

KSU Team's Multiple Choice QA System at the NTCIR-12 QA Lab-2 Task

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NTCIR-12 Conference, June 7-10, 2016, Tokyo, Japan

Overview

- **Abstract**
- **Our QA systems for Phase-3**
- **Results of Phase-3**
- **Discussion in Phase-3**
- **Conclusion**

Abstract

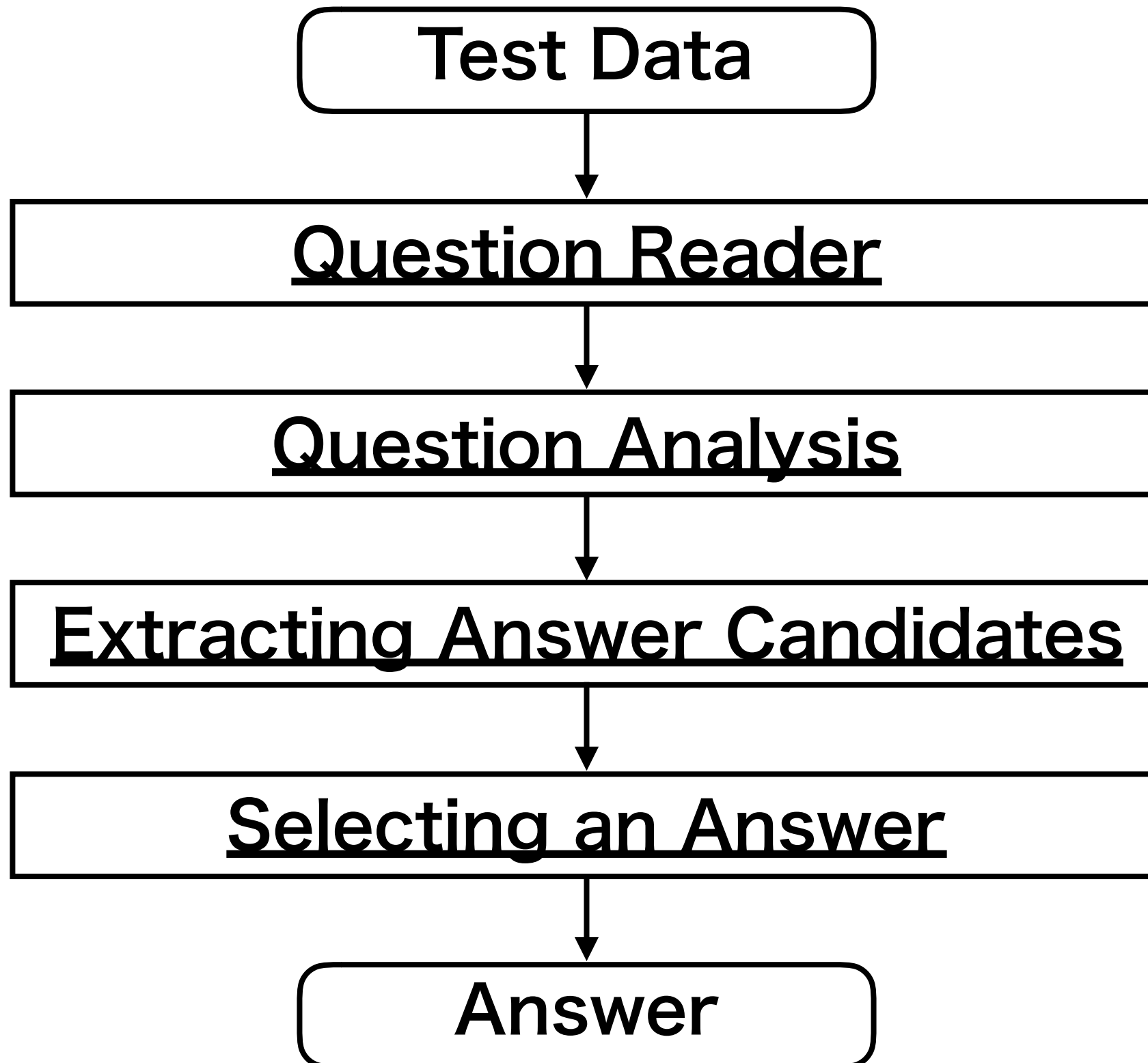
Summary of subtasks in which our team participated

Test	Questions	Lang
Phase-1	National Center Test	Japanese
Phase-2	Mock Examination of National Center Test	Japanese
Phase-3	National Center Test	Japanese

Answer types of subquestions

Answer types	Form of a choice
TERM	Names of people, event, etc.
SENTENCE	A sentence
TF	A combination of “true” or “false”
COMBO	A combination of symbols used in slot-filling problems
UNIQUE	A chronological sequence of events
MAP	Processing of images such as maps or photos are required

Basic system configuration in each phase

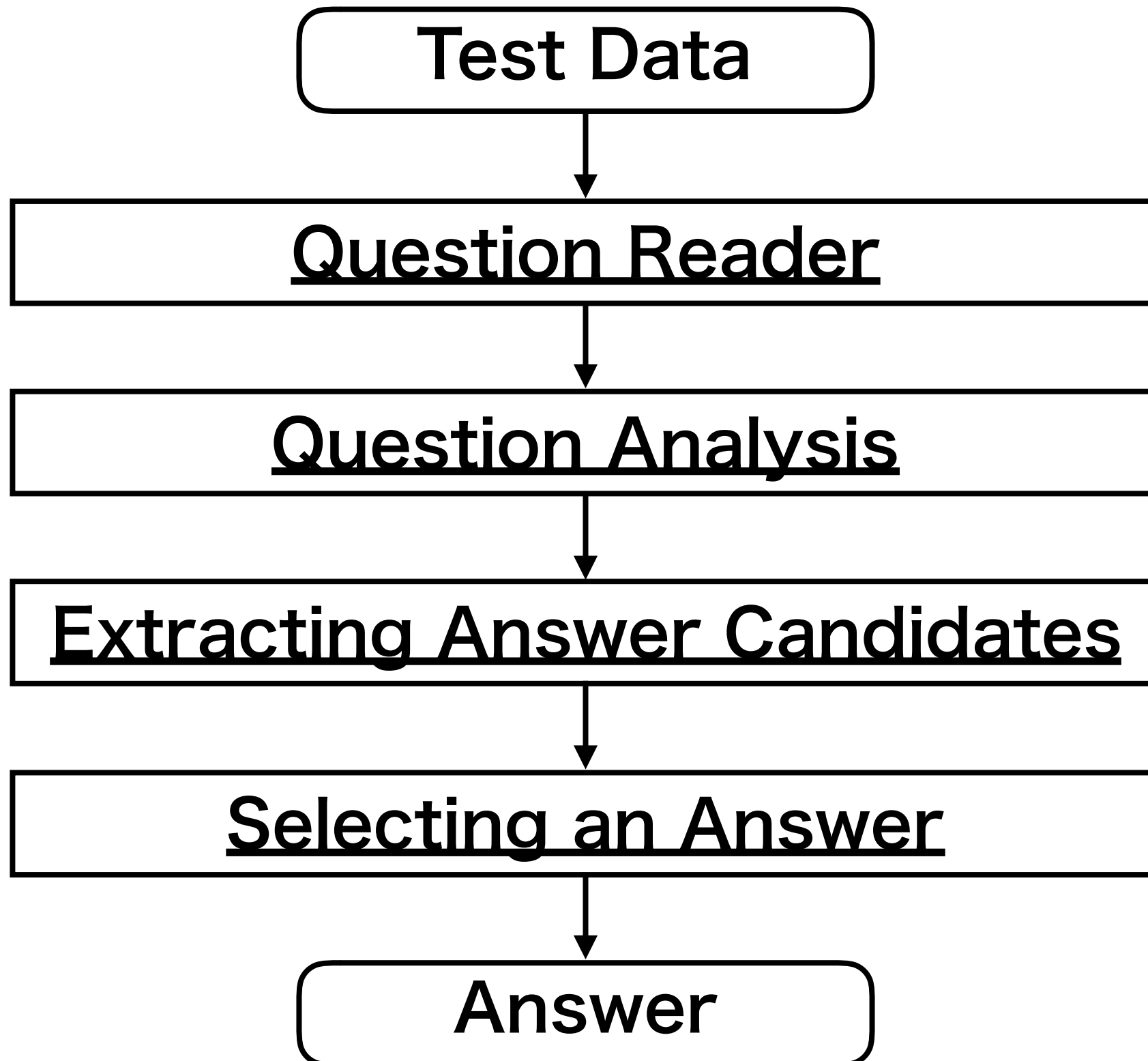


Summary of our systems developed for each phase

Test	Focused points in developing systems
Phase-1	(1) Multiple query generation methods (2) Introducing multiple knowledge sources
Phase-2	(1) Considering temporal intervals
Phase-3	(1) An adaptive utilization of underlined texts (2) A query generation method super-ordinate concept labels

Our QA *systems* for Phase-3

Basic system configuration in Phase-3



Basic system configuration in Phase-3

Test Data



Question Reader

1. Creating user dictionary specialized in world history



Extracting Answer Candidates

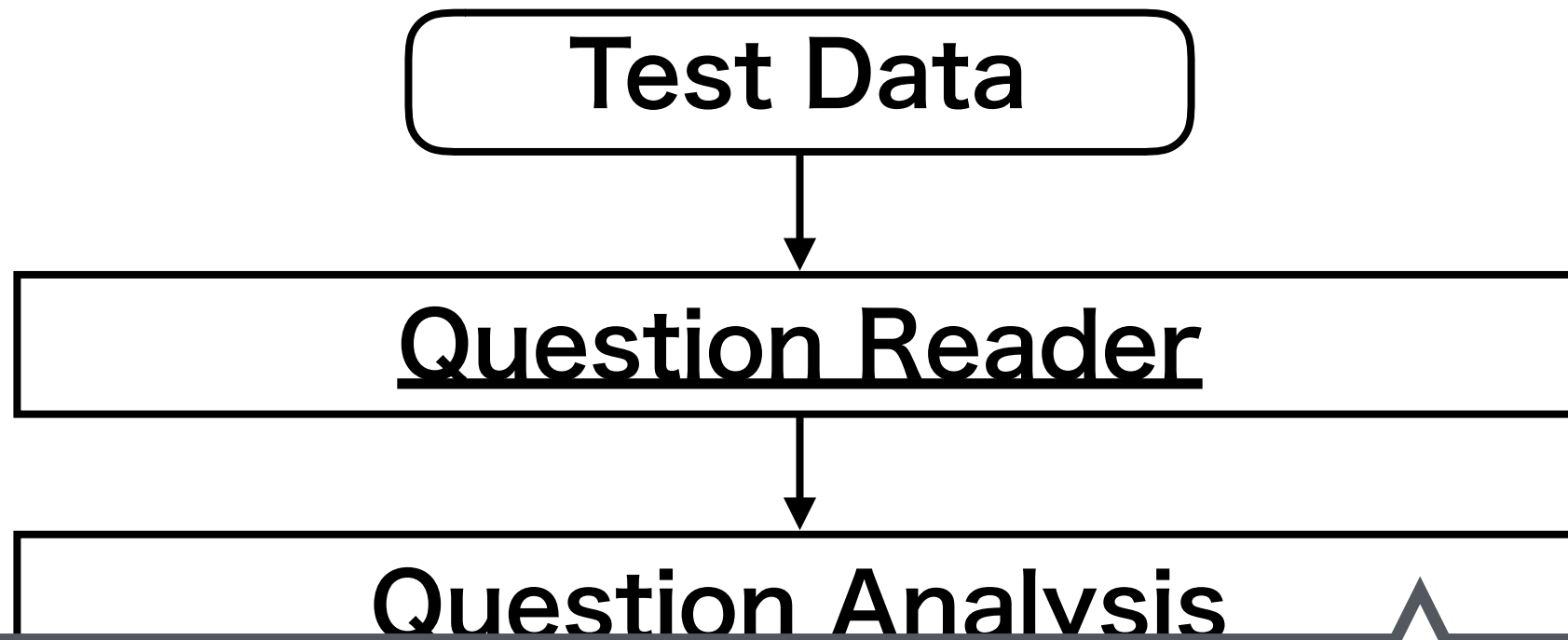


Selecting an Answer



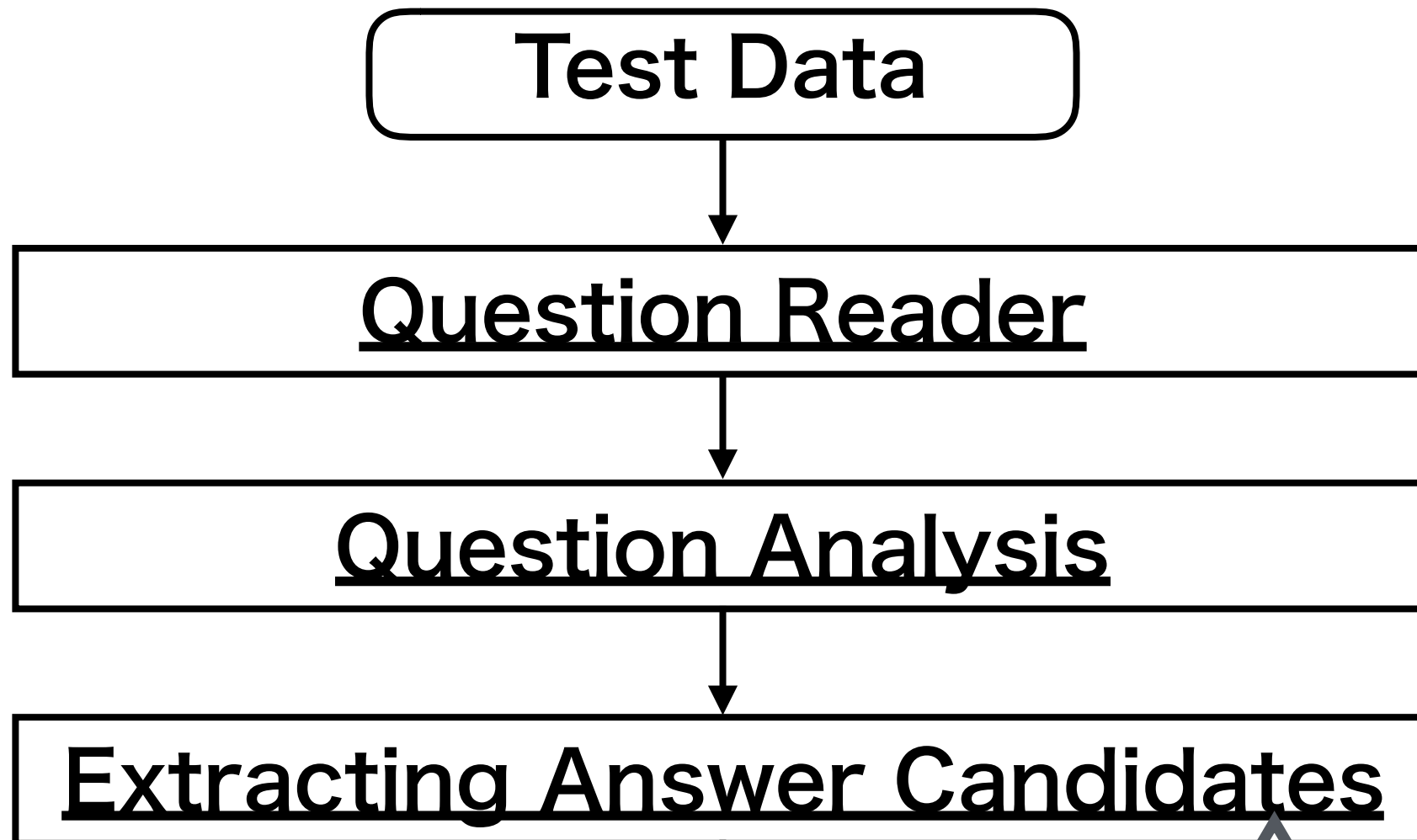
Answer

Basic system configuration in Phase-3



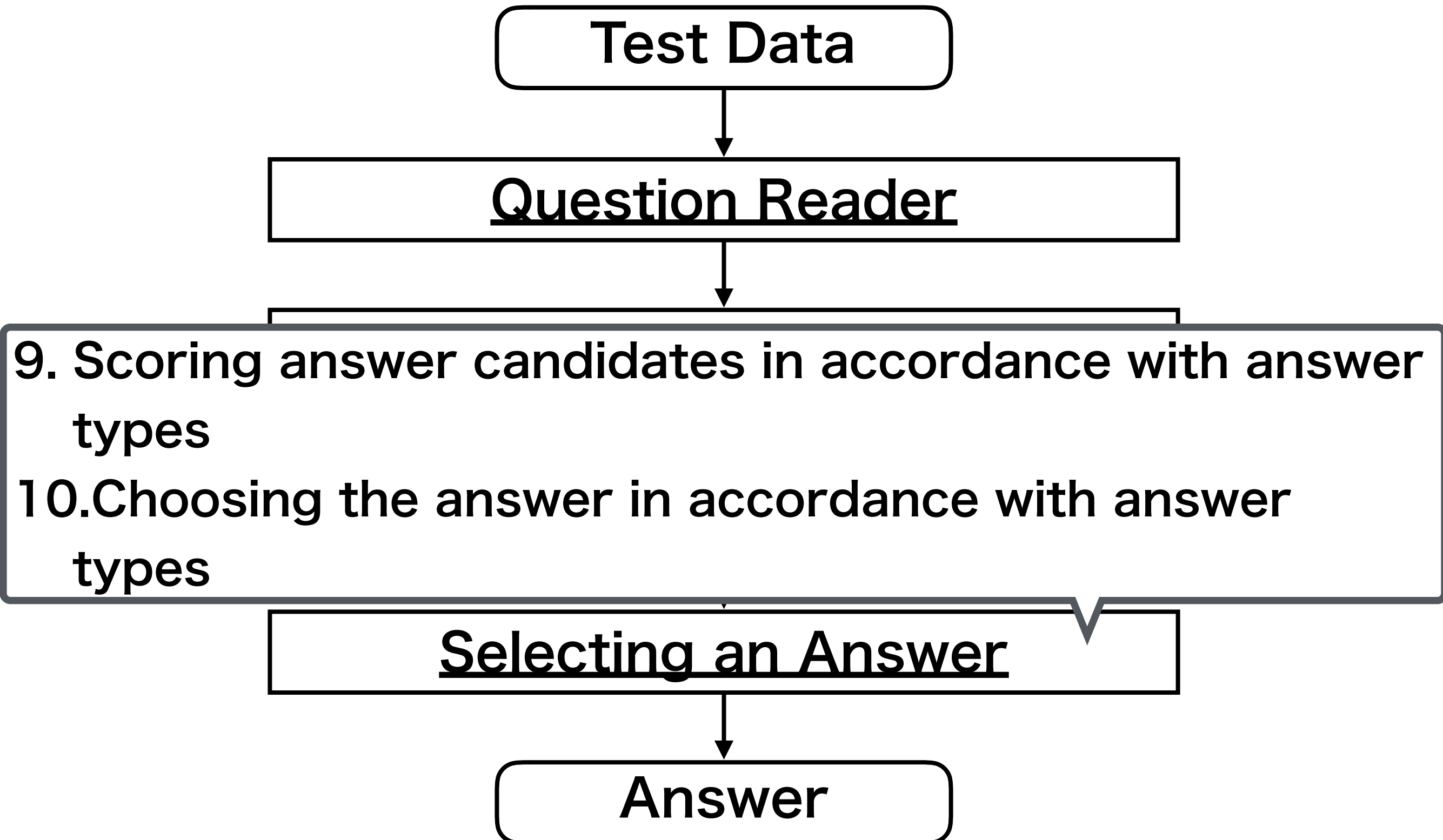
2. Estimating answer types
3. Adding keywords to a set of query words
4. Addition or adaptive addition of underlined texts to a set of query words
5. Extracting a set of query words in accordance with answer types
6. Introducing multiple methods for generating queries

Basic system configuration in Phase-3



7. Introducing multiple knowledge sources for document retrieval
8. Creating a correspondence table of spelling variations for world history

Basic system configuration in Phase-3



Basic system configuration in Phase-3

Test Data



Question Reader



Question Analysis

3. Addition or adaptive addition of underlined texts
to a set of query words



Selecting an Answer



Answer

Addition or adaptive addition of underlined texts to a set of query words

- The underlined texts in sub-questions were morphologically analyzed to extract only nouns, verbs, and adjectives.
- Addition
Those were constantly added to the set of query words
- Adaptive Addition
Those were adaptively added to the set of query words

Addition or adaptive addition of underlined texts to a set of query words

- Some underlined texts were **unnecessary** to answer sub-questions

A ①2世紀末にコンモドゥス帝が殺害されると、ローマ帝国は内乱状態となっていた。この混乱を収めたのは、ドナウ川流域の属州総督であったセプティミウス・セウェルス帝となると、帝国各地や国外へ積極的に遠征した。帝国東部では、皇帝を称していた人物を倒し、さらに、ユーフラテス川を越えて、②パルティアに攻め込んだ。帝国西北部では、反旗を翻した有力総督を討ち、その後、③ブリテン島の北部に遠征した。こうして、セウェルスは、動揺した帝国を建て直すことに成功したが、一方で、ローマ帝国は再び内乱状態に陥った。

The underlined text “2nd century”

The phrase “the event during the period”

問 1 下線部①の時期の出来事について述べた文として正しいものを、次の①～④のうちから一つ選べ。

Addition or adaptive addition of underlined texts to a set of query words

- Some underlined texts were **unnecessary** to answer sub-questions

A 泉州は、唐代中頃から、①南海貿易の中心となった②港の一つである。泉州には、様々な出自・信仰を持つ商人が住み着いた。そこを拠点に長年にわたって人とされている。元朝は、蒲寿庚の持つムスリム商人の貿易ネットワークを利用して、南海諸国に対し朝貢を勧誘して貿易を促進した。このことは商船の誘致にもつながり、13世紀、泉州は東アジア海域と③インド洋方面との結節点とし

The underlined text “trade around South Sea”

The phrase “international commerce in the world history”

問 1 下線部①に関連して、世界史上の交易について述べた文として誤っているものを、次の①～④のうちから一つ選べ。 10

Basic system configuration in Phase-3

Test Data



Question Reader



Question Analysis

6. Introducing multiple methods for generating queries



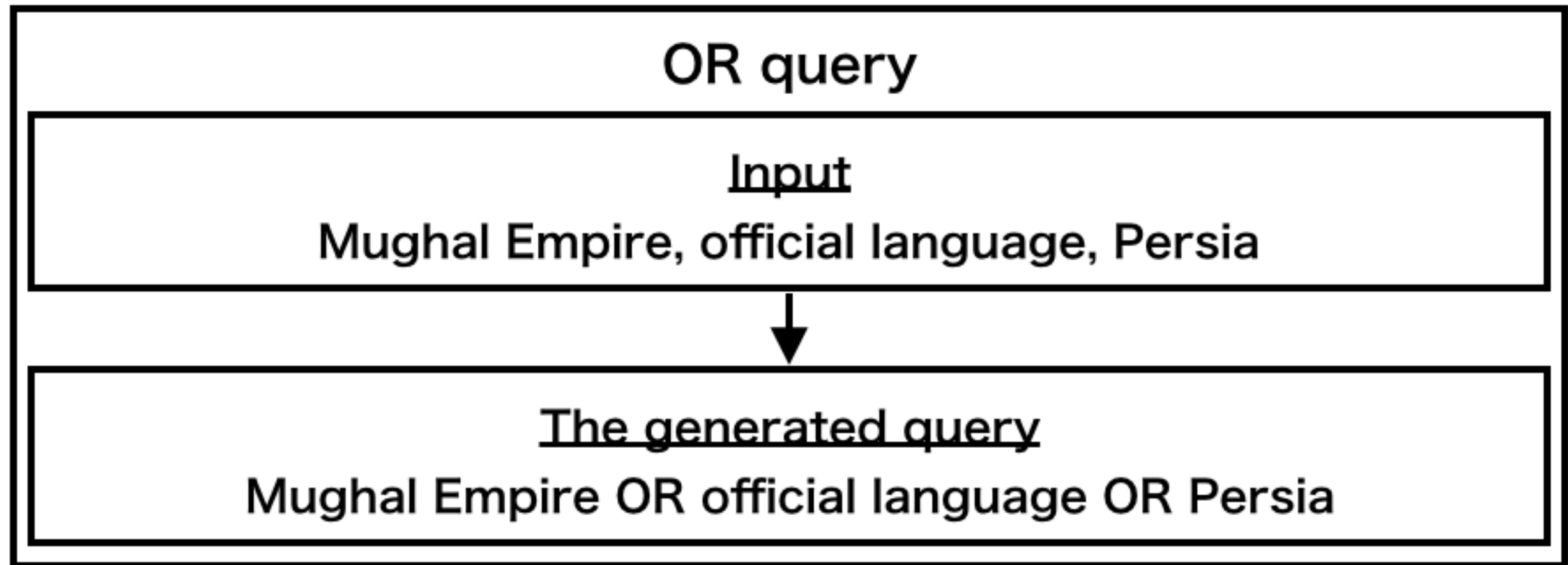
Selecting an Answer



Answer

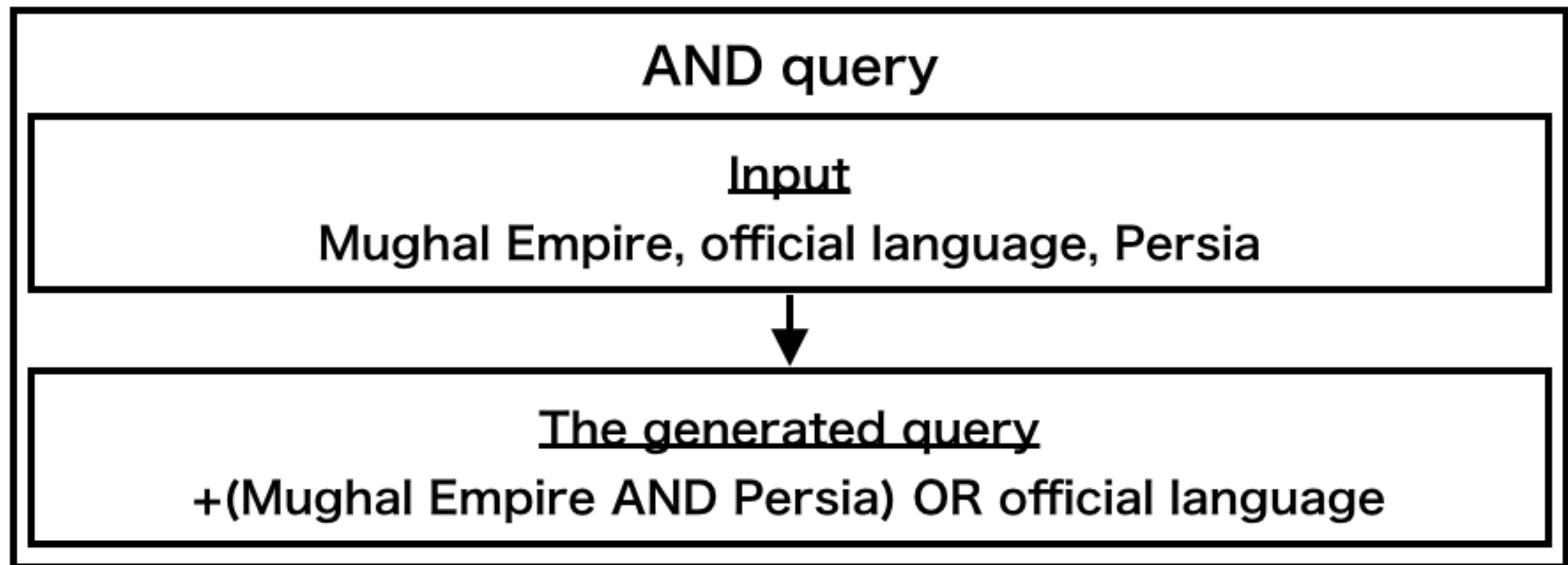
Introducing multiple methods for generating queries

- Four methods of generating queries were implemented:



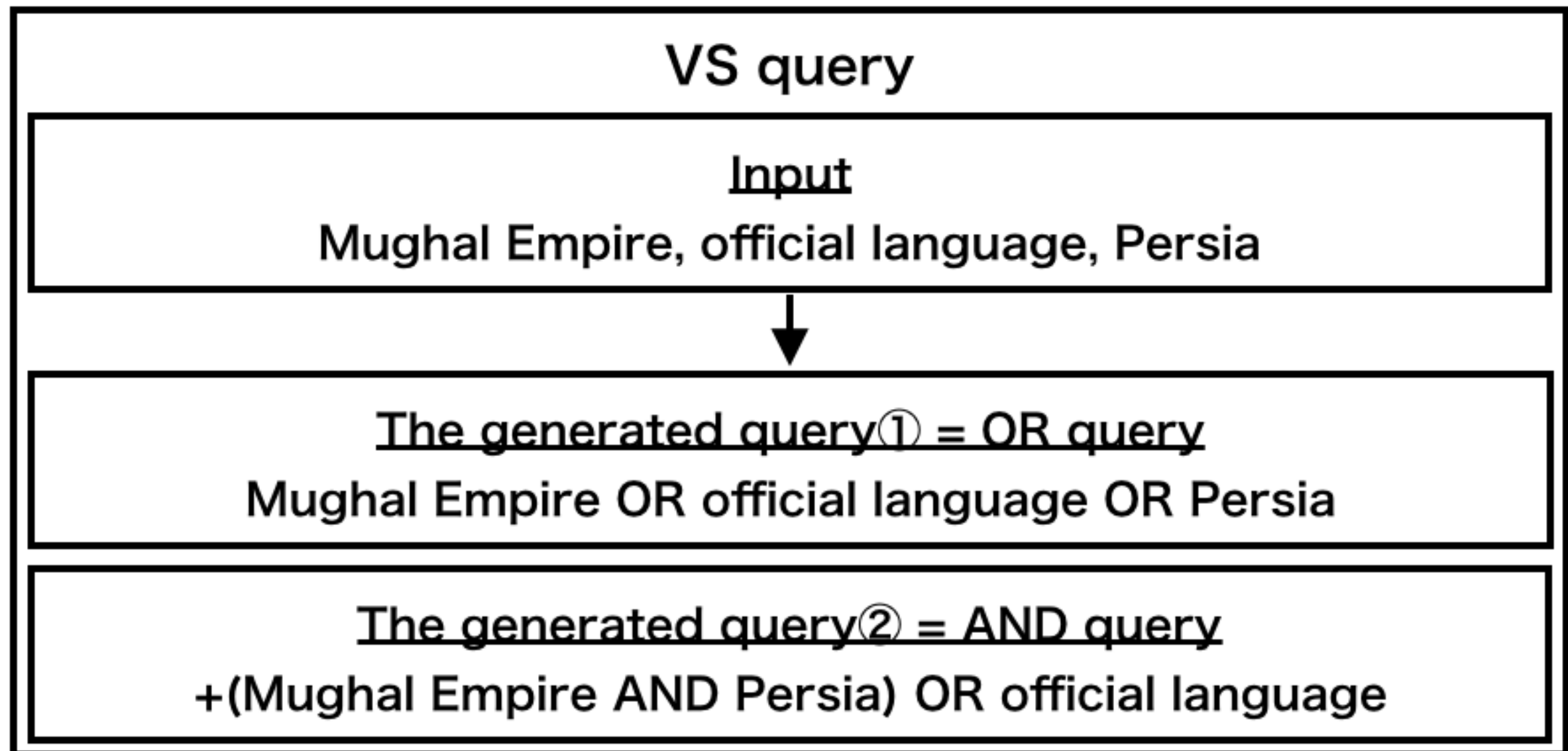
Introducing multiple methods for generating queries

- Four methods of generating queries were implemented:



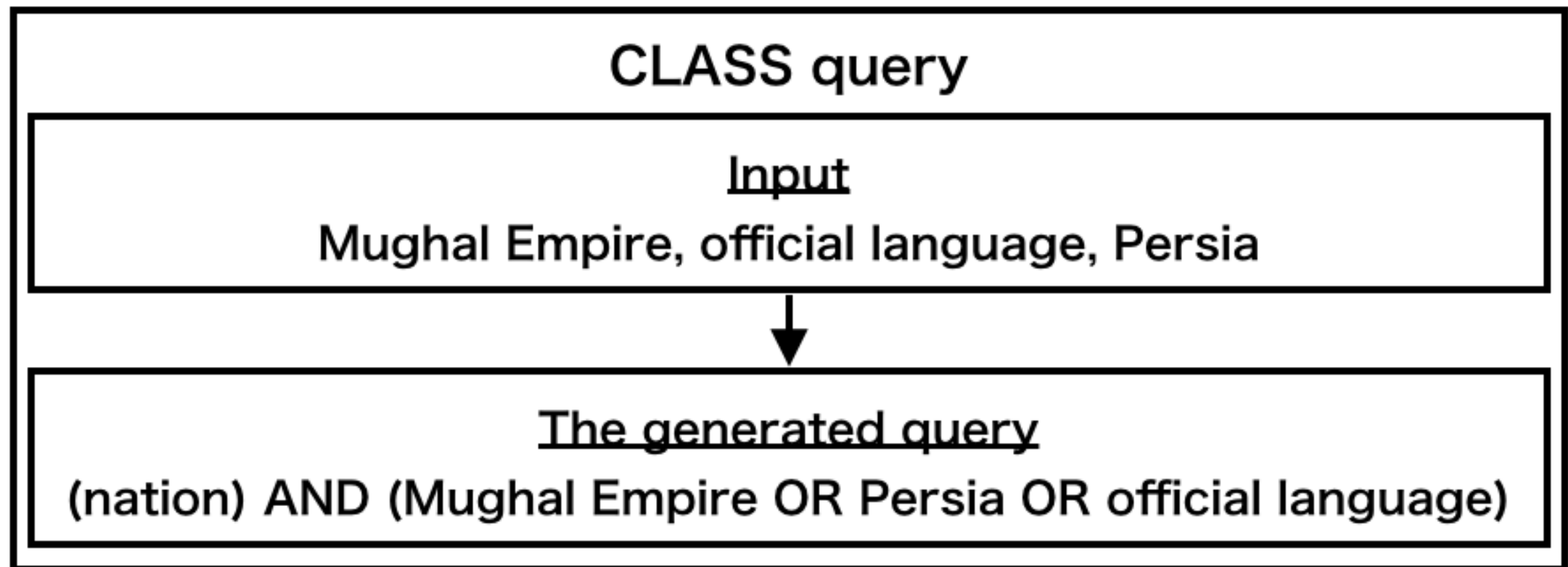
Introducing multiple methods for generating queries

- Four methods of generating queries were implemented:

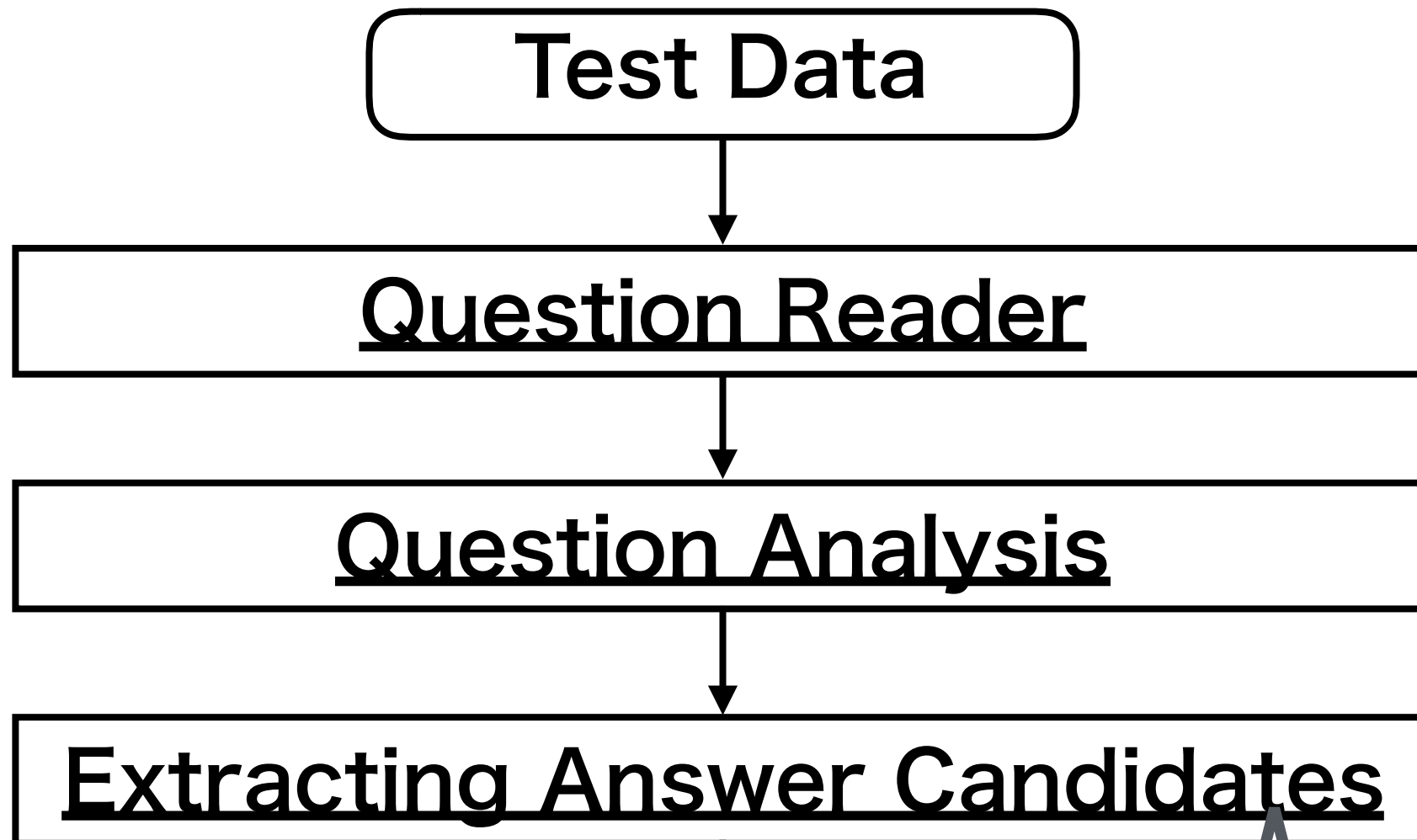


Introducing multiple methods for generating queries

- Four methods of generating queries were implemented:



Basic system configuration in Phase-3



7. Introducing multiple knowledge sources
for document retrieval

Answer

Introducing multiple knowledge sources for document retrieval

- Eight sets of knowledge sources were created :

Knowledge source	Configuration method
T	Textbooks per Paragraph
WD	Wikipedia per Article
WP	Wikipedia per Paragraph
WS	Wikipedia per Sentence
TWD	T + WD
TWP	T + WP
TWS	T + WS

Introducing multiple knowledge sources for document retrieval

- A set of documents was created :

Knowledge source	Configuration method
Evt	Event ontology EVT per NE

- Extracting class, instance, and wikipedia as elements of a document from event ontology EVT

super-ordinate concept	Title	Document
class	instance	wikipedia
evt:国家・王朝(nation)	アメリカ合衆国	アメリカ合衆国（アメリカがっしゅうこく、英語: United States of America）、通称アメリカ、米国（べいこく）は、北アメリカ大陸および北太平洋に位置する連邦共和国である。

Results of Phase-3

The comparison of the system configuration for Phase-3

(a) Multiple methods for generating queries

(b) Multiple knowledge sources for document retrieval

(c) Addition or adaptive addition of underlined texts to a set of query words

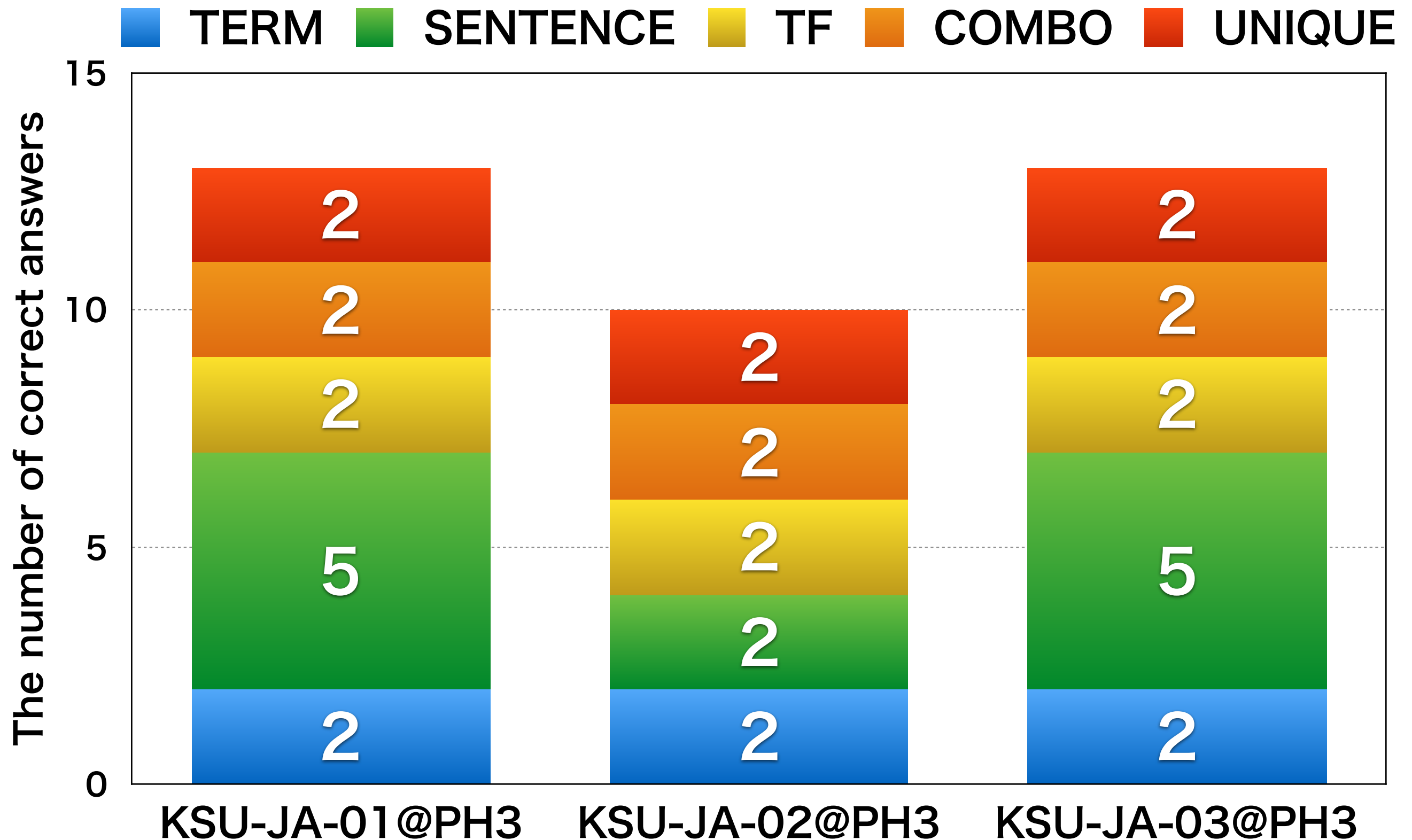
		(b)							
		T	WD	WP	WS	TWD	TWP	TWS	Evt
(a)	OR								
	AND								
	VS			①, ③					
	CLASS								②

(c) Addition

(c) Addition

(c) Adaptive Addition

Results of our runs for Phase-3



Discussion in phase-3

Comparison between KSU-JA-01@PH3 and KSU-JA-02@PH3

- Comparison between
KSU-JA-01@PH3 and KSU-JA-02@PH3

System ID	Query generation	Knowledge source	Accuracy
KSU-JA-01@PH3	VS	WP	0.39
KSU-JA-02@PH3	CLASS	Evt	0.31

- Why was the accuracy of KSU-JA-02@PH3 low?
→ For KSU-JA-02@PH3, the retrieval results often showed **no difference for each of the choices.**

Comparison between KSU-JA-01@PH3 and KSU-JA-03@PH3

- Comparison between
KSU-JA-01@PH3 and KSU-JA-03@PH3

System ID	The query words were	Accuracy
KSU-JA-01@PH3	constantly added to underlined texts	0.39
KSU-JA-03@PH3	adaptively added to underlined texts	0.39

- Why did the accuracy of KSU-JA-01@PH3
and KSU-JA-03@PH3 show no difference?
→ The query words in KSU-JA-03 were only
one or two words less than those in KSU-JA-01

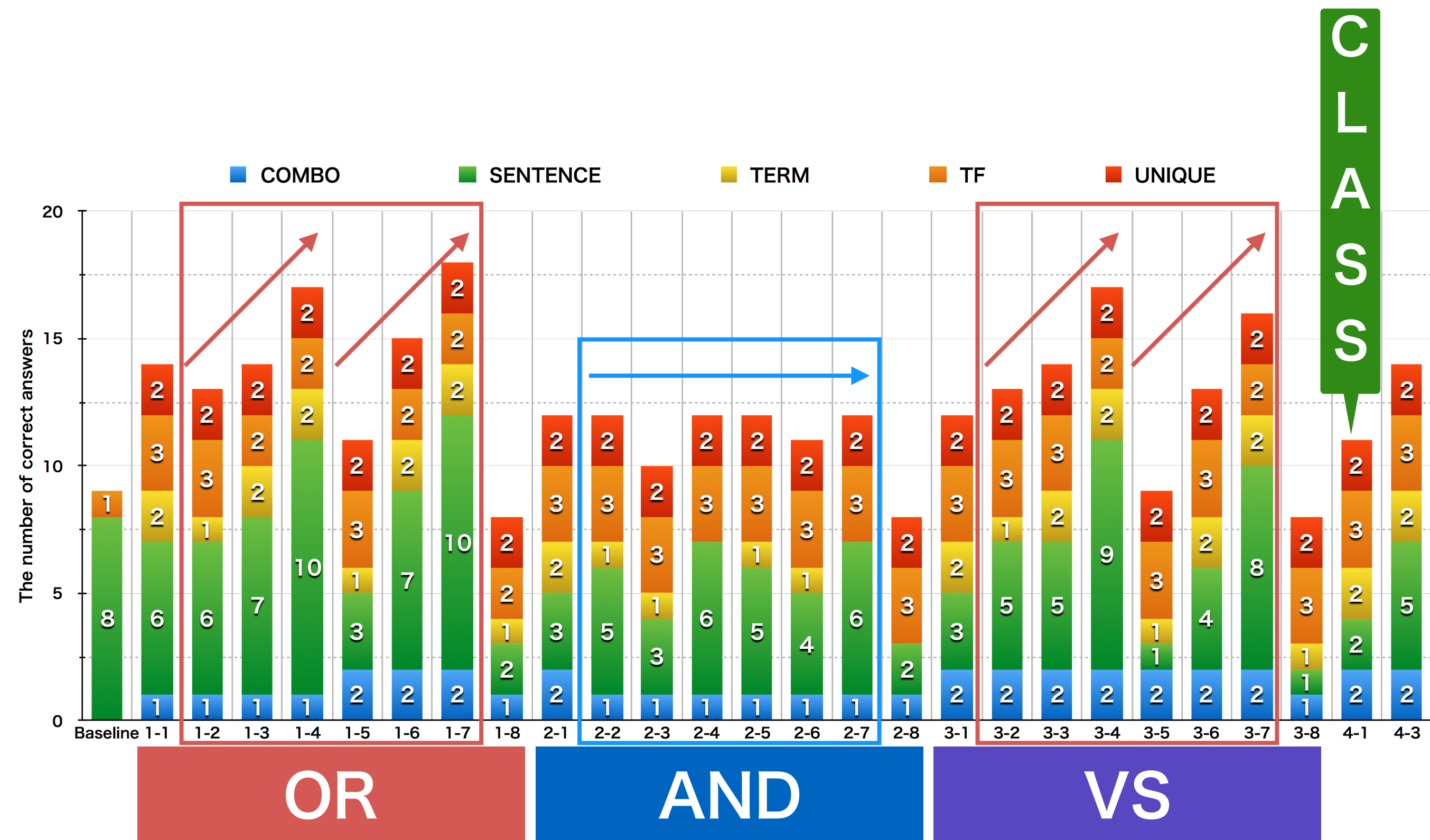
Investigation into systems with other configurations

Motivation:

How much will the accuracy of the systems change depending on the different combinations of each function?

	T	WD	WP	WS	TWD	TWP	TWS	Evt
OR	1-	1-2	1-3	1-4	1-5	1-6	1-7	1-8
AND	2-	2-2	2-3	2-4	2-5	2-6	2-7	2-8
VS	3- 1	3-2	3-3 <u>4-3</u>	3-4	3-5	3-6	3-7	3-8
CLASS	Adaptive addition of underlined texts to a set of query words							4-1

Comparison of the number of correct answers between the systems with different configurations



Discussion for systems with other configurations

**For systems using
the OR query method and the VS query method,
the smaller the granularity of documents became,
the higher the accuracy of systems got.**

- **55.6% of all the sub-questions
had the answer type of SENTENCE.**
- **The sentence-based documents seem to
have more documents which are **more similar to
those descriptions** used in the answer choices.**

Discussion for systems with other configurations

**For systems using the AND query method,
the difference of the accuracy
between the knowledge sources are small.**

- The AND query method always **returned the documents containing particular words.**
- The systems using the query seem to have more often **selected the same answer** as a result.

Conclusion

Conclusion of results for each phase

- Automatic answering systems for world history questions in the National Center Test were developed, which mainly focused on different knowledge sources and query generations.

The top results for each phase

Test	System Id	Accuracy	Total Score
Phase-1	KSU-JA-02@PH1	0.49	68
Phase-2	KSU-JA-01@PH2	0.41	70
Phase-3	KSU-JA-01@PH3	0.39	38

Conclusion of discussion in phase-3

- The set of sentence-based documents was effective on the sub-questions having the answer type of SENTENCE
 - The need for choosing the knowledge source in accordance with answer types
- Future work
 - Using the dependency analysis and the semantic analysis