CODE-PROMPT: Evaluating Code-LLMs for Natural Language Tasks via Code Aligned Prompts

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Abstract

Large language models pre-trained on code (Code-LLMs) have achieved remarkable performance on coding tasks. Despite their success of processing programming language, their application to natural language tasks has largely been limited to narrow tasks and ad-hoc model selection. In this paper, we present CODE-PROMPT, a comprehensive prompt-based framework to benchmark Code-LLMs over ten NLP tasks. We evaluate CODE-PROMPT on 13 Code-LLMs using code-aligned prompts and compare them with their parallel natural language LLMs (NL-LLMs) using natural language prompts.

Our results show that Code-LLMs perform on par with NL-LLMs across a range of NLP tasks, while producing more format-consistent generation with less redundancy. Our cross-lingual experiments further indicate that knowledge in Code-LLMs is well shared among different programming languages, whereas performance across different human languages still varies significantly. All our code and data will be made publicly available at `anonymous_url`.

1 Introduction

The success of large language models (LLMs) (Touvron et al., 2023; OpenAI et al., 2024) across NLP tasks has demonstrated the power of large-scale pre-training on natural language. As prompting has become increasingly important (Liu et al., 2023; Long et al., 2025), model inputs (*prompts*) often include a task description, few-shot demonstrations, and a final example for inference (Brown et al., 2020). Following the trend of large-scale training, large models have been also pre-trained on massive code data for better code generation tasks (Wang et al., 2021; Rozière et al., 2023; Zhao et al., 2024). These Code-LLMs now power modern code assistants, such as Github Copilot[1] and Cursor[2]. Besides executable code, Code-LLMs can also generate *natural language* elements in code repositories such as comment (Geng et al., 2024), docstring (Poudel et al., 2024), repository-level documentation (Luo et al., 2024) and Git commit messages (Zhang et al., 2024). In addition, Yang et al. (2024) and Wang et al. (2025) show that Code-LLMs can generate test cases for **algorithmic functions**, such as those found in programming challenges on LeetCode[3].

With the rise of NLP-related projects in industry (Supriyono et al., 2024), engineers and data scientists increasingly need to prepare test examples with expected outputs for **NLP functions**. In software engineering, such test cases are essential for unit tests and often appear in (Python) docstrings; in LLM-driven projects, developers design prompts and require such test cases inserted as few-shot demonstrations to guide model behaviour. A natural solution is to leverage Code-LLMs to auto-complete these test cases, allowing developers to stay within their IDE. However, unlike NL-LLMs, whose annotation abilities across various NLP tasks are well studied (Zhang et al., 2023b; Tan et al., 2024; Uzair-Ul-Haq et al., 2025), the effectiveness of Code-LLMs for this role remains underexplored, with previous work focusing on specific tasks (Li et al., 2023) and ad-hoc models (Mohajeri et al., 2024; Zhang et al., 2023a).

To address this gap, we propose CODE-PROMPT, a first comprehensive framework for evaluating Code-LLMs across various NLP tasks. When prompting Code-LLMs, we reformulate natural language prompts into code-aligned formats (see Figure 1) inspired by modern (Python) development practices. Each prompt consists of three components: (1) a function definition serving as the task description; (2) unit tests as demonstrations; and (3) a final, incomplete unit test for inference.

We evaluate CODE-PROMPT in zero-shot and

[1] `https://github.com/features/copilot`
[2] `https://cursor.com/`
[3] `https://leetcode.com`

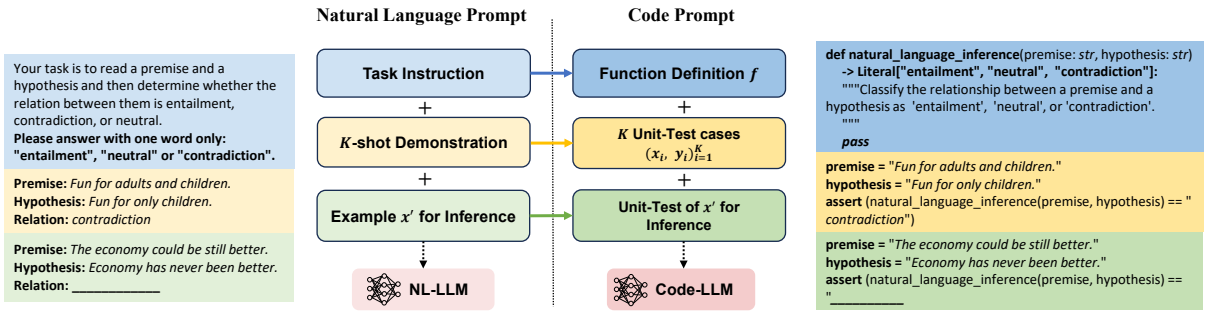

Figure 1: Overview of CODE-PROMPT, showcasing a natural language inference (NLI) task. On the left is the natural-language prompt sent to an NL-LLM, which is asked to generate a prediction after "Relation." On the right is the corresponding code-style prompt for Code-LLMs, formulated as a Python unit-test suite over a defined NLI function. The Code-LLM completes the final `assert` statement as prediction.

few-shot settings and compare their performance against parallel NL-LLMs – models of the same size, version, and provider (see Section 3.2 and Table 3). We find that Code-LLMs using code prompts achieve comparable performance to NL-LLMs across multiple NLP tasks, while producing substantially fewer redundant tokens beyond the target label. Our cross-lingual experiments demonstrate strong knowledge transfer across different programming languages. However, a substantial performance gap remains across human languages, consistent with similar observations from NL-LLMs (Xuan et al., 2025). Given the rapid progress and increasing attention surrounding Code-LLMs (Yang et al., 2025a; Ge et al., 2025), we regard our work as an essential step in exploring their abilities beyond code.

2 Method

We now present CODE-PROMPT, showcased in Figure 1. We first introduce the prompt template and then describe the inference process. As our evaluation primarily uses prompts written in Python, we explain the framework using Python examples.

2.1 Prompt Construction

To leverage Code-LLMs for NLP tasks, we reformulate text generation under a natural language prompt (*NL prompt*) as a **code-completion** problem under a prompt written in code-style (*code prompt*). A code prompt typically contains three components: a function definition, unit-tests from labeled examples and an incomplete unit-test for the example to be predicted.

Function definition. We begin by defining a task-specific function f. The function name f_{name} reflects the underlying NLP task (Li et al., 2023) such as `natural_language_inference`. The function arguments f_{args} correspond to the task input(s), such as `premise:str` and `hypothesis:str` for natural language inference (NLI).

Second, we convert the output specification from natural language instructions into an explicit Python type annotation f_{typing}. Take NLI for example, where the label set consists of *entailment*, *neutral*, and *contradiction*, we express f_{typing} as a `Literal` type enumerating these three labels, as illustrated in Figure 1. Then we put task description into into a concise docstring f_{docstr} that clearly states the function's purpose (Chen et al., 2021) (e.g., *classify the relationship between premise and hypothesis*) and reiterates the expected output (e.g., *as one of the target labels: ...*). Finally, the function body f_{body} is left empty (via `pass` in Python), since the function serves only as a semantic scaffold rather than an executable implementation. The final function definition is given by:

$$f := f_{\text{name}} \oplus f_{\text{args}} \oplus f_{\text{typing}} \oplus f_{\text{docstr}} \oplus f_{\text{body}}, \quad (1)$$

where $\oplus$ denotes concatenation of code strings.

Unit-tests for demonstration. A unit test is expressed as an `assert` statement that applies the defined function f to an input x (mapped to variables from the function arguments f_{args}) and checks whether the output matches the available label y:

$$\text{assert} \;\; f(x) == y. \quad (2)$$

Inspired by prior work on few-shot demonstrations in natural-language prompting (Gao et al., 2021) and code-style prompting (Li et al., 2023), we convert each few-shot example into a corresponding `assert` statement and concatenate these statements to form the code-aligned demonstrations in the code prompt.

Category	Dataset	# Class	# Train	# Val	# Test	Classes
TC	**SST-2** (Socher et al., 2013)	2	67,349	872	1821†	`positive, negative`
	AG News (Zhang et al., 2015)	4	120,000	-	76,000	`World, Sport, Business, Sci/Tech`
	CoLA (Warstadt et al., 2019)	2	8551	1043	1063†	`acceptable, unacceptable`
NLI	**MRPC** (Dolan and Brockett, 2005)	2	3668	408	1725	`not_equivalent, equivalent`
	XNLI (Conneau et al., 2018)	3	392,702	2490	5010	`entailment, neutral, contradiction`
	MSciNLI (Sadat and Caragea, 2024)	4	127,320	1000	4000	`contrasting, reasoning, ...`
RC	**SemEval** (Hendrickx et al., 2010)	10	8000	-	2717	`Member-Collection, Cause-Effect, ...`
	SciERC (Zhang et al., 2015)	7	3219	455	974	`COMPARE, CONJUNCTION, ...`
NR	**Iris** (Fisher, 1936)	3	150	-	-	`setosa, versicolor, virginica`
	HCC-Staging (Ours)	2	116	28	31	`True` (suitable for transplantation), `False` (unsuitable)

Table 1: Overview of the 10 benchmarked datasets. TC: Text classification. NLI: Natural language inference. RC: Relation classification. NR: Numeric reasoning. For XNLI, we report statistics for the English split, which are identical across the other 14 languages. †: The test split is not labelled.

Unit-test for inference. At inference, we construct a final `assert` statement using the test input x' and leave its expected output for the model to complete:

$$\text{assert } f(x') == _____ \quad (3)$$

The Code-LLM is prompted to fill in the missing value on the right-hand side of the equality, which is interpreted as the model's prediction.

Hence, the final code prompt is formed by concatenating (1) the function definition f, (2) the K unit-tests derived from the few-shot examples $\{(x_i, y_i)\}_{i=1}$, and (3) the incomplete unit test for the inference example x'. Appendix E presents the resulting code prompts for each individual task.

2.2 Inference

Code-LLMs first attempt to complete the final unit test for x' according to their underlying generation objective — normally autoregressively (Radford et al., 2019; Raffel et al., 2020), i.e. by iteratively selecting the most probable next token conditioned on all existing tokens (those provided in the prompt as well as those generated so far).

For classification tasks, the predicted label is the first occurrence of any valid target label in the model's generation. This label inference step is also applied to NL-LLM generations.

3 Experiments

The evaluated datasets (Section 3.1) and models (Section 3.2) are as follows, together with our evaluation setup (Section 3.3) including data scenarios and evaluation metrics. Further implementation details are listed in Appendix A.

3.1 Datasets

We collect 10 datasets from four categories of NLP tasks: text classification (TC), natural language inference (NLI), relation classification (RC) and numeric reasoning (NR). Table 1 provides an overview of all the benchmarked datasets.

3.1.1 Text classification

We evaluate CODE-PROMPT on sentiment classification (**SST-2**, Socher et al. (2013)), topic classification (**AG News**, Zhang et al. (2015)) and grammatical acceptability classification (**CoLA**, Warstadt et al. (2019)).

3.1.2 Natural language inference

NLI requires modeling a pair of texts to predict semantic relation between them (such as entailment). In this paper we benchmark three NLI datasets: **XNLI** (Conneau et al., 2018) to recognize entailment, contradict or neither (*neutral*) between premise and hypothesis sentences; **MRPC** (Dolan and Brockett, 2005) to determine if two texts construct paraphrases; and **MSciNLI** (Sadat and Caragea, 2024) for a new and challenging task of detecting more complicated relation from publications in Computer Science.

3.1.3 Relation classification

RC aims to recognize the relation of two extracted entities (Alt et al., 2020) in a text after a preliminary named entity recognition (Tjong Kim Sang and De Meulder, 2003) step. In this study, we consider **SemEval** (Hendrickx et al., 2010) in general domains and **SciERC** (Luan et al., 2018) in the scientific domain.

3.1.4 Logic-based numeric reasoning

Some NLP tasks require models to understand text but also apply explicit logics (Kazemi et al., 2023;

Input	Label	Explanation for labelling
`35mm x 20mm x 15mm`	*True*	Single tumor with diameter 35mm $\leq$ 5 cm
`2cm,1cm,15mm,12mm`	*False*	4 tumors in total, which exceeds the count limit 3
`5x5mm,17x28mm`	*True*	2 tumors with maximal diameter 28mm $\leq$ 3 cm

Table 2: Examples of annotation in HCC-Staging. The labeling follows Milan criteria introduced in Section 3.1.

Servantez et al., 2024); besides, the ability of understanding in text is also crucial (Yang et al., 2025b), especially in scientific context (Akhtar et al., 2023). Since Code-LLMs are pre-trained on code with programming logic and numbers, they might be well-suited for numeric and logical tasks. To evaluate the ability of logic-based numeric reasoning, we consider two datasets: **reformulated Iris** (Fisher, 1936) and a new clinical dataset **HCC-Staging** of patients with hepatocellular carcinoma (HCC).

The original Iris dataset classifies flowers into three species given their numeric features (i.e. sepal and petal dimensions). To reformulate this task into a benchmark for logic-based numeric reasoning, we relabel each example using the following logic:

> *If petal width $<$ 0.8 cm, then label setosa; If petal width $\geq$ 0.8 cm and $<$ 1.8 cm, then versicolor; Otherwise, label virginica.*

The derived labels agree with the original with 0.96 (144/150) accuracy and serve as the reference labels in this paper. In reformulated Iris, each input is presented in a structured textual format (e.g., *"Petal length: x cm, Petal width: y cm, ..."*), requiring models to correctly identify the relevant measurement (petal width) and apply the logic-based numerical comparison to determine the label.

In the context of NLP-assisted clinical care, numeric reasoning is essential for interpreting quantitative information in medical reports to support treatment decisions (Borchert et al., 2022). In this study, we construct dataset **HCC-Staging** by collecting 175 HCC cases provided by an university hospital and extracting tumor sizes from them (see Appendix D for details). Each case is labeled according to *Milan criteria* (Mazzaferro et al., 1996), which determine a patient's suitability for liver transplantation:

> *If the patient has one single tumor with diameter[4] $\leq$ 5 cm, then label as True (suitable for transplantation); Alternatively, if there are up to three tumors, and each has diameter $\leq$ 3 cm, then also True; Otherwise, label False.*

[4]Size of a tumor can be given in 1-D (e.g. `5 mm`), 2-D (e.g. `2cm x 3cm`) or 3-D (e.g. `3x4x5 mm`). In multi-dimensional cases, diameter is defined as the largest dimension.

Provider	Model	# Params (B)
OpenAI	GPT-3.5 Turbo	175
DeepSeek	DeepSeek-V3.1	685
Qwen	Qwen3-Coder-30B	30.5
	Qwen3-30B-Instruct	30.5
	Qwen2.5-Coder-32B	32.8
	Qwen2.5-32B-Instruct	32.8
	Qwen2.5-Coder-14B	14.8
	Qwen2.5-14B-Instruct	14.8
	Qwen2.5-Coder-7B	7.6
	Qwen2.5-7B-Instruct	7.6
	Qwen2.5-Coder-3B	3.1
	Qwen2.5-3B-Instruct	3.1
Llama	CodeLlama-13b	13
	CodeLlama-13b-Python	13
	Llama-2-13b	13
	CodeLlama-7b	6.7
	CodeLlama-7b-Python	6.7
	Llama-2-7b	7
Gemma	codegemma-7b	8.5
	gemma-7b	8.5
	codegemma-2b	2.5
	gemma-2b	2.5

Table 3: Overview of the evaluated models.

During inference, LLMs are given Milan criteria (via task instruction in NL prompt or docstring in code prompt) and required to apply them to classify each patient. Compared to Iris, this task requires abilities of not only numerical comparison but also counting and unit conversion (e.g., *mm* to *cm* if necessary). Table 2 illustrates example annotations.

3.2 Models

We aim to evaluate **paired** Code-LLMs and NL-LLMs — i.e., models that come from the same provider with comparable release dates and parameter scales — so that differences in performance can be attributed to pre-training and prompting style rather than unrelated architectural disparities. Hence, our model selection follows two criteria: (1) we identify publicly available Code-LLMs (as of 15.09.2025), either open-weight or accessible via a public code completion API[5], from five major LLM providers: OpenAI (Brown et al., 2020; OpenAI et al., 2024), DeepSeek (Guo et al., 2024), Qwen (Hui et al., 2024), Llama (Rozière et al., 2023) and Gemma (Zhao et al., 2024). Notably, **GPT-3.5 Turbo** is the **last** OpenAI model that provides a public `complete` API capable of code completion; newer GPT models are restricted to `chat`-based APIs designed primarily for NL conversation. (2) For each identified Code-LLM, we include it only if a parallel NL-LLM counterpart

[5]For example, `https://api.openai.com/v1/completions` from OpenAI and `https://api.deepseek.com/beta` from DeepSeek.

exists, defined as a model from the same provider with comparable version (or release date) and parameter size. Pairs for which one side (Code or NL) is unavailable are excluded to ensure controlled comparison.

After the two steps, we include a total of 22 large language models (grouped in Table 3). Notably, GPT-3.5 Turbo and DeepSeek-V3.1 can be regared as both NL- and Code-LLMs since they provide a unified `complete` API capable of both natural language and code generation. For these two models, we use identical backbones but different prompt formats, referring to them as *X* (Code) and *X* (NL), respectively. In this paper, to ensure fair and reproducible comparisons, we evaluate each model in **full precision** (no quantization) and generate with a **fixed temperature** of 0.

3.3 Evaluation Setup

Data scenarios. We evaluate CODE-PROMPT in zero-shot and few-shot scenarios.

Zero-shot requires the model to predict based on solely prompt instructions without any demonstrated example. For most datasets, we evaluate on the full test split. SST-2 and CoLA are exceptions because their test splits are unlabelled; for these two tasks, we instead evaluate on the validation split. For Iris, which does not provide any data division, we evaluate on the entire dataset.

Few-shot setting is often cast as an N-way K-shot problem (Vinyals et al., 2016), where K examples from each of the N classes are available as demonstration (Li et al., 2023). For datasets with predefined splits, we randomly sample $N \times K$ examples from the training split and evaluate on the same test (or validation) data used in the zero-shot setting. The only exception is Iris, which has no predefined splits; in this case, we sample $N \times K$ examples from the full dataset for prompting and evaluate on all remaining (unsampled) instances.

The selection of K is is constrained by each model's context window, the number of classes, and the length of the demonstrations. For most datasets we set K to be 4, which fits within the context limits of all models. Relation classification datasets contain substantially more classes, making larger K infeasible: for SCIERC we set K as 2, and for SemEval even a 1-shot prompt exceeds the context window of several models. Consequently, we exclude SemEval from the few-shot experiments.

To ensure fair comparison and reproducible results, we repeat the few-shot evaluation three times using fixed random seeds 0, 1 and 2. Therefore, within each run the same set of sampled shots is used across all test instances and all models.

Evaluation metrics. For each dataset, we report the performance scores commonly applied in prior research. Following Wang et al. (2018), we report accuracy for SST-2 and MRPC, and Matthews correlation for CoLA; following Zhang et al. (2015), we report accuracy for AG News; following Conneau et al. (2018), we report accuracy for XNLI; following Sadat and Caragea (2024), we report Macro-F1 for MSciNLI; we report Micro-F1 for SemEval and SCIERC according to Harbecke et al. (2022) and Luan et al. (2018), respectively; we report accuracy for Iris following Nugroho et al. (2020) and apply the same metric for HCC-Staging.

Beyond correctness, we introduce redundancy, measuring how well models adhere to the "*answer only with the label*" instruction in both NL and code prompts (see Appendix E). Redundancy R is defined as the complement of the ratio between the **label length** and the **full raw output**:

$$R := 1 - \frac{\text{length}(pred_label)}{\text{length}(total_generation)} \quad (4)$$

where length is measured in characters rather than tokens to avoid tokenizer-specific variation across models. Special tokens (`<eos>`, `\n`), block marks (`` ``` ``) and the ending full point, quotation mark or bracket are excluded in computation. Given output *Negative. Right?* for example from sentiment analysis, its redundancy is 8 (`len` of the first observed target label *negative*) divided by 16 (`len` of the whole sentence). A lower redundancy indicates that the model produces fewer extraneous tokens and adheres more strictly to the prompt. In this study we report performance (implemented by `sklearn` (Pedregosa et al., 2011)) and redundancy.

4 Results and Analysis

We first present results in zero-shot and few-shot scenarios in general; then we study the effect of multilinguality, including different programming languages as well as human languages.

4.1 Zero-shot Results

Table 4 presents the zero-shot **performance** for different models and tasks. We see that Code-LLMs deliver comparable performance with NL-LLMs on all tasks and show advantage in specific tasks: (1) Code-LLMs outperform NL-LLMs in 64 of the

Model	TC			NLI			RC		NR		$\overline{X}$	#Win
	SST-2 *Acc*	AG News *Acc*	CoLA *MCC*	MRPC *Acc*	XNLI *Acc*	MSciNLI *Macro-F1*	SemEval *Micro-F1*	SciERC *Micro-F1*	Iris *Acc*	HCC-Staging *Acc*		
GPT-3.5 Turbo (Code)	**94.6**	61.3	57.6	73.7	68.0	**37.5**	45.2	44.6	92.7	58.1	63.3	2
GPT-3.5 Turbo (NL)	93.1	**62.5**†	**64.1**	**76.7**	**68.4**	34.2	**48.9**	**50.4**	**96.0**	**64.5**	**65.9**	8
DeepSeek-V3.1 (Code)	**95.1**	**60.0**	66.6	76.6	75.6	60.4	**62.0**†	**59.2**	**96.7**†	**83.9**†	**73.6**†	6
DeepSeek-V3.1 (NL)	94.6	56.7	**67.9**†	**78.5**	**83.3**	**63.1**†	29.0	34.0	96.0	80.6	68.4	4
Qwen3-Coder-30B	94.0	60.8	60.9	**79.2**†	**84.2**	**49.8**	46.8	45.9	**96.0**	67.7	**68.5**	5
Qwen3-30B-Instruct	**95.3**†	**61.7**	**67.2**	74.7	73.8	41.2	**49.1**	**53.6**	30.0	**74.2**	62.1	5
Qwen2.5-Coder-32B	**94.8**	50.4	49.7	77.7	77.8	44.0	42.6	**59.8**†	94.5	**80.6**	67.2	3
Qwen2.5-32B-Instruct	93.5	**61.4**	**67.1**	**78.5**	**89.1**†	**58.2**	**57.3**	49.0	**96.0**	64.5	**71.5**	7
Qwen2.5-Coder-14B	**94.5**	51.6	46.1	73.4	82.2	46.4	33.1	56.8	68.7	**71.0**	62.4	2
Qwen2.5-14B-Instruct	89.8	**59.2**	**65.1**	**77.0**	**84.6**	**52.6**	**51.2**	**57.8**	**90.0**	61.3	**68.9**	8
Qwen2.5-Coder-7B	**93.8**	49.1	49.6	**69.4**	77.4	**44.4**	31.3	18.4	**86.0**	48.4	56.8	4
Qwen2.5-7B-Instruct	89.6	**57.8**	**58.5**	50.6	**80.3**	22.8	**42.7**	**46.0**	78.7	**67.7**	**59.5**	6
Qwen2.5-Coder-3B	**90.1**	32.5	40.0	**69.7**	65.8	**42.1**	31.8	**49.8**	**72.7**	51.6	**54.6**	5
Qwen2.5-3B-Instruct	88.9	**52.9**	**52.8**	49.9	**75.9**	22.0	**36.5**	47.8	33.3	**64.5**	52.5	5
CodeLlama-13b	**89.0**	37.9	**30.3**	68.0	**57.6**	22.9	**36.3**	14.9	**54.0**	51.6	**46.3**	6
CodeLlama-13b-Python	88.1	**48.7**	22.0	**74.0**	56.1	**35.2**	29.6	14.9	34.0	51.6	45.4	4
Llama-2-13b	39.0	14.7	3.7	27.8	44.3	19.5	20.4	**15.2**	0.0	**48.4**	23.3	0
CodeLlama-7b	**89.3**	53.3	14.7	66.7	38.9	15.6	23.9	14.0	**37.3**	**48.4**	40.2	1 (1)
CodeLlama-7b-Python	**89.3**	**54.9**	**26.4**	**69.1**	**53.4**	**20.2**	**25.3**	**17.1**	33.3	**48.4**	**43.7**	8 (1)
Llama-2-7b	42.1	14.5	-6.0	22.6	20.0	11.9	20.5	2.4	0.0	35.5	16.4	0
codegemma-7b	**91.9**	**51.0**	**17.6**	**73.6**	**57.2**	**28.0**	**35.3**	**30.9**	**66.7**	**67.7**	**52.0**	9 (1)
gemma-7b	41.2	18.9	5.4	63.7	43.8	24.7	21.6	7.7	**66.7**	48.4	34.2	0 (1)
codegemma-2b	**79.4**	**31.4**	0.0	**66.5**	**34.4**	10.4	**25.6**	12.9	33.3	**48.4**	**34.2**	9
gemma-2b	51.6	24.0	**2.9**	31.6	19.5	**11.6**	20.3	**21.1**	33.3	45.2	26.1	1

Table 4: Zero-shot performance (%) of NL-LLMs using natural language prompts and Code-LLMs using code-based prompts. The higher score within each comparison is highlighted in bold. The highest score of each task is denoted with †. *Acc*: Accuracy. *MCC*: Matthews correlation coefficient. $\overline{X}$: the macro mean across 10 tasks. **#Win**: Number of **group-wise wins (and draws recorded in bracket)** across 10 tasks.

Model	TC			NLI			RC		NR		$\overline{R}$	#Win
	SST-2	AG News	CoLA	MRPC	XNLI	MSciNLI	SemEval	SciERC	Iris	HCC-Staging		
GPT-3.5 Turbo (Code)	**0.0**	26.0	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.6**	2 (7)
GPT-3.5 Turbo (NL)	**0.0**	**25.2**	**0.0**	**0.0**	**0.0**	**0.0**	7.6	10.7	**0.0**	**0.0**	4.4	1 (7)
DeepSeek-V3.1 (Code)	**0.0**	**24.4**	**0.0**	**0.0**	0.2	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.5**	3 (6)
DeepSeek-V3.1 (NL)	**0.0**	25.3	**0.0**	**0.0**	**0.0**	**0.0**	92.5	77.3	**0.0**	**0.0**	19.5	1 (6)
Qwen3-Coder-30B	**20.0**	**36.7**	**16.1**	**13.7**	**16.3**	**19.0**	**6.9**	**10.3**	**19.9**	**30.9**	**19.0**	10
Qwen3-30B-Instruct	88.5	93.0	85.2	84.1	83.8	89.6	79.0	87.4	97.4	90.8	87.9	0
Qwen2.5-Coder-32B	**0.0**	**29.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.9**	10
Qwen2.5-32B-Instruct	71.6	83.5	81.4	86.8	88.3	88.5	78.8	87.3	51.0	88.6	80.6	0
Qwen2.5-Coder-14B	**0.0**	**26.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**	**2.6**	10
Qwen2.5-14B-Instruct	80.7	92.1	83.5	86.9	88.6	88.8	78.5	87.8	77.3	92.2	85.6	0
Qwen2.5-Coder-7B	**0.0**	**21.4**	**0.6**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.2**	10
Qwen2.5-7B-Instruct	89.2	92.7	86.8	85.7	83.6	90.0	80.2	88.4	89.3	92.0	87.8	0
Qwen2.5-Coder-3B	**0.0**	**5.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.6**	10
Qwen2.5-3B-Instruct	89.2	93.1	85.5	68.1	86.5	91.1	80.1	88.6	94.9	93.2	87.0	0
CodeLlama-13b	84.6	89.9	80.4	80.0	**78.3**	**79.3**	71.4	81.5	**83.4**	91.8	82.1	2 (1)
CodeLlama-13b-Python	84.7	**89.2**	77.1	**78.0**	**78.3**	79.7	77.5	74.5	87.1	91.3	81.7	2 (1)
Llama-2-13b	**79.6**	94.0	**75.9**	99.3	97.3	95.5	**52.5**	**13.0**	100.0	**90.8**	**79.8**	5
CodeLlama-7b	84.1	85.8	79.2	79.2	75.9	78.3	59.4	77.9	**81.5**	**89.5**	79.1	2
CodeLlama-7b-Python	**11.1**	**82.4**	**20.7**	**74.6**	**31.4**	**78.1**	62.5	**70.3**	85.9	93.6	**61.1**	7
Llama-2-7b	80.4	93.6	96.6	98.8	99.8	99.6	**46.4**	89.0	100.0	94.3	89.9	1
codegemma-7b	**0.0**	**24.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.4**	10
gemma-7b	50.5	92.1	87.1	83.6	77.4	77.6	79.8	89.5	94.4	92.4	82.4	0
codegemma-2b	**0.0**	**0.9**	**67.9**	**84.9**	**4.6**	**0.5**	**0.1**	**0.7**	**0.0**	**0.0**	**16.0**	9 (1)
gemma-2b	81.8	89.4	90.5	91.2	91.1	70.2	81.0	75.3	**0.0**	3.2	67.4	0 (1)

Table 5: Redundancy (%) (defined in Section 3.3; the lower, the better) of zero-shot experiments. The lower redundancy in each comparison is highlighted in bold. $\overline{R}$: mean redundancy across 10 tasks. **#Win**: Number of **group-wise wins (and draws recorded in bracket)** across 10 tasks.

110 group-wise comparisons (11 model groups $\times$ 10 datasets). Measured by accuracy $\overline{X}$ over all ten tasks, their largest deficit to NL model is 6.5% (from Qwen2.5-14B). (2) On a per dataset basis, NL-LLMs achieve the best results (marked with †) on all three text classification and two out of the three NLI datasets. In contrast, Code-LLM (DeepSeek V3.1 in code mode) achieves the best performance on both numerical reasoning tasks.

Table 5 shows the **redundancy** for different models. We observe remarkably lower redundancy from Code-LLMs: (1) in the 110 pair-wise comparisons for lower redundancy, code models achieve 78 wins (and 24 draws, 8 losses) against NL models. (2) Across all experiments in Table 5, Code-LLMs produce zero-redundancy in 63 experiments (48.5% of all their runs), whereas NL-LLMs do so in 15 (13.6%). We further notice even smaller, open-source coders such as Qwen-Coder and codegemma often output only the target label,

Model	SST-2 (*Acc*)				MRPC (*Acc*)				SemEval (*Micro-F1*)				HCC-Staging (*Acc*)				$\overline{X}$
	Python	JS	C++	Ruby	Python	JS	C++	Ruby	Python	JS	C++	Ruby	Python	JS	C++	Ruby	
GPT-3.5 Turbo (Code)	94.6	94.4	94.5	95.1	73.7	72.1	74.6	71.6	45.2	46.0	44.6	46.2	58.1	58.1	64.5	58.1	62.4
DeepSeek-V3.1 (Code)	95.1	95.2	95.2	95.6	76.6	78.9	77.0	77.0	62.0	65.1	62.3	62.5	83.9	77.4	87.1	77.4	75.6
Qwen3-Coder-30B	94.0	95.0	94.5	94.2	79.2	79.1	79.4	77.3	46.8	41.8	45.7	43.6	67.7	74.2	64.5	64.5	62.1
CodeLlama-13b	89.0	90.6	90.5	90.4	68.0	68.2	69.7	69.3	36.3	39.9	36.5	36.0	51.6	51.6	51.6	51.6	55.0
codegemma-7b	91.9	92.2	92.5	92.2	66.7	68.1	67.7	67.8	35.3	41.8	41.8	37.7	67.7	71.0	67.7	67.7	63.4
Avg.	92.5	93.3	93.2	93.1	72.6	73.6	73.5	72.9	45.1	47.2	46.6	45.0	67.7	68.6	67.7	65.3	

Table 6: Zero-shot performance (%) of four different programming languages: Python, JavaScript (JS), C++ and Ruby. Code-prompts written in those programming languages are presented in Appendix E.

Model	Modality	$\overline{X}$	#Win Perf.	$\overline{R}$	#Win Red.	#0-Red.
Code-LLM	Code	**59.8**	**35**	**30.5**	**64**	**63 (48.5%)**
Code-LLM	NL	43.4	24	60.9	**13**	22 (16.9%)
NL-LLM	Code	41.0	26	**45.8**	11	**23 (20.9%)**
NL-LLM	NL	**59.5**	**36**	67.0	7	15 (13.6%)

Table 7: Overview of zero-shot performance (%) and redundancy (%) of different models and prompt modalities across 10 tasks. GPT-3.5 and DeepSeek are counted as both Code- and NL-LLMs (see Section 3.2). Reported are mean performance ($\overline{X}$), mean redundancy ($\overline{R}$), number of group-wise wins (**totally 110 comparisons** among the four variants) for performance and redundancy, and count of experiments with zero-redundancy (#0-Red.). Best two scores are in bold.

	Model	$\overline{X}$	#Win Perf.	$\overline{R}$	#Win Red.
Few-shot (9 tasks)	Code-LLM	62.2	54	23.3	81
	NL-LLM	50.6	41	68.9	7
Zero-shot (9 tasks)	Code-LLM	56.5	59	27.9	68
	NL-LLM	51.4	30	70.4	6

Table 8: Overview of few-shot performance (%) and redundancy (%) of Code-LLMs using code prompts and NL-LLMs using natural language prompts, compared against zero-shot results. We exclude SemEval for both few-shot and zero-shot for fair comparison.

adhering strictly to the format specification. By contrast, most evaluted open-source NL-LLMs frequently add unsolicited text (e.g. *Based on the information* or *I am not sure*) although prompted with concise output constraints (*answer with the label only*). This indicates the strength of Code-LLMs of producing format-faithful outputs that require less post-processing for classification tasks.

Cross-modal prompting. To disentangle the effects of prompt style from those of model pre-training, we conduct zero-shot experiments where NL-LLMs are prompted with code prompts and Code-LLMs with NL prompts. We present the performance (Table 13) and redundancy (Table 14) of all in-modal and cross-modal experiments in Appendix B, and summarize the results in Table 7. Our results show that: (1) cross-modal prompting does not consistently help overall performance of Code- (35 wins to 24) and NL-models (36 wins to 26), but can yield gains in specific cases, e.g., prompting Qwen3-30B-Instruct boosts performance in 6 out of the 10 tasks. (2) Code prompts substantially reduce redundancy for both Code- and NL-LLMs. Compared with NL prompts, code prompts produce 41 additional zero-redundancy cases across 130 runs with code models, and 8 additional zero-redundancy cases across 110 runs with NL models. We attribute the lower redundancy to the prompt style rather than pre-training effects alone.

4.2 Few-shot Results

We present few-shot results including raw performance metrics (Table 15) and redundancy (Table 16) in Appendix B. Group-wise comparisons against the zero-shot baseline are summarized in Table 8. We observe the inclusion of few-shot examples does not universally improve performance. For example, while few-shot prompting boosts the performance of Qwen3-30B-Instruct and Qwen2.5-32B-Instruct by 13.6 and 19.0 percentage points respectively, it induces a severe 23.0-point degradation for gemma-2b on the AGNews dataset. The outlier behavior explains the apparent paradox in our macro-level results: the mean performance of NL-LLMs decreases slightly with few-shot despite achieving a higher win rate against Code-LLMs.

4.3 Results of Multilinguality

To assess multilingual abilities of Code-LLMs, we first select the best performing (indicated by highest mean score across tasks $\overline{X}$ in Table 4) code model from each of the 5 providers: GPT-3.5 Turbo, DeepSeek-V3.1, Qwen3-Coder-30B, CodeLlama-13b and codegemma-7b; then we experiment in different programming and human languages.

Programming languages. We translate code prompts (originally in Python) into three additional programming languages: two high-resource (JavaScript and C++) and one relatively low-resourced (Ruby). All four languages share a property: they support one-line, assert-style unit tests, enabling a consistent prompt structure across lan-

Model	AR	BG	DE	EL	EN	ES	FR	HI	RU	SW	TH	TR	UR	VI	ZH	Avg.
GPT-3.5 Turbo (Code)	57.8	60.4	63.5	59.0	68.0	63.3	63.2	52.2	59.2	56.3	52.6	58.0	49.2	58.7	59.9	58.8
DeepSeek-V3.1 (Code)	71.0	74.2	74.5	73.4	75.6	74.4	75.8	70.6	73.4	64.5	70.1	71.5	66.1	73.0	74.3	72.2
Qwen3-Coder-30B	72.5	75.3	75.1	73.2	84.2	79.1	77.7	68.1	74.0	62.4	69.4	71.6	61.2	74.5	76.0	73.0
CodeLlama-13b	45.7	51.5	52.5	43.4	57.6	54.1	54.5	40.1	53.4	33.7	43.2	47.8	42.5	48.3	49.2	47.8
codegemma-7b	49.0	51.9	53.8	49.5	57.2	55.8	53.9	45.0	52.5	46.2	49.0	51.7	42.2	49.5	50.4	50.5
Avg.	59.2	62.7	63.9	59.7	68.5	65.3	65.0	55.2	62.5	52.6	56.9	60.1	52.2	60.8	62.0	
Ranking by Avg.	#11	#5	#4	#10	#1	#2	#3	#13	#7	#14	#12	#9	#15	#8	#6	

Table 9: Zero-shot accuracy (%) of XNLI over 15 languages. The prompt is presented in Appendix E.5. Evaluated languages are AR (Arabic), BG (Bulgarian), DE (German), EL (Greek), EN (English), ES (Spanish), FR (French), HI (Hindi), RU (Russian), SW (Swahili), TH (Thai), TR (Turkish), UR (Urdu), VI (Vietnamese), and ZH (Chinese).

guages (see Appendix E for all translated prompts).

We conduct zero-shot experiments with translated code prompts on four datasets, one drawn from each task category. As shown in Table 6, performance remains highly consistent across programming languages. For each task, we average scores over five models per language and then compare these language-wise averages. The resulting divergences are minimal: 0.8% for SST, 1.0% for MRPC, 2.1% for SemEval, and 3.3% for HCC-Staging — indicating that the world knowledge encoded in Code-LLMs to perform evaluated NLP tasks is largely programming-language agnostic, transferring robustly across these 4 languages.

Human languages. We further evaluate Code-LLMs on non-English inputs using dataset XNLI. Since XNLI provides sentence-aligned translations across 15 languages, it allows direct, language-wise comparison. We keep the prompt template in English and add a short instruction indicating the language such as "*Both premise and hypothesis are written in German*". Table 9 shows Code-LLMs perform best on English (68.5%), followed by other high-resource European languages such as Spanish, French and German. A substantial drop appears for lower-resource languages (e.g., -16.3% for Urdu, -15.9% for Swahili). Table 10 in Appendix B spotlights these five Code-LLMs across English and Chinese. The two China-based models (DeepSeek, Qwen-Coder) exhibit the smallest relative accuracy drop when switching from English to Chinese.

5 Related Work

Evaluating Code-LLMs has largely focused on code generation, either from natural language instructions (e.g., MBPP (Austin et al., 2021), CODE-JUDGE (Tong and Zhang, 2024), CodeArena (Yang et al., 2025c)) or from partial code contexts (*auto-completion*), such as HumanEval (Chen et al., 2021) and RepoBench (Liu et al., 2024). Some recent benchmarks extend this scope to broader software engineering tasks, including unit test generation (Yang et al., 2024) and Github issue-driven code modification (Jimenez et al., 2024). To our knowledge, the general NLP capabilities of Code-LLMs remain largely unexplored.

However, **applying Code-LLMs to NLP** has shown promise in specific settings. Li et al. (2023) show that code-style prompting with Code-LLMs can outperform NL-LLMs on information extraction tasks in few-shot scenarios and introduce *format fidelity* to assess whether generated code conforms to a parsable Python dictionary structure. Mohajeri et al. (2024) evaluate CodeLlama on three TC and one NLI task, also under few-shot settings. Zhang et al. (2023a) explore code-style prompts with GPT models for generation tasks such as QA and summarization, again relying on few-shot demonstrations. Our work extends this line of research through a systematic evaluation of Code-LLMs over a broad spectrum of NLP tasks and model families, across both zero-shot and few-shot regimes and multilingual settings.

6 Conclusion

In this paper, we introduce CODE-PROMPT, an evaluation framework for benchmarking Code-LLMs on a range of NLP tasks using code-style prompts. Our results demonstrate that Code-LLMs achieve comparable performance to their parallel-sized NL-LLMs (winning approximately half of the comparisons), while exhibiting operational advantages such as reduced redundant generation and strong transferability across programming languages. Specifically, under zero-shot code-style prompting, Code-LLMs generate exact label-only outputs in 48.5% of the experiments, substantially outperforming NL-LLMs prompted in NL-style (13.6%). This behavioral trait can reduce downstream parsing overhead, e.g. in a complex workflow. As a first systematic work evaluating code models on general NLP, our findings provide a foundational baseline to drive future research at the intersection of code intelligence and NLP.

Limitations

Potential data leakage in LLMs. A major source of bias in benchmarking large language models is data leakage (Xu et al., 2024; Zhou et al., 2025), where a benchmarked dataset may have been included in a model's pre-training corpus. Such leakage can inflate reported performance and undermine fair comparison. While many of the datasets evaluated in this work were released prior to the deployment of modern LLMs, Table 1 shows that **MSciNLI** (released in 2024) and our proposed **HCC-Staging** dataset are relatively recent, and therefore less likely to be present in model pre-training data. We find that our main conclusions remain consistent when focusing on these two datasets: Code-LLMs achieve performance comparable to NL-LLMs, exhibit substantially better redundancy, and (on HCC-Staging) demonstrate strong transferability across programming languages. Nevertheless, we cannot fully rule out indirect exposure through continuously updated training pipelines, and the results should therefore be interpreted with this limitation in mind.

Limited access to the latest models. As discussed in Section 3.2, our evaluation includes the most recent Code-LLMs that are publicly accessible at the time of study, either as open-weight checkpoints or via a public code-completion API. However, evaluating the very latest coding models is constrained by limited openness in the ecosystem: (1) several proprietary model families that power state-of-the-art coding assistants (e.g., Gemini and Claude) are closed-source and do not provide a public code-completion API. (2) Some open-weight model lines, such as CodeLlama and codegemma, have not released updated code-specialized variants beyond the versions evaluated in this work.

We view this limitation as highlighting the importance of **continued openness** in (Code-)LLM development for future research, and we acknowledge providers such as DeepSeek and Qwen for consistently releasing up-to-date coding models to the research community.

Ethics Statement

The **HCC-Staging** dataset is derived from clinical reports and therefore involves sensitive patient information. To ensure ethical compliance and protect patient privacy, we take the following measures: (1) The source hospital anonymizes the original reports by removing direct identifiers such as patient names and dates of birth (replaced by age). (2) We will publish the ethic code from our partner hospital upon acceptance. (3) To further reduce re-identification risk, we slightly perturbed all tumor dimensions (e.g., `17 mm` adjusted to `15 mm`, `9 x 9 x 8 mm` adjusted to `8 x 8 x 5 mm`) while preserving the original staging outcome under the Milan criteria. The final post-processed dataset was reviewed and approved by the annotator. Here we explicitly specify non-commercial research-only use for this HCC-Staging dataset.

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A Implementation Details

Model access and licenses. The links (given as URL) of the evaluated models in this paper are listed in Table 11.

OpenAI models (such as GPT-3.5-Turbo) are governed by a proprietary license[6], which permits usage via their APIs for both businesses and developers. DeepSeek uses a custom license for its models that allows free distribution, reproduction and usage of model copies under certain conditions (refer to Section 4 and Attachment A from `https://github.com/deepseek-ai/DeepSeek-Coder/blob/main/LICENSE-CODE`) which we meet. Qwen models are generally available under the permissive Apache 2.0 License[7]. Llama and Gemma models use their custom licenses[8]. For this study, we strictly adhere to the terms and conditions defined by each license: we access proprietary models via their respective APIs and locally reproduce copies of the open-weight models solely for evaluation purposes, without modification or redistribution. All uses remain compliant with the terms of use defined in the aforementioned licenses, limiting our scope to research.

Model deployment. For inference, we follow the appropriate computation framework for each provider: GPT and DeepSeek models are accessed through their official APIs, while all other models are run locally: NL-LLMs using `vLLM` (Kwon et al., 2023) and Code-LLMs using the HuggingFace `transformers` (Wolf et al., 2020) library.

`vLLM` is widely used for efficient inference in recent NL-LLM studies (Salemi et al., 2025; Feng et al., 2025), but it primarily supports instruction-mode generation. In contrast, code completion is natively supported by `transformers`, which is also the officially recommended framework for *all* locally evaluated Code-LLMs in this work, including Qwen Coder[9], codegemma[10] and CodeLlama[11]. To ensure fair comparison across models, we further fix the maximum output length to 16 tokens,

[6] `https://openai.com/policies/terms-of-use/`

[7] `https://github.com/QwenLM/Qwen?tab=Apache-2.0-1-ov-file`

[8] `https://www.llama.com/llama2/license/` and `https://ai.google.dev/gemma/terms`

[9] `https://github.com/QwenLM/Qwen3-Coder/blob/main/README.md`

[10] `https://huggingface.co/google/codegemma-7b`

[11] `https://huggingface.co/meta-llama/CodeLlama-7b-hf`

which matches the default setting in vLLM[12] and comfortably covers the length of all target labels used in our tasks (see Table 1).

Computation infrastructure. To ensure full-precision inference, models with at least 30B parameters (e.g., the 30B and 32B Qwen models) are run on a single NVIDIA H200 GPU, while smaller models are run on a single NVIDIA A100 GPU.

B Detailed Experimental Results

Table 10 spotlights the zero-shot performance of five Code-LLMs across the English and Chinese splits from the XNLI dataset.

Table 13 and Table 14 present the performance and redundancy scores of all zero-shot experiments, respectively. Both *in-modal* (Code-LLMs with code prompts and NL-LLMs with NL prompts) and *cross-modal* (Code-LLMs with NL prompts and NL-LLMs with code promtps) are included.

Table 15 and Table 16 present the performance and redundancy scores of few-shot experiments, respectively.

Model	English	Chinese	Drop by (%)
DeepSeek-V3.1 (Code)	0.756	0.743	**-1.72**
Qwen3-Coder-30B	0.842	0.760	**-9.74**
codegemma-7b	0.572	0.504	-11.89
GPT-3.5 Turbo (Code)	0.680	0.599	-11.91
CodeLlama-13b	0.576	0.492	-14.58

Table 10: Comparison of zero-shot accuracy between English (EN) and Chinese (ZH) subsets of XNLI. The drop ratio is measured relative to the English score, i.e. $(\text{score}_{ZH} - \text{score}_{EN})/\text{score}_{EN}$.

C Effect of Components in Code Prompt

To analyze the contribution of individual components in our code-style prompt, we conduct an ablation study with four prompt variants on the HCC-Staging dataset. We choose HCC-Staging because, as discussed in the Limitations section, it is newly introduced and thus minimizes the risk of data leakage during LLM pre-training. The four prompt variants are defined as follows:

full: the original code prompt (see the Python prompt in Appendix E.10 for example);

–typing: the full prompt with type hints (e.g., `Literal["True", "False"]`) removed;

–docstring: the full prompt with the docstring removed;

[12] https://docs.vllm.ai/en/v0.8.4/api/inference_params.html

Model	URL
GPT-3.5-Turbo	https://platform.openai.com/docs/models/gpt-3.5-turbo
DeepSeek-V3.1	https://api.deepseek.com/beta (API until 2025/09/21) and https://huggingface.co/deepseek-ai/DeepSeek-V3.1
Qwen3-Coder-30B	https://huggingface.co/Qwen/Qwen3-Coder-30B-A3B-Instruct
Qwen3-30B-Instruct	https://huggingface.co/Qwen/Qwen3-30B-A3B-Instruct-2507
Qwen2.5-Coder-32B	https://huggingface.co/Qwen/Qwen2.5-Coder-32B
Qwen2.5-32B-Instruct	https://huggingface.co/Qwen/Qwen2.5-32B-Instruct
Qwen2.5-Coder-14B	https://huggingface.co/Qwen/Qwen2.5-Coder-14B
Qwen2.5-14B-Instruct	https://huggingface.co/Qwen/Qwen2.5-14B-Instruct
Qwen2.5-Coder-7B	https://huggingface.co/Qwen/Qwen2.5-Coder-7B
Qwen2.5-7B-Instruct	https://huggingface.co/Qwen/Qwen2.5-7B-Instruct
Qwen2.5-Coder-3B	https://huggingface.co/Qwen/Qwen2.5-Coder-3B
Qwen2.5-3B-Instruct	https://huggingface.co/Qwen/Qwen2.5-3B-Instruct
CodeLlama-13b	https://huggingface.co/meta-llama/CodeLlama-13b-hf
CodeLlama-13b-Python	https://huggingface.co/meta-llama/CodeLlama-13b-Python-hf
Llama-2-13b	https://huggingface.co/meta-llama/Llama-2-13b-hf
CodeLlama-7b	https://huggingface.co/meta-llama/CodeLlama-7b-hf
CodeLlama-7b-Python	https://huggingface.co/meta-llama/CodeLlama-7b-Python-hf
Llama-2-7b	https://huggingface.co/meta-llama/Llama-2-7b-hf
codegemma-7b	https://huggingface.co/google/codegemma-7b
gemma-7b	https://huggingface.co/google/gemma-7b
codegemma-2b	https://huggingface.co/google/codegemma-2b
gemma-2b	https://huggingface.co/google/gemma-2b

Table 11: The URLs of evaluated models.

Model	full	-typing	-docstring	-both
		Accuracy		
DeepSeek-V3.1 (Code)	**83.9**	80.0	**83.9**	0.0
GPT-3.5 Turbo (Code)	58.1	**64.5**	61.3	0.0
Qwen3-Coder-30B	**67.7**	64.5	58.1	0.0
codegemma-7b	67.7	**70.9**	64.5	0.0
CodeLlama-13b	51.6	**61.2**	54.8	0.0
Avg.	65.8	**68.3**	64.5	0.0
		Redundancy		
DeepSeek-V3.1 (Code)	**0.0**	**0.0**	**0.0**	100.0
GPT-3.5 Turbo (Code)	**0.0**	**0.0**	**0.0**	100.0
Qwen3-Coder-30B	30.9	**29.8**	30.4	100.0
codegemma-7b	**0.0**	**0.0**	**0.0**	100.0
CodeLlama-13b	**0.0**	91.3	91.2	100.0
Avg.	**6.2**	24.2	24.3	100.0

Table 12: Comparison of the four prompt variants in zero-shot results (%) over the HCC-Staging dataset.

–both: the full prompt with both type hints and the docstring removed. The resulting prompt

Model	TC			NLI			RC		NR		$\overline{X}$	#Win
	SST-2 *Acc*	**AG News** *Acc*	**CoLA** *MCC*	**MRPC** *Acc*	**XNLI** *Acc*	**MSciNLI** *Macro-F1*	**SemEval** *Micro-F1*	**SciERC** *Micro-F1*	**Iris** *Acc*	**HCC-Staging** *Acc*		
GPT-3.5 Turbo (Code)	**94.6**	61.3	57.6	73.7	68.0	**37.5**	45.2	44.6	92.7	58.1	63.3	2
GPT-3.5 Turbo (NL)	93.1	**62.5**†	**64.1**	**76.7**	**68.4**	34.2	**48.9**	**50.4**	**96.0**	**64.5**	**65.9**	8
DeepSeek-V3.1 (Code)	**95.1**	**60.0**	66.6	76.6	75.6	60.4	**62.0**†	**59.2**	**96.7**†	**83.9**†	**73.6**†	6
DeepSeek-V3.1 (NL)	94.6	56.7	**67.9**	**78.5**	**83.3**	**63.1**	29.0	34.0	96.0	80.6	68.4	4
Qwen3-Coder-30B	94.0	60.8	60.9	**79.2**†	**84.2**	49.8	46.8	45.9	**96.0**	67.7	68.5	3
Qwen3-Coder-30B (NL)	*93.8*	***61.8***	***83.7***†	*0.1*	*0.0*	***86.1***†	***57.8***	*77.6*	*90.7*	*67.7*	*61.9*	*4*
Qwen3-30B-Instruct	**95.3**†	61.7	67.2	74.7	73.8	41.2	49.1	53.6	30.0	**74.2**	62.1	2
Qwen3-30B-Instruct (Code)	*94.7*	*62.3*	*84.0*	*51.9*	*48.5*	*83.4*	*55.9*	***77.7***	*94.0*	*64.5*	***71.7***	*1*
Qwen2.5-Coder-32B	**94.8**	50.4	49.7	77.7	77.8	44.0	42.6	**59.8**†	94.5	**80.6**	67.2	3
Qwen2.5-Coder-32B (NL)	*0.1*	*3.6*	*32.9*	*43.6*	*56.0*	***84.9***	*51.7*	*52.2*	*88.0*	*16.1*	*42.9*	*1*
Qwen2.5-32B-Instruct	93.5	**61.4**	**67.1**	**78.5**	**89.1**†	58.2	**57.3**	49.0	**96.0**	64.5	**71.5**	6
Qwen2.5-32B-Instruct (Code)	*0.0*	*0.0*	*0.2*	*29.9*	*7.9*	*2.6*	*17.5*	*7.2*	*0.0*	*0.0*	*6.5*	*0*
Qwen2.5-Coder-14B	**94.5**	51.6	46.1	73.4	82.2	46.4	33.1	56.8	68.7	**71.0**	62.4	2
Qwen2.5-Coder-14B (NL)	*0.0*	*33.9*	*36.5*	*40.2*	*58.9*	***77.4***	*43.4*	*21.2*	*36.0*	*0.0*	*34.8*	*1*
Qwen2.5-14B-Instruct	89.8	**59.2**	**65.1**	**77.0**	**84.6**	52.6	**51.2**	**57.8**	**90.0**	61.3	**68.9**	7
Qwen2.5-14B-Instruct (Code)	*0.2*	*1.4*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.2*	*0*
Qwen2.5-Coder-7B	**93.8**	49.1	49.6	**69.4**	77.4	44.4	31.3	18.4	**86.0**	48.4	56.8	3
Qwen2.5-Coder-7B (NL)	*23.2*	*23.1*	*48.2*	*35.3*	*27.5*	***50.6***	*34.3*	***76.5***	*82.0*	*54.8*	*45.6*	*2*
Qwen2.5-7B-Instruct	89.6	**57.8**	58.5	50.6	**80.3**	22.8	**42.7**	46.0	78.7	**67.7**	**59.5**	4
Qwen2.5-7B-Instruct (Code)	*63.8*	*11.1*	***76.1***	*0.0*	*0.0*	*50.1*	*25.5*	*39.3*	*39.3*	*3.2*	*30.8*	*1*
Qwen2.5-Coder-3B	**90.1**	32.5	40.0	**69.7**	65.8	**42.1**	31.8	49.8	**72.7**	51.6	**54.6**	4
Qwen2.5-Coder-3B (NL)	*50.2*	*23.7*	*36.2*	*34.1*	*58.2*	*39.6*	*34.2*	***54.7***	*53.3*	*45.2*	*42.9*	*1*
Qwen2.5-3B-Instruct	88.9	**52.9**	**52.8**	49.9	**75.9**	22.0	**36.5**	47.8	33.3	**64.5**	52.5	5
Qwen2.5-3B-Instruct (Code)	*62.3*	*23.7*	*0.0*	*0.0*	*0.0*	*19.9*	*0.3*	*1.2*	*33.3*	*16.1*	*15.7*	*0*
CodeLlama-13b	89.0	37.9	30.3	68.0	**57.6**	22.9	**36.3**	14.9	54.0	51.6	46.3	2
CodeLlama-13b (NL)	*0.0*	*2.0*	*0.0*	*20.0*	*43.3*	*1.2*	*24.9*	***70.8***	*0.0*	*48.4*	*21.1*	*1*
CodeLlama-13b-Python	88.1	**48.7**	22.0	**74.0**	56.1	35.2	29.6	14.9	34.0	51.6	45.4	2
CodeLlama-13b-Python (NL)	*4.7*	*22.1*	*0.4*	*23.6*	*14.5*	*2.0*	*1.7*	*26.7*	*0.0*	*45.2*	*14.1*	*0*
Llama-2-13b	39.0	14.7	3.7	27.8	44.3	19.5	20.4	15.2	0.0	48.4	23.3	0
Llama-2-13b (Code)	***91.6***	*43.5*	***72.5***	*27.2*	*14.5*	***37.7***	*27.0*	*66.5*	***60.7***	***71.0***	***51.2***	*5*
CodeLlama-7b	**89.3**	53.3	14.7	66.7	38.9	15.6	23.9	14.0	**37.3**	**48.4**	40.2	1 (2)
CodeLlama-7b	*0.0*	*1.2*	*0.0*	*21.4*	*10.3*	*5.5*	*7.6*	*62.5*	*0.0*	*12.9*	*12.1*	*0*
CodeLlama-7b-Python	**89.3**	**54.9**	26.4	**69.1**	**53.4**	20.2	25.3	17.1	33.3	**48.4**	43.7	3 (2)
CodeLlama-7b-Python (NL)	*0.1*	*21.2*	*8.9*	*11.8*	*12.6*	*12.3*	*3.0*	*11.8*	*0.0*	*9.7*	*9.1*	*0*
Llama-2-7b	42.1	14.5	-6.0	22.6	20.0	11.9	20.5	2.4	0.0	35.5	16.4	0
Llama-2-7b (Code)	*82.1*	*52.7*	***69.7***	*21.3*	*12.9*	***53.0***	***30.8***	***66.5***	*33.3*	***48.4***	***47.1***	*4 (1)*
codegemma-7b	**91.9**	**51.0**	17.6	**73.6**	**57.2**	28.0	**35.3**	30.9	**66.7**	67.7	**52.0**	5 (1)
codegemma-7b (NL)	*6.9*	*1.1*	***72.1***	*32.4*	*10.9*	*19.8*	*20.8*	*71.3*	*0.0*	***74.2***	*31.0*	*2*
gemma-7b	41.2	18.9	5.4	63.7	43.8	24.7	21.6	7.7	**66.7**	48.4	34.2	0 (1)
gemma-7b (Code)	*88.0*	*42.9*	*49.9*	*34.7*	*37.8*	***53.2***	*26.0*	***71.7***	*50.0*	*58.1*	*51.2*	*2*
codegemma-2b	**79.4**	**31.4**	0.0	**66.5**	**34.4**	10.4	25.6	12.9	33.3	**48.4**	34.2	4 (1)
codegemma-2b (NL)	*51.5*	*25.5*	*69.0*	*2.5*	*4.0*	*1.1*	*18.2*	*4.0*	*33.3*	***48.4***	*25.8*	*0 (1)*
gemma-2b	51.6	24.0	2.9	31.6	19.5	11.6	20.3	21.1	33.3	45.2	26.1	0
gemma-2b (Code)	*72.6*	*26.3*	***69.1***	*24.2*	*10.3*	***41.3***	***29.1***	***66.6***	*33.3*	***48.4***	***42.1***	*5 (1)*

Table 13: Zero-shot performance (%) of in-modal (NL-LLMs using NL prompts and Code-LLMs using code prompts) as well as *cross-modal* (marked as *italic*: NL-LLMs using code prompts and Code-LLMs using NL prompts). The higher score within each group is highlighted in bold. The highest score of each task is denoted with †. *Acc*: Accuracy. *MCC*: Matthews correlation coefficient. $\overline{X}$: the arithmetic mean across 10 tasks. **#Win**: Number of **group-wise wins (and draws recorded in bracket)** across 10 tasks.

contains only the function signature (i.e., `def HCC_staging(text: str):`) followed by an empty function body (`pass`).

Table 12 reports the zero-shot accuracy and redundancy of the four prompt variants. The evaluated models are the best performing ones in general across 10 tasks (see Section 4.3 for selection criteria). (1) **Accuracy**: removing either type hints or the docstring leads to a comparable and modest accuracy change (less than 0.03) from the full prompt. In contrast, removing both components (i.e., leaving only the function name and its argument) results in zero accuracy. This indicates a low risk of data leakage and confirms that the task cannot be solved from prior knowledge alone, but instead requires explicit rule specification provided by the prompt. (2) **Redundancy**: removing either component has no effect on redundancy for DeepSeek-V3.1, GPT-3.5 Turbo, and CodeGemma-7B, but increases redundancy for CodeLlama. Overall, the full prompt consistently achieves the best balance between accuracy and redundancy across models.

D Annotation Details

For the HCC-Staging dataset, a specialized physician from a German university hospital extracted tumor size information following the instruction: *Reports more than 12 months prior to the tumor*

Model	TC			NLI			RC		NR		$\overline{R}$	#Win
	SST-2	AG News	CoLA	MRPC	XNLI	MSciNLI	SemEval	SciERC	Iris	HCC-Staging		
GPT-3.5 Turbo (Code)	**0.0**	26.0	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.6**	2 (7)
GPT-3.5 Turbo (NL)	**0.0**	**25.2**	**0.0**	**0.0**	**0.0**	**0.0**	7.6	10.7	**0.0**	**0.0**	4.4	1 (7)
DeepSeek-V3.1 (Code)	**0.0**	**24.4**	**0.0**	**0.0**	0.2	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.5**	3 (6)
DeepSeek-V3.1 (NL)	**0.0**	25.3	**0.0**	**0.0**	**0.0**	**0.0**	92.5	77.3	**0.0**	**0.0**	19.5	1 (6)
Qwen3-Coder-30B	20.0	36.7	16.1	**13.7**	**16.3**	19.0	**6.9**	**10.3**	19.9	30.9	**19.0**	4
Qwen3-Coder-30B (NL)	***0.1***	***26.6***	***0.0***	*99.9*	*100.0*	***1.3***	*8.8*	*11.6*	***3.3***	***27.5***	*27.9*	*6*
Qwen3-30B-Instruct	88.5	93.0	85.2	84.1	83.8	89.6	79.0	87.4	97.4	90.8	87.9	0
Qwen3-30B-Instruct (Code)	*83.4*	*87.2*	*80.8*	*74.3*	*81.9*	*79.9*	*84.0*	*55.8*	*82.6*	*91.4*	*80.1*	*0*
Qwen2.5-Coder-32B	**0.0**	**29.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.9**	6 (4)
Qwen2.5-Coder-32B (NL)	*99.9*	*96.1*	*83.1*	*7.1*	*10.7*	*3.5*	*2.0*	*33.0*	*6.7*	*91.3*	*43.3*	*0*
Qwen2.5-32B-Instruct	71.6	83.5	81.4	86.8	88.3	88.5	78.8	87.3	51.0	88.6	80.6	0
Qwen2.5-32B-Instruct (Code)	***0.0***	*100.0*	***0.0***	*28.2*	*2.5*	*79.2*	*90.2*	*86.8*	***0.0***	***0.0***	*38.7*	*0 (4)*
Qwen2.5-Coder-14B	**0.0**	**26.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**	**2.6**	8 (2)
Qwen2.5-Coder-14B (NL)	*100.0*	*79.7*	*78.6*	*13.7*	*20.6*	*0.2*	*5.5*	*79.1*	*90.4*	*100.0*	*56.8*	*0*
Qwen2.5-14B-Instruct	80.7	92.1	83.5	86.9	88.6	88.8	78.5	87.8	77.3	92.2	85.6	0
Qwen2.5-14B-Instruct (Code)	*99.9*	*99.5*	***0.0***	*99.9*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	***0.0***	*79.9*	*0 (2)*
Qwen2.5-Coder-7B	**0.0**	**21.4**	**0.6**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.2**	9 (1)
Qwen2.5-Coder-7B (NL)	*76.8*	*92.8*	*88.4*	*33.5*	*82.1*	*31.5*	*17.3*	*1.0*	***0.0***	*82.9*	*50.6*	*0 (1)*
Qwen2.5-7B-Instruct	89.2	92.7	86.8	85.7	83.6	90.0	80.2	88.4	89.3	92.0	87.8	0
Qwen2.5-7B-Instruct (Code)	*58.0*	*90.7*	*64.6*	*100.0*	*100.0*	*86.6*	*89.9*	*89.5*	*92.4*	*99.7*	*87.1*	*0*
Qwen2.5-Coder-3B	**0.0**	**5.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.6**	9 (1)
Qwen2.5-Coder-3B (NL)	*32.3*	*68.1*	*91.8*	*7.5*	*11.0*	*51.7*	*22.4*	*48.2*	***0.0***	*24.8*	*35.8*	0 (1)
Qwen2.5-3B-Instruct	89.2	93.1	85.5	68.1	86.5	91.1	80.1	88.6	94.9	93.2	87.0	0
Qwen2.5-3B-Instruct (Code)	*88.9*	*91.3*	*100.0*	*100.0*	*100.0*	*95.6*	*99.9*	*99.7*	*89.1*	*96.5*	*96.1*	0
CodeLlama-13b	84.6	89.9	80.4	80.0	78.3	79.3	71.4	81.5	83.4	91.8	82.1	0
CodeLlama-13b (NL)	*99.9*	*98.9*	***0.0***	*50.5*	*24.0*	*99.5*	*81.7*	*74.6*	***0.0***	*91.7*	***62.1***	1 (1)
CodeLlama-13b-Python	84.7	**89.2**	77.1	78.0	78.3	79.7	77.5	74.5	87.1	91.3	81.7	1
CodeLlama-13b-Python (NL)	*87.3*	*90.2*	*88.4*	***4.1***	***0.7***	*99.3*	*99.2*	*80.4*	***0.0***	*91.9*	*64.2*	2 (1)
Llama-2-13b	**79.6**	94.0	**75.9**	99.3	97.3	95.5	**52.5**	**13.0**	100.0	90.8	79.8	4
Llama-2-13b (Code)	*83.1*	*87.8*	*77.0*	*65.4*	*79.4*	***77.0***	*79.8*	*79.2*	*79.9*	***87.6***	*79.6*	2
CodeLlama-7b	84.1	85.8	79.2	79.2	75.9	78.3	59.4	77.9	81.5	**89.5**	79.1	1
CodeLlama-7b (NL)	*99.9*	*99.4*	*100.0*	***4.8***	***8.6***	*97.5*	*96.8*	*82.9*	***0.0***	*96.8*	*68.7*	2 (1)
CodeLlama-7b-Python	**11.1**	82.4	**20.7**	74.6	31.4	78.1	62.5	**70.3**	85.9	93.6	**61.1**	4
CodeLlama-7b-Python (NL)	*66.7*	*92.0*	*82.6*	*8.1*	*19.0*	*93.7*	*98.1*	*95.4*	***0.0***	*97.8*	*65.3*	0 (1)
Llama-2-7b	80.4	93.6	96.6	98.8	99.8	99.6	**46.4**	89.0	100.0	94.3	89.9	1
Llama-2-7b (Code)	*81.8*	***82.2***	*74.5*	*62.9*	*73.6*	***74.1***	*78.2*	*78.9*	*81.8*	***89.5***	*77.8*	2 (1)
codegemma-7b	**0.0**	**24.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.4**	10
codegemma-7b (NL)	*91.8*	*99.4*	*84.1*	*82.4*	*88.2*	*95.2*	*89.8*	*79.9*	*93.2*	*1.9*	*80.6*	0
gemma-7b	50.5	92.1	87.1	83.6	77.4	77.6	79.8	89.5	94.4	92.4	82.4	0
gemma-7b (Code)	*11.1*	*50.4*	*8.0*	*7.6*	*10.6*	*81.2*	*81.6*	*72.7*	*12.0*	*19.5*	*35.5*	0
codegemma-2b	**0.0**	**0.9**	67.9	84.9	**4.6**	**0.5**	**0.1**	**0.7**	**0.0**	**0.0**	16.0	7 (1)
codegemma-2b (NL)	*17.1*	*80.5*	*62.9*	*90.6*	*79.2*	*93.8*	*87.5*	*96.9*	*79.2*	*85.2*	*77.3*	0
gemma-2b	81.8	89.4	90.5	91.2	91.1	70.2	81.0	75.3	**0.0**	3.2	67.4	0 (1)
gemma-2b (Code)	*11.1*	*17.3*	***9.1***	***6.5***	*9.2*	*9.7*	*9.0*	*9.1*	*14.3*	*20.0*	***11.5***	2

Table 14: Redundancy (%) (defined in Section 3.3; the lower, the better) of zero-shot experiments. The lower redundancy in each comparison is highlighted in bold. $\overline{R}$: mean redundancy across 10 tasks. **#Win**: Number of **group-wise wins (and draws recorded in bracket)** across 10 tasks.

board meeting are excluded. Only tumor size information (number + unit) is extracted, and multiple tumor sizes may be annotated for a single report. The annotator was compensated according to the hospital's tariff, which is above the local minimum wage. The annotation process required approximately 12 hours in total, distributed over several weeks, with no more than 6 working hours on any single day, fully complying with local labor regulations.

E Prompts

E.1 SST-2

Natural language prompt.

```
You are a data annotator for sentiment classification. Your
task is to read the following text and classify the text into
either positive or negative based on its sentiment.
Please answer directly with "positive" or "negative" only.
{few_shot_examples}
Here is the text to classify:
Input: {text}
Output:
```

Few-shot example in natural language:

```
Input: {text}
Output: {label}
```

Code prompt (Python).

	TC			NLI			RC	NR			
	SST-2	**AG News**	**CoLA**	**MRPC**	**XNLI**	**MSciNLI**	**SciERC**	**Iris**	**HCC-Staging**	$\overline{X}$	**#Win**
Metric	*Acc*	*Acc*	*MCC*	*Acc*	*Acc*	*Macro-F1*	*Micro-F1*	*Acc*	*Acc*		
# Shots	4	4	4	4	4	4	2	4	4		
GPT-3.5 Turbo (Code)	93.7±0.24	**63.4**±1.42	61.1±1.73	76.8±0.48	71.5±0.57	**42.5**±0.82	**60.8**±2.80	96.0±10.97	58.1±0.54	69.3	2 (1)
GPT-3.5 Turbo (NL)	**94.6**±0.19	**63.4**±0.20	**61.9**±1.53	**78.2**±0.52	**75.5**±1.05	28.1±1.08	55.3±3.05	**96.7**±4.02	**74.2**±0.54	**69.8**	6 (1)
DeepSeek-V3.1 (Code)	94.7±0.25	**63.1**±0.51	**71.0**†±1.30	78.0±0.44	85.1±0.35	47.4±1.93	33.7±0.51	**96.0**±3.04	87.1±0.00	72.9	1 (2)
DeepSeek-V3.1 (NL)	**95.8**†±0.69	**63.1**±0.74	70.5±0.28	**80.2**†±0.43	**87.4**±0.40	**63.4**†±1.80	**66.7**±4.02	**96.0**±1.52	**90.3**†±0.00	**79.3**†	6 (2)
Qwen3-Coder-30B	**95.3**±0.19	**65.1**†±0.35	60.4±1.43	**79.0**±0.50	**86.8**±0.25	57.4±1.67	53.9±3.20	**95.7**±1.52	64.5±0.68	**73.1**	5
Qwen3-30B-Instruct	88.3±5.30	61.2±1.91	**64.1**±0.74	42.2±11.91	85.5±1.49	**60.8**±3.42	**67.2**±2.11	90.1±6.08	**77.4**±3.69	70.8	4
Qwen2.5-Coder-32B	**95.8**†±0.28	**63.9**±1.87	59.3±1.17	72.8±0.90	87.2±0.22	**53.5**±0.61	42.0±4.59	**97.8**†±3.04	**83.9**±2.08	72.9	4 (1)
Qwen2.5-32B-Instruct	94.4±0.14	**63.9**±0.32	**60.3**±1.41	**78.6**±0.56	**89.6**†±1.04	47.0±4.34	**68.0**†±2.06	95.7±10.54	64.5±0.00	**73.6**	4 (1)
Qwen2.5-Coder-14B	94.6±0.24	59.8±1.32	53.3±2.38	71.7±1.19	85.5±0.79	**50.7**±1.53	52.6±0.35	**92.8**±4.02	**77.4**±1.77	70.9	3
Qwen2.5-14B-Instruct	**95.4**±0.61	**63.6**±0.18	**59.5**±0.38	**75.7**±1.43	**85.9**±0.69	43.4±4.02	**63.5**±6.11	91.3±1.52	71.0±3.13	**72.1**	6
Qwen2.5-Coder-7B	93.5±0.52	52.0±5.17	50.2±3.52	**71.4**±0.76	82.7±1.34	35.6±5.94	26.4±1.38	88.4±5.27	**74.2**±3.13	63.8	2
Qwen2.5-7B-Instruct	**94.0**±0.24	**55.2**±1.61	**58.5**±1.76	51.4±4.52	**83.5**±0.71	**41.8**±1.35	**45.5**±5.10	**95.7**±5.48	61.3±3.04	**65.2**	7
Qwen2.5-Coder-3B	**92.1**±0.27	47.8±3.13	45.8±1.91	**71.2**±0.41	78.4±0.94	39.0±1.56	30.1±1.65	79.7±12.07	**77.4**±1.81	62.4	3
Qwen2.5-3B-Instruct	89.3±2.51	**57.1**±2.40	**51.3**±1.14	39.9±0.36	**81.9**±0.92	**46.3**±0.60	**48.4**±2.38	**89.1**±10.64	58.1±1.71	**62.4**	6
CodeLlama-13b	**91.9**±1.19	49.0±1.38	35.8±2.48	72.1±0.49	**60.0**±0.48	42.2±1.52	16.2±2.36	79.7±8.47	**51.6**±2.13	55.4	3
CodeLlama-13b-Python	88.9±1.59	**52.7**±9.30	**40.7**±4.59	**75.1**±0.34	58.5±0.47	**43.0**±2.01	**16.8**±1.30	**80.4**±12.07	48.4±4.16	**56.1**	6
Llama-2-13b	0.0±0.00	0.9±1.10	0.0±0.00	68.7±1.32	41.1±1.38	21.4±4.36	5.7±0.58	0.0±0.00	0.0±0.00	15.3	0
CodeLlama-7b	**93.7**±1.70	52.8±1.88	**24.4**±0.87	71.0±0.37	**55.8**±0.77	30.4±0.80	17.8±1.21	83.3±11.88	**67.7**±2.08	**55.2**	4
CodeLlama-7b-Python	91.9±1.52	**53.3**±1.01	9.1±1.66	**75.1**±0.18	54.0±0.44	**36.0**±3.44	**19.9**±1.56	**90.6**±9.50	64.5±1.49	54.9	5
Llama-2-7b	0.0±0.43	1.9±9.40	1.0±3.17	23.9±2.36	0.7±0.29	11.3±0.61	18.0±3.50	0.0±1.52	0.0±0.00	6.3	0
codegemma-7b	**94.0**±0.43	**62.7**±2.16	**40.3**±7.50	**54.8**±5.60	**66.1**±1.85	**48.7**±4.08	**20.8**±2.60	**91.3**±2.63	**80.6**±1.02	**62.1**	9
gemma-7b	1.4±1.55	1.8±0.60	0.0±0.96	39.2±16.12	56.7±2.01	23.7±6.45	19.0±0.50	0.0±3.04	19.4±0.00	17.9	0
codegemma-2b	**71.4**±4.58	**25.8**±0.28	**3.4**±1.88	**66.5**±0.00	**39.1**±1.19	10.0±0.00	9.3±0.17	**64.5**±13.69	**71.0**±3.47	**40.1**	7
gemma-2b	5.7±8.58	1.0±0.64	2.4±2.80	63.4±1.29	29.8±1.02	**17.8**±2.90	**12.3**±3.28	33.3±1.52	48.4±0.00	23.8	2

Table 15: Few-shot performance (%) of NL-LLMs using natural language prompts and Code-LLMs using code-based prompts. Both mean and standard deviation across three runs are reported. The higher score within each comparison is highlighted in bold. The highest score of each task is denoted with †. *Acc*: Accuracy. *MCC*: Matthews correlation coefficient. $\overline{X}$ denotes the arithmetic mean across 9 tasks (SemEval excluded, see Section 3.3). **#Win**: Number of **group-wise wins (and draws recorded in bracket)** across 9 tasks.

	TC			NLI			RC	NR			
	SST-2	**AG News**	**CoLA**	**MRPC**	**XNLI**	**MSciNLI**	**SciERC**	**Iris**	**HCC-Staging**	$\overline{R}$	**#Win**
# Shots	4	4	4	4	4	4	2	4	4		
GPT-3.5 Turbo (Code)	**0.0**±0.00	25.2±0.04	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	**0.0**±0.02	**0.3**±0.11	**0.0**±0.00	**0.0**±0.00	**2.8**	1 (7)
GPT-3.5 Turbo (NL)	**0.0**±0.00	**25.1**±0.14	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	10.3±0.12	**0.0**±0.00	**0.0**±0.00	3.9	1 (7)
DeepSeek-V3.1 (Code)	**0.0**±0.00	**25.3**±0.09	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	94.5±0.00	**0.0**±0.00	**0.0**±0.00	13.3	5 (3)
DeepSeek-V3.1 (NL)	**0.0**±0.00	25.4±0.03	2.6±0.00	**0.0**±0.00	10.5±0.00	6.8±0.00	**0.0**±0.00	2.4±0.00	**0.0**±0.00	**5.3**	1 (3)
Qwen3-Coder-30B	**19.3**±0.55	**38.6**±1.07	**15.9**±0.15	**14.3**±1.86	**17.6**±0.15	**18.5**±0.14	**14.7**±0.59	**19.9**±0.33	**29.5**±0.01	**20.9**	9
Qwen3-30B-Instruct	88.8±1.68	92.6±0.79	86.1±0.31	79.6±1.13	84.0±0.28	88.1±0.31	54.1±5.86	98.6±0.27	92.1±0.52	84.9	0
Qwen2.5-Coder-32B	**0.0**±0.00	**25.7**±0.18	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	**2.9**	9
Qwen2.5-32B-Instruct	88.8±0.25	91.9±0.16	81.1±1.73	83.8±0.94	83.8±0.05	88.4±0.61	86.0±0.60	68.8±0.15	91.5±3.18	84.9	0
Qwen2.5-Coder-14B	**0.0**±0.00	**25.7**±1.10	**0.0**±0.00	**0.0**±0.00	**0.0**±0.02	**2.0**±7.59	**1.0**±1.26	**32.9**±0.00	**0.0**±0.00	**6.8**	9
Qwen2.5-14B-Instruct	86.2±11.22	92.1±0.16	85.4±0.24	82.5±0.61	85.9±0.44	88.7±0.23	88.6±0.47	81.5±0.41	91.3±0.27	86.9	0
Qwen2.5-Coder-7B	**0.0**±0.00	**20.4**±0.96	**0.0**±0.00	**0.0**±0.00	**68.8**±9.62	**7.2**±13.26	**0.8**±0.42	**0.0**±0.00	**0.0**±0.00	**10.8**	9
Qwen2.5-7B-Instruct	88.4±0.07	91.7±0.12	85.2±0.23	68.4±4.98	85.3±0.21	88.3±0.37	89.4±0.56	88.2±0.59	89.9±0.26	86.1	0
Qwen2.5-Coder-3B	**4.5**±5.50	**15.9**±3.82	**0.0**±0.30	**0.0**±0.05	**80.7**±9.88	**6.1**±9.98	**6.5**±3.83	**23.2**±1.41	**3.0**±2.11	**15.5**	9
Qwen2.5-3B-Instruct	59.8±6.68	92.3±0.70	81.7±1.07	68.4±3.82	84.8±0.27	86.8±0.97	86.9±0.21	82.8±0.16	93.1±0.32	81.8	0
CodeLlama-13b	84.6±0.07	89.8±0.14	80.0±0.52	**79.3**±0.24	78.3±0.30	**80.1**±0.27	80.5±0.51	83.0±0.18	91.8±0.14	83.0	1 (1)
CodeLlama-13b-Python	84.8±0.09	**88.9**±1.06	**79.8**±0.30	**79.3**±0.51	**76.8**±0.11	82.1±0.22	**74.6**±0.67	82.4±0.24	**91.7**±0.53	82.3	5 (1)
Llama-2-13b	**0.0**±0.00	99.8±0.19	100.0±0.00	82.8±3.27	82.1±1.87	96.5±1.27	95.0±1.04	**0.0**±0.00	100.0±0.00	**72.9**	2
CodeLlama-7b	84.5±0.13	89.2±0.61	77.8±0.73	79.9±0.07	77.3±0.06	**79.8**±0.38	**75.7**±1.43	82.7±0.23	91.4±0.14	82.0	2
CodeLlama-7b-Python	**60.3**±10.49	**87.7**±3.30	**75.2**±2.37	79.0±0.32	**76.7**±0.23	80.4±0.27	77.3±1.55	15.3±7.71	**52.1**±1.73	**67.1**	5
Llama-2-7b	100.0±0.12	99.7±2.97	100.0±0.62	**73.3**±0.49	99.5±0.19	99.6±0.18	92.7±1.47	**0.0**±0.13	100.0±0.00	85.0	2
codegemma-7b	**0.0**±0.00	**24.3**±0.18	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	**2.7**	9
gemma-7b	99.6±0.42	99.2±0.26	95.9±0.58	89.2±4.70	85.1±0.50	93.6±3.01	80.8±1.64	100.0±19.86	36.5±0.00	86.7	0
codegemma-2b	**4.4**±13.71	**2.7**±0.51	**82.6**±0.23	**40.7**±17.86	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	**0.0**±0.00	6.0±0.00	**15.2**	8
gemma-2b	98.9±1.12	99.1±0.56	87.4±2.35	83.2±2.18	82.2±0.75	95.7±2.42	83.3±2.66	83.3±18.34	**2.6**±0.00	79.5	1

Table 16: Redundancy (%) (defined in Section 3.3; lower values indicate better generation precision) of few-shot experiments. Mean and standard deviation of redundancy across three runs are reported. The better (i.e. lower) redundancy in each comparison is highlighted in bold. $\overline{R}$: mean redundancy across 9 tasks (SemEval excluded, see Section 3.3). **#Win**: Number of **group-wise wins (and draws recorded in bracket)** across 9 tasks.

```
def classify_sentiment(text: str) -> Literal["positive", "negative"]:
  """Classify the sentiment of the given text as either positive or negative.
  Args:
    - text (str): The text to classify.
  Returns:
    Literal["positive", "negative"]: The sentiment label of the text.
  """
  pass

{few_shot_examples}
# Test case for inference
text = "{text}"
assert (classify_sentiment(text) == "
```

Few-shot example in Python:

```
# Example test case
text = "{text}"
assert (classify_sentiment(text) == "{label}")
```

Code prompt (JavaScript).

```
const assert = require('assert');
function classifySentiment(text) {
  /*
  Classify the sentiment of the given text as either positive or negative.
  Args:
    - text (string): The text to classify.
  Returns:
    "positive" | "negative": The sentiment label of the text.
  */
  // TODO: Implement classification logic
}
{few_shot_examples}
# Test case for inference
const text = "{text}";
assert.strictEqual(classifySentiment(text), "
```

Few-shot example in JavaScript:

```
# Example test case
const text = "{text}";
assert.strictEqual(classifySentiment(text), "{label}")
```

Code prompt (C++).

```
#include <cassert>
#include <string>
std::string classify_sentiment(const std::string& text) {
  /*
  Classify the sentiment of the given text as either positive or negative.
  Args:
    - text (std::string): The text to classify.
  Returns:
    "positive" or "negative": The sentiment label of the text.
  */
  // TODO: Implement classification logic
}
{few_shot_examples}
# Test case for inference
std::string text = "{text}";
assert(classify_sentiment(text) == "
```

Few-shot example in C++:

```
# Example test case
std::string text = "{text}";
assert(classify_sentiment(text) == "{label}")
```

E.2 AG News

Natural language prompt.

```
You are a data annotator for topic classification of news.
Your task is to read the following news (Title + Description) and classify the news into one of the topics: World, Sport, Business, or Sci/Tech.
Please answer directly with "World", "Sport", "Business", or "Sci/Tech" only.
{few_shot_examples}
Here is the text to classify:
Input: {text}
Output:
```

Few-shot example in natural language:

```
Input: {text}
Output: {label}
```

Code prompt (Python).

```
def classify_topic(text: str) -> Literal["World", "Sport", "Business", "Sci/Tech"]:
  """Classify the given text (title + description of news) into one of the following topics:
    - World
    - Sport
    - Business
    - Sci/Tech
  Args:
    - text (str): The text of news, which consists of title and description.
  Returns:
    Literal["World", "Sport", "Business", "Sci/Tech"]: The topic label of the text.
  """
  pass

{few_shot_examples}
# Test case for inference
text = "{text}"
assert (classify_topic(text) == "
```

Few-shot example in Python:

```
# Example test case
text = "{text}"
assert (classify_topic(text) == "{label}")
```

E.3 CoLA

Natural language prompt.

```
You are a linguist to annotate grammatical acceptance. Your task is to read the following text and tell if it is grammatically acceptable or unacceptable in standard English.
Please answer with "acceptable" or "unacceptable" only.
{few_shot_examples}
Here is the text to classify:
Input: {text}
Output:
```

Few-shot example in natural language:

```
Input: {text}
Output: {label}
```

Code prompt (Python).

```
def classify_grammatical_acceptance(text: str) ->
Literal["acceptable", "unacceptable"]:
  """Classify the given text as either grammatically
"acceptable" or "unacceptable".
n
n
  Args:
    - text (str): The text to classify.
  Returns:
    Literal["acceptable", "unacceptable"]: The grammatical
acceptance of the text.
  """
  pass

{few_shot_examples}
# Test case for inference
text = "{text}"
assert (classify_grammatical_acceptance(text) == "
```

Few-shot example in Python:

```
# Example test case
text = "{text}"
assert (classify_grammatical_acceptance(text) == "{label}")
```

E.4 MRPC

Natural language prompt.

```
You are a linguist to annotate sentence pairs for semantic
equivalence. Your task is to read two sentences and determine
whether they are paraphrases of each other or not.
Paraphrase (equivalent) means the two sentences express the
same meaning. Not paraphrase (not_equivalent) means they do
not express the same meaning.
Please answer with one word only: "equivalent" or
"not_equivalent".
{few_shot_examples}
Sentence 1: {sentence1}
Sentence 2: {sentence2}
Relation:
```

Few-shot example in natural language:

```
Sentence 1: {sentence1}
Sentence 2: {sentence2}
Relation: {label}
```

Code prompt (Python).

```
def detect_paraphrase(sentence1: str, sentence2: str) ->
Literal["equivalent", "not_equivalent"]:
  """Detect if two sentences are paraphrases of each other.
  Paraphrase means the two sentences express the same
meaning.
  Args:
    - sentence1 (str): The first sentence.
    - sentence2 (str): The second sentence.
  Returns:
    Literal["equivalent", "not_equivalent"]: "equivalent"
if the sentences are paraphrases, "not_equivalent"
otherwise.
  """
  pass

{few_shot_examples}
# Test case for inference
sentence1 = "{sentence1}"
sentence2 = "{sentence2}"
assert (detect_paraphrase(sentence1, sentence2) == "
```

Few-shot example in Python:

```
# Example test case
sentence1 = "{sentence1}"
sentence2 = "{sentence2}"
assert (detect_paraphrase(sentence1, sentence2) ==
"{label}")
```

Code (JavaScript) prompt.

```
const assert = require('assert');
function detectParaphrase(sentence1, sentence2) {
  /*
  Detect if two sentences are paraphrases of each other.
  Paraphrase means the two sentences express the same
meaning.
  Args:
    - sentence1 (string): The first sentence.
    - sentence2 (string): The second sentence.
  Returns:
    "equivalent" or "not_equivalent": "equivalent" if the
sentences are paraphrases, "not_equivalent" otherwise.
  */
  // TODO: Implement paraphrase detection logic
}
{few_shot_examples}
// Test case for inference
const sentence1 = "{sentence1}";
const sentence2 = "{sentence2}";
assert.strictEqual(detectParaphrase(sentence1, sentence2),
"
```

Few-shot example in JavaScript:

```
# Example test case
const sentence1 = "{sentence1}";
const sentence2 = "{sentence2}";
assert.strictEqual(detectParaphrase(sentence1, sentence2),
"{label}");
```

Code (C++) prompt.

```
#include <cassert>
#include <string>
std::string detect_paraphrase(const std::string& sentence1,
const std::string& sentence2) {
  /*
  Detect if two sentences are paraphrases of each other.
  Paraphrase means the two sentences express the same
meaning.
  Args:
    - sentence1 (std::string): The first sentence.
    - sentence2 (std::string): The second sentence.
  Returns:
    "equivalent" or "not_equivalent": "equivalent" if the
sentences are paraphrases, "not_equivalent" otherwise.
  */
  // TODO: Implement paraphrase detection logic
}
{few_shot_examples}
// Test case for inference
std::string sentence1 = "{sentence1}";
std::string sentence2 = "{sentence2}";
assert(detect_paraphrase(sentence1, sentence2) == "
```

Few-shot example in C++:

```
std::string sentence1 = "{sentence1}";
std::string sentence2 = "{sentence2}";
assert(detect_paraphrase(sentence1, sentence2) ==
"{label}");
```

Code (Ruby) prompt.

```
def detect_paraphrase(sentence1, sentence2)
  # Detect if two sentences are paraphrases of each other.
  # Paraphrase means the two sentences express the same
meaning.
  # Args:
    - sentence1 (String): The first sentence.
    - sentence2 (String): The second sentence.
  # Returns:
    "equivalent" or "not_equivalent": "equivalent" if the
sentences are paraphrases, "not_equivalent" otherwise.
  # TODO: Implement paraphrase detection logic
end
{few_shot_examples}
# Test case for inference
sentence1 = "{sentence1}"
sentence2 = "{sentence2}"
raise "Assertion failed" unless (detect_paraphrase(sentence1,
sentence2) == "
```

Few-shot example in Ruby:

```
sentence1 = "{sentence1}"
sentence2 = "{sentence2}"
raise "Assertion failed" unless (detect_paraphrase(sentence1,
sentence2) == "{label}")
```

E.5 XNLI

Natural language prompt.

```
You are a linguist to annotate textual
entailment/contradiction. Your task is to read a
premise and a hypothesis, and then determine whether the
relation between them is entailment, contradiction, or
neutral.
Entailment means the hypothesis logically follows from the
premise. Contradiction means the hypothesis contradicts the
premise. Neutral means neither entailment nor contradiction.
Please answer with one word only: "entailment", "neutral"
or "contradiction".
{few_shot_examples}
Premise: {premise}
Hypothesis: {hypothesis}
Relation:
```

Few-shot example in natural language:

```
Premise: {premise}
Hypothesis: {hypothesis}
Relation: {label}
```

Code (Python) prompt.

```
def natural_language_inference(premise: str, hypothesis:
str) -> Literal["entailment", "neutral", "contradiction"]:
  """Classify the relationship between a premise and a
hypothesis (both written in {language}) as
  "entailment", "neutral", or "contradiction".
  "entailment" means the hypothesis logically follows from
the premise.
  "contradiction" means the hypothesis contradicts the
premise.
  "neutral" means neither entailment nor contradiction.
  Args:
    - premise (str): The premise text.
    - hypothesis (str): The hypothesis text.
  Returns:
    Literal["entailment", "neutral", "contradiction"]: The
relationship label.
  """
  pass

{few_shot_examples}
# Test case for inference
premise = "{premise}"
hypothesis = "{hypothesis}"
assert (natural_language_inference(premise, hypothesis) ==
"
```

Few-shot example in Python:

```
# Example test case
premise = "{premise}"
hypothesis = "{hypothesis}"
assert (natural_language_inference(premise, hypothesis) ==
"{label}")
```

E.6 MSciNLI

Natural language prompt.

```
You are a linguist to annotate textual
entailment/contrasting/reasoning/neutral over a pair
of sentences extracted from publications in the field
of computer science. Your task is to read sentence1 and
sentence2, and then determine whether the relation between
them is entailment, contrasting, reasoning or neutral.
Entailment means sentence2 can be appended to sentence1 using
words like "Specifically", "Precisely", "In particular",
"Particularly", "That is", "In other words".
Contrasting means sentence2 can be appended to sentence1
using words like "However", "On the other hand", "In
contrast", "On the contrary".
Reasoning means sentence2 can be appended to sentence1
using words like "Therefore", "Thus", "Consequently", "As a
result", "As a consequence", "From here we can infer".
Neutral means none of the above.
Please answer with one word only: "entailment",
"contrasting", "reasoning" or "neutral".
{few_shot_examples}
sentence1: {sentence1}
sentence2: {sentence2}
relation:
```

Few-shot example in natural language:

```
sentence1: {sentence1}
sentence2: {sentence2}
relation: {label}
```

Code (Python) prompt.

```
def natural_language_inference(sentence1: str, sentence2:
str) -> Literal["entailment", "contrasting", "reasoning",
"neutral"]:
  """Classify the relation between sentence1 and sentence2
from publications
  in the field of computer science into one of 4 categories:
  "entailment" means sentence2 can be appended to sentence1
using words like
  'Specifically', 'Precisely', 'In particular',
'Particularly', 'That is', 'In other words'.
  "contrasting" means sentence2 can be appended to sentence1
using words like
  'However', 'On the other hand', 'In contrast', 'On the
contrary'.
  "reasoning" means sentence2 can be appended to sentence1
using words like
  'Therefore', 'Thus', 'Consequently', 'As a result', 'As a
consequence', 'From here we can infer'.
  "neutral" means none of the above.
  Args:
    - sentence1 (str): The first sentence.
    - sentence2 (str): The second sentence.
  Returns:
    Literal["entailment", "contrasting", "reasoning",
"neutral"]: The relation label.
  """
  pass

{few_shot_examples}
# Test case for inference
sentence1 = "{sentence1}"
sentence2 = "{sentence2}"
assert (natural_language_inference(sentence1, sentence2) ==
"
```

Few-shot example in Python:

```
# Example test case
sentence1 = "{sentence1}"
sentence2 = "{sentence2}"
assert (natural_language_inference(sentence1, sentence2) ==
"{label}")
```

E.7 SemEval

Natural language prompt.

```
You are a data annotator for relation classification of two
entities in a text. Your task is to read the following text
in which two entities are marked by <e1> and </e1> for the
subject entity, and <e2> and </e2> for the object entity, and
classify the relation between the two entities into one of
the following 10 labels:
"Cause-Effect", "Component-Whole", "Content-Container",
"Entity-Destination", "Entity-Origin", "Instrument-Agency",
"Member-Collection", "Message-Topic", "Product-Producer",
"Other",
where "Other" means there is no relation between the two
entities.
{few_shot_examples}
Here is the text for relation classification:
Input: {text}
Output: The relation between {subj} and {obj} in the input
is
```

Few-shot example in natural language:

```
Input: {text}
Output: The relation between {subj} and {obj} in the input
is {label}.
```

Code (Python) prompt.

```
def classify_relation(text: str, subj: str, obj:
str) -> Literal["Cause-Effect", "Component-Whole",
"Content-Container", "Entity-Destination", "Entity-Origin",
"Instrument-Agency", "Member-Collection", "Message-Topic",
"Product-Producer", "Other"]:
  """Classify the relation of the subject entity and object
entity from the given text
  into one of the following 10 labels:
  "Cause-Effect", "Component-Whole", "Content-Container",
"Entity-Destination",
  "Entity-Origin", "Instrument-Agency", "Member-Collection",
"Message-Topic",
  "Product-Producer", "Other", where "Other" means there is
no relation between the two entities.
  Args:
    - text (str): A text with a subject entity marked by
<e1> and </e1>, and an object entity marked by <e2> and
</e2>.
    - subj (str): The subject entity in the text.
    - obj (str): The object entity in the text.
  Returns:
    Literal["Cause-Effect", "Component-Whole",
"Content-Container", "Entity-Destination", "Entity-Origin",
"Instrument-Agency", "Member-Collection", "Message-Topic",
"Product-Producer", "Other"]: The relation label between
the subject entity and object entity.
  """
  pass

{few_shot_examples}
# Test case for inference
text = "{text}"
subj, obj = "{subj}", "{obj}"
assert (classify_relation(text, subj, obj) == "
```

Few-shot example in Python:

Example test case

```
text = "{text}"
subj, obj = "{subj}", "{obj}"
assert (classify_relation(text, subj, obj) == "{label}")
```

Code (JavaScript) prompt.

```
const assert = require('assert');
function classifyRelation(text, subj, obj) {
  /*
  Classify the relation of the subject entity and object
entity from the given text
  into one of the following 10 labels:
  "Cause-Effect", "Component-Whole", "Content-Container",
"Entity-Destination",
  "Entity-Origin", "Instrument-Agency", "Member-Collection",
"Message-Topic",
  "Product-Producer", "Other", where "Other" means there is
no relation between the two entities.
  Args:
    - text (string): A text with a subject entity marked
by <e1> and </e1>, and an object entity marked by <e2> and
</e2>.
    - subj (string): The subject entity in the text.
    - obj (string): The object entity in the text.
  Returns:
    "Cause-Effect" | "Component-Whole" | "Content-Container"
| "Entity-Destination" |
    "Entity-Origin" | "Instrument-Agency" |
"Member-Collection" | "Message-Topic" |
    "Product-Producer" | "Other": The relation label between
the subject entity and object entity.
  */
  // TODO: Implement classification logic
}
{few_shot_examples}
## Test case for inference
const text = "{text}";
const subj = "{subj}", obj = "{obj}";
assert.strictEqual(classifyRelation(text, subj, obj), "
```

Few-shot example in JavaScript:

```
# Example test case
const text = "{text}";
const subj = "{subj}", obj = "{obj}";
assert.strictEqual(classifyRelation(text, subj, obj),
"{label}");
```

Code (C++) prompt.

```
#include <cassert>
#include <string>

std::string classify_relation(const std::string& text,
const std::string& subj, const std::string& obj) {
  /*
  Classify the relation of the subject entity and object
entity from the given text
  into one of the following 10 labels:
  "Cause-Effect", "Component-Whole", "Content-Container",
"Entity-Destination",
  "Entity-Origin", "Instrument-Agency", "Member-Collection",
"Message-Topic",
  "Product-Producer", "Other", where "Other" means there is
no relation between the two entities.
  Args:
    - text (std::string): A text with a subject entity
marked by <e1> and </e1>, and an object entity marked by
<e2> and </e2>.
    - subj (std::string): The subject entity in the text.
    - obj (std::string): The object entity in the text.
  Returns:
    "Cause-Effect" or "Component-Whole" or
"Content-Container" or "Entity-Destination" or
    "Entity-Origin" or "Instrument-Agency" or
"Member-Collection" or "Message-Topic" or
    "Product-Producer" or "Other": The relation label
between the subject entity and object entity.
  */
  // TODO: Implement classification logic
}
{few_shot_examples}
## Test case for inference
std::string text = "{text}";
std::string subj = "{subj}", obj = "{obj}";
assert(classify_relation(text, subj, obj) == "
```

Few-shot example in C++:

```
# Example test case
std::string text = "{text}";
std::string subj = "{subj}", obj = "{obj}";
assert(classify_relation(text, subj, obj) == "{label}");
```

Code (Ruby) prompt.

```
def classify_relation(text, subj, obj)
  # Classify the relation of the subject entity and object
entity from the given text
  # into one of the following 10 labels:
  # "Cause-Effect", "Component-Whole", "Content-Container",
"Entity-Destination",
  #         "Entity-Origin",           "Instrument-Agency",
"Member-Collection", "Message-Topic",
  # "Product-Producer", "Other", where "Other" means there
is no relation between the two entities.
  # Args:
    # - text (String): A text with a subject entity marked
by <e1> and </e1>, and an object entity marked by <e2> and
</e2>.
    # - subj (String): The subject entity in the text.
    # - obj (String): The object entity in the text.
  # Returns:
    #          "Cause-Effect",            "Component-Whole",
"Content-Container", "Entity-Destination",
    #         "Entity-Origin",           "Instrument-Agency",
"Member-Collection", "Message-Topic",
    #  "Product-Producer",  "Other":  The  relation  label
between the subject entity and object entity.
  # TODO: Implement classification logic
end
{few_shot_examples}
# Test case for inference
text = "{text}"
subj, obj = "{subj}", "{obj}"
raise  "Assertion  failed"  unless  (classify_relation(text,
subj, obj) == "
```

Few-shot example in Ruby:

```
# Example test case
text = "{text}"
subj, obj = "{subj}", "{obj}"
raise  "Assertion  failed"  unless  (classify_relation(text,
subj, obj) == "{label}")
```

E.8 SciERC

Natural language prompt.

```
You are a data annotator for relation classification of two
entities in a text.  Your task is to read the following
text in which the subject entity is surrounded by '[[' and
']]', and object entity is surrounded by '«' and '»', and then
classify the relation between the two entities into one of the
following 7 labels: "compare", "conjunction", "evaluate-for",
"feature-of", "hyponym-of", "part-of", "used-for".
{few_shot_examples}
Here is the text for relation classification:
Input: {text}
Output: The relation between {subj} and {obj} in the input
is
```

Few-shot example in natural language:

```
Input: {text}
Output: The relation between {subj} and {obj} in the input
is {label}
```

Code (Python) prompt.

```
def  classify_relation(text:  str,  subj:  str,  obj:  str)
->   Literal["compare",    "conjunction",    "evaluate-for",
"feature-of", "hyponym-of", "part-of", "used-for"]:
  """Classify the relation of the subject entity and object
entity from the given text
  into  one  of  the  following  7  labels:   "compare",
"conjunction", "evaluate-for", "feature-of", "hyponym-of",
"part-of", "used-for".
  Args:
    - text (str): A text with a subject entity surrounded
by '[[' and ']]', and an object entity surrounded by '«' and
'»'.
    - subj (str): The subject entity in the text.
    - obj (str): The object entity in the text.
  Returns:
    Literal["compare",    "conjunction",    "evaluate-for",
"feature-of",  "hyponym-of",  "part-of",  "used-for"]:  The
relation label between the subject entity and object entity.
  """
  pass

{few_shot_examples}
# Test case for inference
text = "{text}"
subj, obj = "{subj}", "{obj}"
assert (classify_relation(text, subj, obj) == "
```

Few-shot example in Python:

```
# Example test case
text = "{text}"
subj, obj = "{subj}", "{obj}"
assert (classify_relation(text, subj, obj) == "{label}")
```

E.9 Iris

Natural language prompt.

```
You  are  a  data  annotator  for  species  classification  of
iris flowers.  Your task is to read the following rule for
classification and the numerical features of the iris flower,
and classify the species into either setosa, versicolor, or
virginica based on the rule.
Please  answer  directly  with  only  one  of:   "setosa",
"versicolor", or "virginica" as output.
Rule:
If Petal Width < 0.8 cm, then the species is "setosa".
If Petal Width >= 0.8 cm and < 1.8 cm, then the species is
"versicolor".
If Petal Width >= 1.8 cm, then the species is "virginica".
{few_shot_examples}
Here is the flower to classify:
Input:  sepal  length:  {sepal_length}  cm,  sepal  width:
{sepal_width} cm, petal length: {petal_length} cm, petal
width: {petal_width} cm
Output:
```

Few-shot example in natural language:

```
Input:  sepal  length:  {sepal_length}  cm,  sepal  width:
{sepal_width} cm, petal length: {petal_length} cm, petal
width: {petal_width} cm
Output: {label}
```

Code (Python) prompt.

```
def classify_iris_species(text: str) -> Literal["setosa", "versicolor", "virginica"]:
  """Classify the species of the iris flower based on its features and the following rule.
  Rule: If Petal Width < 0.8 cm, then the species is "setosa".
   If Petal Width >= 0.8 cm and < 1.8 cm, then the species is "versicolor".
   If Petal Width >= 1.8 cm, then the species is "virginica".
  Args:
    - text (str): A string containing the features of the iris flower in the format: "sepal length: X cm, sepal width: Y cm, petal length: Z cm, petal width: W cm".
  Returns:
    Literal["setosa", "versicolor", "virginica"]: The species label of the iris flower.
  """
  pass

{few_shot_examples}
# Test case for inference
text = "sepal length: {sepal_length} cm, sepal width: {sepal_width} cm, petal length: {petal_length} cm, petal width: {petal_width} cm"
assert (classify_iris_species(text) == "
```

Few-shot example in Python:

```
# Example test case
text = "sepal length: {sepal_length} cm, sepal width: {sepal_width} cm, petal length: {petal_length} cm, petal width: {petal_width} cm"
assert (classify_iris_species(text) == "{label}")
```

E.10 HCC-Staging

Natural language prompt.

```
You are a clinical annotator to determine whether a patient with hepatocellular carcinoma (HCC) meets the Milan criteria based on reported tumor size(s).
Milan criteria:
- One single tumor with its diameter <= 5 cm,
- Alternatively, up to 3 tumors, each with its diameter <= 3 cm.
Important notes on tumor size interpretation:
- Tumor size (or diameter) may be reported in millimeters (mm) or centimeters (cm).
- It may appear as:
 A single value (e.g., "25 mm"),
 Two dimensions (e.g., "25 x 20 mm"), or
 Three dimensions (e.g., "2.5 x 2.0 x 1.8 cm").
- In all cases, the diameter is defined as the largest single dimension.
- If a patient has multiple tumors, their sizes will be listed together as a comma-separated text, e.g., '5 mm, 30 mm, 3x4x5 mm'.
Your task: Read the provided text describing the patient's tumor size(s), and classify whether the patient meets the Milan criteria.
If the patient is within the criteria, label 'True'. If not, label 'False'.
Please answer directly with 'True' or 'False' only.
{few_shot_examples}
Here is the text to classify:
Input: The tumor sizes of the HCC patient: {text}
Output:
```

Few-shot example in natural language:

```
Input: The tumor size(s) of the HCC patient: {text}
Output: {label}
```

Code (Python) prompt.

```
def HCC_staging(text: str) -> Literal["True", "False"]:
  """Classify the patient according to Milan criteria based on tumor size(s) in the text.
  Milan criteria:
    - One single tumor with its diameter <= 5 cm,
    - Alternatively, up to 3 tumors, each with its diameter <= 3 cm.
  Important notes on tumor size interpretation:
    - Tumor size (or diameter) may be reported in millimeters (mm) or centimeters (cm).
    - It may appear as:
      * A single value (e.g., "25 mm"),
      * Two dimensions (e.g., "25 x 20 mm"), or
      * Three dimensions (e.g., "2.5 x 2.0 x 1.8 cm").
    - In all cases, the diameter is defined as the largest single dimension.
    - If a patient has multiple tumors, their sizes will be listed together as a comma-separated text, e.g., '5 mm, 30 mm, 3x4x5 mm'.
  This function reads the provided 'text' describing the patient's tumor size(s), and classify whether the patient meets the Milan criteria.
  If the patient is within the criteria, return "True". If not, return "False".
  Args:
    - text (str): The input text of the HCC patient reporting tumor size(s).
  Returns:
    - str: "True" if the patient meets the Milan criteria, "False" otherwise.
  """
  pass

{few_shot_examples}
# Test case for inference
text = "The tumor size(s) of the HCC patient: {text}"
assert (HCC_staging(text) == "
```

Few-shot example in Python:

```
# Example test case
text = "The tumor size(s) of the HCC patient: {text}"
assert (HCC_staging(text) == "{label}")
```

Code (JavaScript) prompt.

```
const assert = require('assert');

function HCCStaging(text) {
  /*
  Classify the patient according to Milan criteria based on tumor size(s) in the text.

  Milan criteria:
    - One single tumor with its diameter <= 5 cm,
    - Alternatively, up to 3 tumors, each with its diameter <= 3 cm.

  Important notes on tumor size interpretation:
    - Tumor size (or diameter) may be reported in millimeters (mm) or centimeters (cm).
    - It may appear as:
      * A single value (e.g., "25 mm"),
      * Two dimensions (e.g., "25 x 20 mm"), or
      * Three dimensions (e.g., "2.5 x 2.0 x 1.8 cm").
    - In all cases, the diameter is defined as the largest single dimension.
    - If a patient has multiple tumors, their sizes will be listed together as a comma-separated text, e.g., '5 mm, 30 mm, 3x4x5 mm'.

  This function reads the provided 'text' describing the patient's tumor size(s),
  and classify whether the patient meets the Milan criteria.
  If the patient is within the criteria, return "True". If not, return "False".
  Args:
    - text (string): The input text of the HCC patient reporting tumor size(s).
  Returns:
    - string: "True" if the patient meets the Milan criteria, "False" otherwise.
  */
  // TODO: Implement Milan staging logic
}
```

{*few_shot_examples*}

```
# Test case for inference
const text = "The tumor size(s) of the HCC patient: {text}";
assert.strictEqual(HCCStaging(text), "
```

Few-shot example in JavaScript:

```
# Example test case
const text = "The tumor size(s) of the HCC patient: {text}";
assert.strictEqual(HCCStaging(text), "{label}");
```

Code (C++) prompt.

```
#include <cassert>
#include <string>

std::string HCC_staging(const std::string& text) {
  /*
  Classify the patient according to Milan criteria based on
tumor size(s) in the text.

  Milan criteria:
    - One single tumor with its diameter <= 5 cm,
    - Alternatively, up to 3 tumors, each with its diameter
<= 3 cm.

  Important notes on tumor size interpretation:
    - Tumor size (or diameter) may be reported in millimeters
(mm) or centimeters (cm).
    - It may appear as:
      * A single value (e.g., "25 mm"),
      * Two dimensions (e.g., "25 x 20 mm"), or
      * Three dimensions (e.g., "2.5 x 2.0 x 1.8 cm").
    - In all cases, the diameter is defined as the largest
single dimension.
    - If a patient has multiple tumors, their sizes will be
listed together as a comma-separated text, e.g., '5 mm, 30
mm, 3x4x5 mm'.

  This function reads the provided 'text' describing the
patient's tumor size(s),
  and classify whether the patient meets the Milan criteria.
  If the patient is within the criteria, return "True". If
not, return "False".
  Args:
    - text (std::string): The input text of the HCC patient
reporting tumor size(s).
  Returns:
    - std::string: "True" if the patient meets the Milan
criteria, "False" otherwise.
  */
  // TODO: Implement Milan staging logic
}

{few_shot_examples}
# Test case for inference
std::string text = "The tumor size(s) of the HCC patient:
{text}";
assert(HCC_staging(text) == "
```

Few-shot example in C++:

```
# Example test case
std::string text = "The tumor size(s) of the HCC patient:
{text}";
assert(HCC_staging(text) == "{label}");
```

Code (Ruby) prompt.

```
def HCC_staging(text)
  # Classify the patient according to Milan criteria based
on tumor size(s) in the text.

  # Milan criteria:
    - One single tumor with its diameter <= 5 cm,
    - Alternatively, up to 3 tumors, each with its diameter
<= 3 cm.

  # Important notes on tumor size interpretation:
    - Tumor size (or diameter) may be reported in millimeters
(mm) or centimeters (cm).
    - It may appear as:
      * A single value (e.g., "25 mm"),
      * Two dimensions (e.g., "25 x 20 mm"), or
      * Three dimensions (e.g., "2.5 x 2.0 x 1.8 cm").
    - In all cases, the diameter is defined as the largest
single dimension.
    - If a patient has multiple tumors, their sizes will be
listed together as a comma-separated text, e.g., '5 mm, 30
mm, 3x4x5 mm'.

  # This function reads the provided 'text' describing the
patient's tumor size(s),
  # and classify whether the patient meets the Milan
criteria.
  # If the patient is within the criteria, return "True".
If not, return "False".
  # Args:
    - text (string): The input text of the HCC patient
reporting tumor size(s).
  # Returns:
    - string: "True" if the patient meets the Milan criteria,
"False" otherwise.
  # TODO: Implement Milan staging logic
end

{few_shot_examples}
# Test case for inference
text = "The tumor size(s) of the HCC patient: {text}"
raise "Assertion failed" unless (HCC_staging(text) == "
```

Few-shot example in Ruby:

```
# Example test case
text = "The tumor size(s) of the HCC patient: {text}"
raise "Assertion failed" unless (HCC_staging(text) ==
"{label}")
```