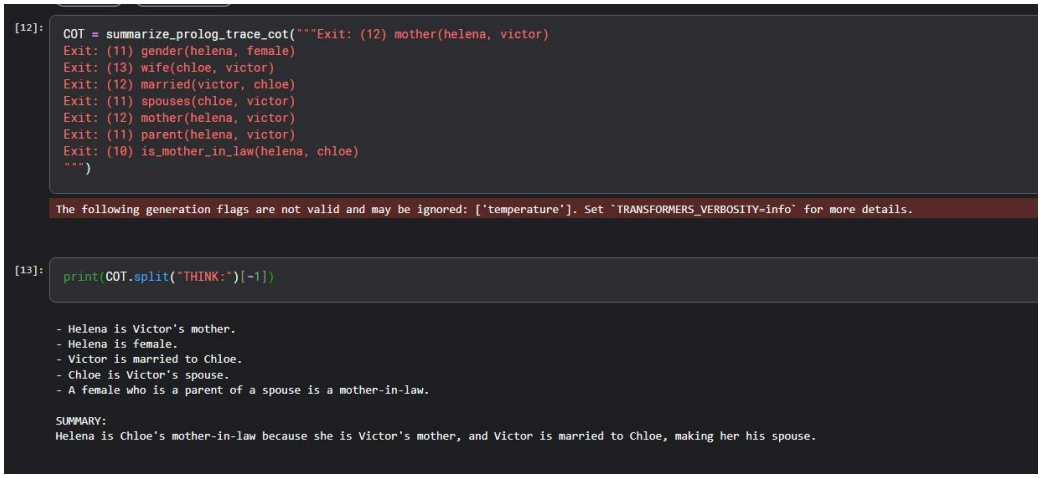


```
    facts = get_predicates(dataset["test"][253]["clean_story"])
    allpreds[i] = facts

The following generation flags are not valid and may be ignored: ['temperature']. Set `TRANSFORMERS_VERBOSITY=info` for more details.
actual story :  [Patricia] and her sister [Thelma] were building a sand castle. [Benito], [Patricia]'s brother, came by and kicked it, and the girls cried. [William] took his daughter [Thelma] to dance practice. [William] took his daughter [Thelma] to cheer practice. [Thelma] went to the baseball game with her uncle [Milton].
Running model1.....................................................................
The following generation flags are not valid and may be ignored: ['temperature']. Set `TRANSFORMERS_VERBOSITY=info` for more details.

    1. Patricia is Thelma's sister.
    2. Thelma is William's daughter.
    3. Milton is Thelma's uncle.
    4. Benito is Patricia's brother.
Running model2.....................................................................

    sections:
    ----------
    SECTION 1 — Genders
    Patricia=female, Thelma=female, William=male, Milton=male, Benito=male

    SECTION 2 — Triplets
    (Thelma, daughter, William), (Patricia, sister, Thelma), (Milton, uncle, Thelma), (Benito, brother, Patricia)

    SECTION 3 — Facts
    father(william, thelma).
    brother(benito, patricia).
    sister(patricia, thelma).
    uncle(milton, thelma).
    male(william).
    female(patricia).
    female(thelma).
    male(milton).
    male(benito).
```



```
[16]: query = to_prolog_query("is helena chloe's mother in law")
      print(query.split("A:")[-1])

The following generation flags are not valid and may be ignored: ['temperature']. Set `TRANSFORMERS_VERBOSITY=info` for more details.

mother_in_law(helena, chloe).
```

```
% c:/Users/The Fiery dragon/Downloads/Rules.pl compiled 0.02 sec, 71 clauses
?-  is_mother_in_law(helena,chloe).
true .

?- trace.
true.

[trace]  ?- is_mother_in_law(helena,chloe).
   Call: (10) is_mother_in_law(helena, chloe) ? creep
   Call: (11) gender(helena, female) ? creep
   Call: (12) mother(helena, _21568) ? creep
   Exit: (12) mother(helena, victor) ? creep
   Exit: (11) gender(helena, female) ? creep
   Call: (11) spouses(chloe, _23924) ? creep
   Call: (12) married(chloe, _23924) ? creep
   Call: (13) husband(chloe, _23924) ? creep
   Fail: (13) husband(chloe, _23924) ? creep
   Redo: (12) married(chloe, _23924) ? creep
   Call: (13) wife(_23924, chloe) ? creep
   Fail: (13) wife(_23924, chloe) ? creep
   Redo: (12) married(chloe, _23924) ? creep
   Call: (13) father(chloe, _30406) ? creep
   Fail: (13) father(chloe, _30406) ? creep
   Fail: (12) married(chloe, _23924) ? creep
   Redo: (11) spouses(chloe, _23924) ? creep
   Call: (12) married(_23924, chloe) ? creep
   Call: (13) husband(_23924, chloe) ? creep
   Fail: (13) husband(_23924, chloe) ? creep
   Redo: (12) married(_23924, chloe) ? creep
   Call: (13) wife(chloe, _23924) ? creep
   Exit: (13) wife(chloe, victor) ? creep
   Exit: (12) married(victor, chloe) ? creep
   Exit: (11) spouses(chloe, victor) ? creep
   Call: (11) parent(helena, victor) ? creep
   Call: (12) father(helena, victor) ? creep
   Fail: (12) father(helena, victor) ? creep
   Redo: (11) parent(helena, victor) ? creep
   Call: (12) mother(helena, victor) ? creep
   Exit: (12) mother(helena, victor) ? creep
   Exit: (11) parent(helena, victor) ? creep
   Exit: (10) is_mother_in_law(helena, chloe) ? creep
true .
```



Example 1: (Fully explained)

Story:

[Victor]'s mother [Helena] took him to the park. [Victor] later met his brother [Mason] near the café. [Mason] told him that their uncle [Ryan] would visit soon. Meanwhile, [Helena] got a message from her aunt [Julia] asking to meet this weekend. At home, [Victor]'s wife [Chloe] was waiting for him with dinner ready.

Predicates generated by the LLM:

mother(helena,victor),
wife(chloe,victor),
father(Victor, Mason),
brother(Mason, Ryan),
brother(Ryan, Julia),
sister(Helena, Julia),
husband(Victor, Chloe)

Trace generated by running the query on Prolog:

[trace] ?- is_mother_in_law(helena,chloe).
   Call: (10) is_mother_in_law(helena, chloe) ? creep
   Call: (11) gender(helena, female) ? creep
   Call: (12) mother(helena, _21568) ? creep
   Exit: (12) mother(helena, victor) ? creep

Exit: (11) gender(helena, female) ? creep
Call: (11) spouses(chloe, _23924) ? creep
Call: (12) married(chloe, _23924) ? creep
Call: (13) husband(chloe, _23924) ? creep
Fail: (13) husband(chloe, _23924) ? creep
Redo: (12) married(chloe, _23924) ? creep
Call: (13) wife(_23924, chloe) ? creep
Fail: (13) wife(_23924, chloe) ? creep
Redo: (12) married(chloe, _23924) ? creep
Call: (13) father(chloe, _30406) ? creep
Fail: (13) father(chloe, _30406) ? creep
Fail: (12) married(chloe, _23924) ? creep
Redo: (11) spouses(chloe, _23924) ? creep
Call: (12) married(_23924, chloe) ? creep
Call: (13) husband(_23924, chloe) ? creep
Fail: (13) husband(_23924, chloe) ? creep
Redo: (12) married(_23924, chloe) ? creep
Call: (13) wife(chloe, _23924) ? creep
Exit: (13) wife(chloe, victor) ? creep
Exit: (12) married(victor, chloe) ? creep
Exit: (11) spouses(chloe, victor) ? creep
Call: (11) parent(helena, victor) ? creep
Call: (12) father(helena, victor) ? creep
Fail: (12) father(helena, victor) ? creep
Redo: (11) parent(helena, victor) ? creep
Call: (12) mother(helena, victor) ? creep
Exit: (12) mother(helena, victor) ? creep
Exit: (11) parent(helena, victor) ? creep
Exit: (10) is_mother_in_law(helena, chloe) ? creep
true .

All the Exit calls are extracted:

Exit: (12) mother(helena, victor)
Exit: (11) gender(helena, female)
Exit: (13) wife(chloe, victor)
Exit: (12) married(victor, chloe)
Exit: (11) spouses(chloe, victor)
Exit: (12) mother(helena, victor)
Exit: (11) parent(helena, victor)
Exit: (10) is_mother_in_law(helena, chloe)

COT generated by the Exit calls:

- Helena is Victor's mother.
- Helena is female.
- Victor is married to Chloe.
- Chloe is Victor's spouse.
- A female who is a parent of a spouse is a mother-in-law.

SUMMARY:

Helena is Chloe's mother-in-law because she is Victor's mother, and Victor is married to Chloe, making her his spouse.

Example 2:

story: [Liam] visited his father [Robert] in the hospital. [Liam] later spoke with his sister [Emily] outside the room. [Emily] mentioned that their grandmother [Nora] would arrive soon. Meanwhile, [Robert] received a call from his brother [Thomas] about family plans. At home, [Liam]’s wife [Sarah] was preparing tea.

query : is robert sarah's father in law

processed query:
father_in_law(robert, sarah)

actual story : Liam visited his father Robert in the hospital.
Liam later spoke with his sister Emily outside the room.
Emily mentioned that their grandmother Nora would arrive soon.
Meanwhile, Robert received a call from his brother Thomas about family plans.
At home, Liam’s wife Sarah was preparing tea.

Running model1.....
The following generation flags are not valid and may be ignored: ['temperature']. Set TRANSFORMERS_VERBOSITY=info for more details.

1. Robert is Liam's father.
2. Emily is Liam's sister.
3. Nora is Emily's grandmother.
4. Thomas is Robert's brother.
5. Sarah is Liam's wife.

Running model2.....

sections:

SECTION 1 — Genders
Robert=male,
Liam=male,
Emily=female,
Nora=female,
Sarah=female

SECTION 2 — Triplets
(Robert, father, Liam),
(Emily, sister, Liam),
(Thomas, brother, Robert)

SECTION 3 — Facts

father(robert,liam),
wife(sarah,liam),
sister(emily,liam),
brother(thomas,robert),
grandmother(nora,emily),
husband(liam,sarah)

trace :
Exit: (12) father(robert, liam)
Exit: (11) gender(robert, male)
Exit: (13) wife(sarah, liam)
Exit: (12) married(liam, sarah)
Exit: (11) spouses(sarah, liam)
Exit: (12) father(robert, liam)
Exit: (11) parent(robert, liam)
Exit: (10) is_father_in_law(robert, sarah)

COT explanation:

Robert is Liam's father.

Robert is male.

Liam is married to Sarah.

Sarah is Liam's spouse.

A male who is a parent of a spouse is a father-in-law.

SUMMARY:
Robert is Sarah's father-in-law because he is Liam's father, and Liam is married to Sarah, making her his spouse.

Example 3

story: [Ava] went shopping with her mother [Diana]. Later, [Ava] met her cousin [Oliver] at the bookstore. Oliver said his father [Jacob] would join them soon. Meanwhile, [Diana] received a call from her sister [Linda]. At home, [Ava]’s husband [Ethan] was reading.

query : is diana ethan's mother in law

processed query:
mother_in_law(diana, ethan)

actual story : Ava went shopping with her mother Diana.
Later, Ava met her cousin Oliver at the bookstore.
Oliver said his father Jacob would join them soon.
Meanwhile, Diana received a call from her sister Linda.
At home, Ava’s husband Ethan was reading.

Running model1.....
The following generation flags are not valid and may be ignored: ['temperature']. Set TRANSFORMERS_VERBOSITY=info for more details.

1. Diana is Ava's mother.
2. Oliver is Ava's cousin.
3. Jacob is Oliver's father.
4. Linda is Diana's sister.
5. Ethan is Ava's husband.

Running model2.....

sections:

SECTION 1 — Genders
Diana=female,
Ava=female,

Oliver=male,
Linda=female,
Ethan=male

SECTION 2 — Triplets
(Diana, mother, Ava),
(Jacob, father, Oliver),
(Linda, sister, Diana)

SECTION 3 — Facts

mother(diana,ava),
husband(ethan,ava),
sister(linda,diana),
father(jacob,oliver)

trace :
Exit: (12) mother(diana, ava)
Exit: (11) gender(diana, female)
Exit: (13) husband(ethan, ava)
Exit: (12) married(ava, ethan)
Exit: (11) spouses(ethan, ava)
Exit: (12) mother(diana, ava)
Exit: (11) parent(diana, ava)
Exit: (10) is_mother_in_law(diana, ethan)

COT explanation:

Diana is Ava's mother.

Diana is female.

Ava is married to Ethan.

Ethan is Ava's spouse.

A female who is a parent of a spouse is a mother-in-law.

SUMMARY:
Diana is Ethan's mother-in-law because she is Ava's mother, and Ava is married to Ethan, making him her spouse.

Example 4:

story: [Noah] helped his father [Sam] fix the car. Later, [Noah] met his aunt [Grace] at the market. Grace mentioned that her daughter [Isla] would join soon. Meanwhile, [Sam] chatted with his brother [Henry] on the phone. At home, [Noah]’s wife [Lily] was organizing the living room.

query : is sam lily's father in law

processed query:
father_in_law(sam, lily)

actual story : Noah helped his father Sam fix the car.
Later, Noah met his aunt Grace at the market.
Grace mentioned that her daughter Isla would join soon.
Meanwhile, Sam chatted with his brother Henry on the phone.
At home, Noah’s wife Lily was organizing the living room.

Running model1.....
The following generation flags are not valid and may be ignored: ['temperature']. Set TRANSFORMERS_VERBOSITY=info for more details.

1. Sam is Noah's father.
2. Grace is Noah's aunt.
3. Isla is Grace's daughter.
4. Henry is Sam's brother.
5. Lily is Noah's wife.

Running model2.....

sections:

SECTION 1 — Genders
Sam=male,
Noah=male,
Grace=female,
Isla=female,
Lily=female,
Henry=male

SECTION 2 — Triplets
(Sam, father, Noah),
(Grace, aunt, Noah),

(Isla, daughter, Grace),
(Henry, brother, Sam)

SECTION 3 — Facts

father(sam,noah),
wife(lily,noah),
brother(henry,sam),
aunt(grace,noah)

trace :
Exit: (12) father(sam, noah)
Exit: (11) gender(sam, male)
Exit: (13) wife(lily, noah)
Exit: (12) married(noah, lily)
Exit: (11) spouses(lily, noah)
Exit: (12) father(sam, noah)
Exit: (11) parent(sam, noah)
Exit: (10) is_father_in_law(sam, lily)

COT explanation:

Sam is Noah's father.

Sam is male.

Noah is married to Lily.

Lily is Noah's spouse.

A male who is a parent of a spouse is a father-in-law.

SUMMARY:
Sam is Lily's father-in-law because he is Noah's father, and Noah is married to Lily, making her his spouse.

Example 5:

story: [James] drove his mother [Sophia] to the airport. After that, [James] met his cousin [Liam] for lunch. Liam said his sister [Mia] would come later. Meanwhile, [Sophia] talked to her brother [Aaron] about plans. At home, [James]’s wife [Bella] was writing emails.

query : is sophia bella's mother in law

processed query:
mother_in_law(sophia, bella)

actual story : James drove his mother Sophia to the airport.
After that, James met his cousin Liam for lunch.
Liam said his sister Mia would come later.
Meanwhile, Sophia talked to her brother Aaron about plans.
At home, James’s wife Bella was writing emails.

Running model1.....
The following generation flags are not valid and may be ignored: ['temperature']. Set TRANSFORMERS_VERBOSITY=info for more details.

1. Sophia is James's mother.
2. Liam is James's cousin.
3. Mia is Liam's sister.
4. Aaron is Sophia's brother.
5. Bella is James's wife.

Running model2.....

sections:

SECTION 1 — Genders
Sophia=female,
James=male,
Liam=male,
Mia=female,
Bella=female,
Aaron=male

SECTION 2 — Triplets
(Sophia, mother, James),
(Mia, sister, Liam),
(Aaron, brother, Sophia)

SECTION 3 — Facts

mother(sophia,james),

wife(bella,james),
brother(aaron,sophia),
sister(mia,liam)

trace :
Exit: (12) mother(sophia, james)
Exit: (11) gender(sophia, female)
Exit: (13) wife(bella, james)
Exit: (12) married(james, bella)
Exit: (11) spouses(bella, james)
Exit: (12) mother(sophia, james)
Exit: (11) parent(sophia, james)
Exit: (10) is_mother_in_law(sophia, bella)

COT explanation:

Sophia is James's mother.

Sophia is female.

James is married to Bella.

Bella is James's spouse.

A female who is a parent of a spouse is a mother-in-law.

SUMMARY:
Sophia is Bella's mother-in-law because she is James's mother, and James is married to Bella, making her his spouse.