# IMTKU Question Answering System for World History Exams at NTCIR-13 QA Lab3
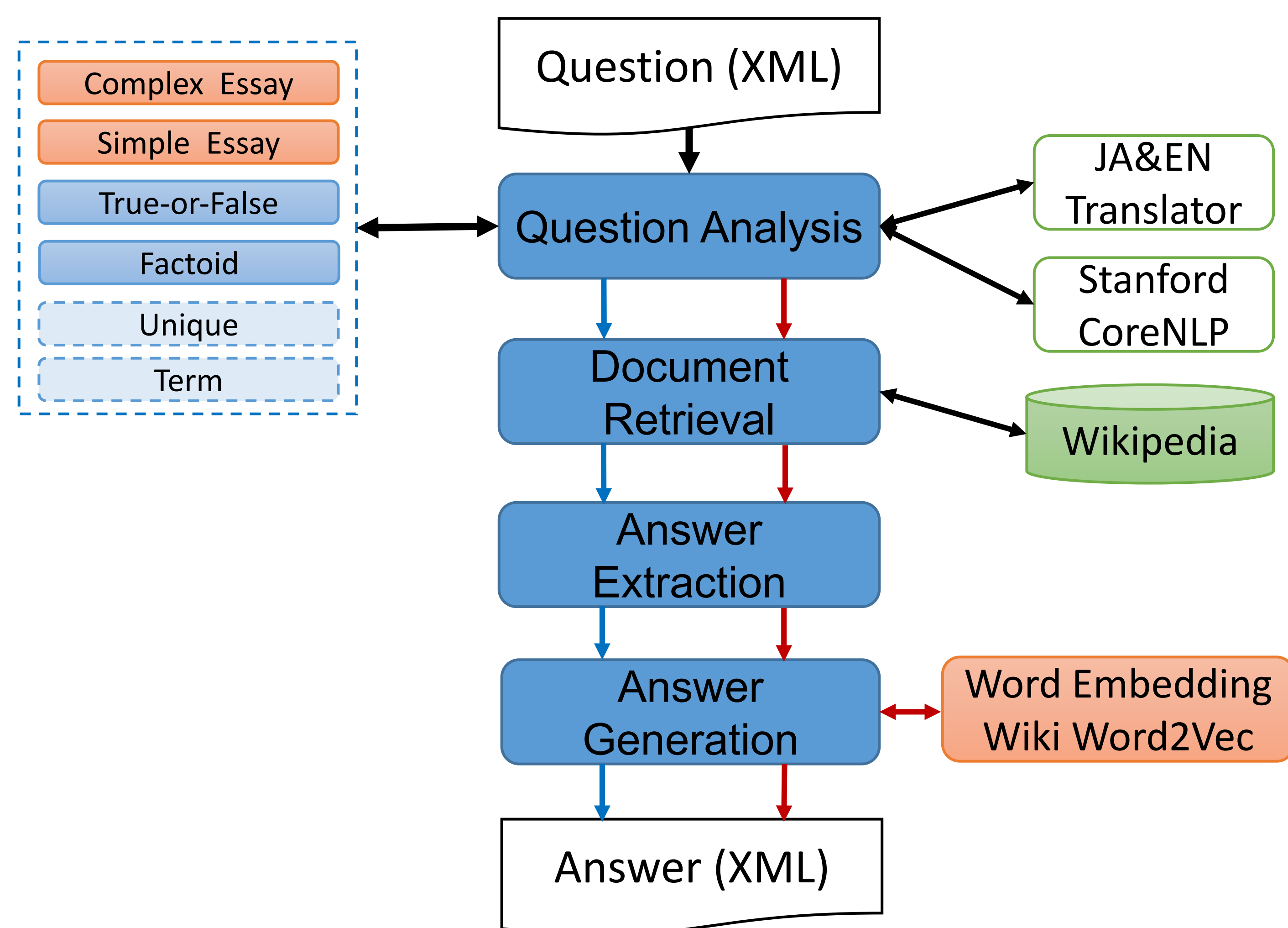
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This paper describes the IMTKU (Information Management at Tamkang University) question answering system for world history exams in Japanese university entrance exams at NTCIR-13 QA Lab-3. The IMTKU team proposed a question answering system that integrates natural language processing with deep learning approach for Japanese university entrance exams at NTCIR-13 QA Lab-3. In QA Lab-3 phase-2, the IMTKU team submitted 3 English End-to-End multiple-choice run results, 2 English End-to-End essay run results, 2 Japanese End-to-End essay run results, 2 English extraction essay run results, 2 Japanese extraction essay run results, 1 English summarization essay run result, and 1 Japanese summarization essay run result for National Center Tests and Second-stage Examinations. The best total score of IMTKU QA system is 40 in English multiple-choice subtask phase-3 and the best score is 0.408 for the complex Japanese essay subtask at NTCIR-13 QA Lab-3.

## System Architecture



## IMTKU QA System Components

### • Question Analysis
### • Document Retrieval
### • Answer Extraction
### • Answer Generation



**Japanese:**
古代メソポタミアと古代エジプトにおける暦とその発達の背景について，3行以内で説明しなさい。

**English (JA & EN Translator by Google Translate):**
Explain the calendar in ancient Mesopotamia and ancient Egypt and the background of its development within 3 lines.

The Uighurs destroyed the Kyrgyz.
("The", "DT")
("Uighurs", "NNP")
("destroyed", "VBD")
("Kyrgrz", "NNP")
("", ".")

## Performance

| Run | Correct | Incorrect | Total | Total Score |
|---|---|---|---|---|
| IMTKURUN01 | 12 | 24 | 12/36 | 34 |
| **IMTKURUN02** | **14** | **22** | **14/36** | **40** |
| IMTKURUN03 | 7 | 29 | 7/36 | 18 |

| SYSTEM | IMTKU1QALab3 | | | | | | IMTKU2QALab3 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | SIMPLE | | | COMPLEX | | | SIMPLE | | | COMPLEX | | |
| METHOD | CASE | STEM | STOP | CASE | STEM | STOP | CASE | STEM | STOP | CASE | STEM | STOP |
| R-1 | 0.075 | 0.077 | 0.026 | 0.312 | **0.329** | 0.131 | 0.006 | 0.009 | 0.012 | 0.008 | 0.014 | 0.013 |
| R-2 | 0.005 | 0.007 | 0 | 0.052 | 0.054 | 0.007 | 0 | 0 | 0 | 0 | 0 | 0 |
| R-S* | 0.056 | 0.057 | 0.023 | 0.164 | 0.167 | 0.063 | 0.006 | 0.009 | 0.012 | 0.007 | 0.012 | 0.012 |
| R-S4 | 0.031 | 0.032 | 0.015 | 0.047 | 0.048 | 0.025 | 0.003 | 0.006 | 0.008 | 0.004 | 0.006 | 0.007 |
| R-S9 | 0.007 | 0.007 | 0 | 0.092 | 0.102 | 0.013 | 0 | 0 | 0 | 0 | 0 | 0 |
| R-SU* | 0.007 | 0.008 | 0 | 0.063 | 0.069 | 0.005 | 0 | 0 | 0 | 0 | 0 | 0 |
| R-SU4 | 0.008 | 0.009 | 0 | 0.073 | 0.080 | 0.006 | 0 | 0 | 0 | 0 | 0 | 0 |
| R-SU9 | 0.009 | 0.010 | 0.001 | 0.094 | 0.104 | 0.015 | 0 | 0 | 0 | 0 | 0 | 0 |
| R-L | 0.018 | 0.019 | 0.003 | 0.105 | 0.113 | 0.027 | 0 | 0.001 | 0.001 | 0.001 | 0.002 | 0.003 |
| R-W1.2 | 0.015 | 0.015 | 0.002 | 0.095 | 0.103 | 0.018 | 0 | 0 | 0 | 0.001 | 0.002 | 0.002 |

| SYSTEM | IMTKU1QALab3 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| TYPE | SIMPLE | | | | COMPLEX | | | |
| METHOD | content | text | shortest unit (stem) | shortest unit (root) | content | text | shortest unit (stem) | shortest unit (root) |
| R-1 | 0.014 | 0.185 | 0.175 | 0.180 | 0.098 | **0.408** | 0.347 | 0.352 |
| R-2 | 0 | 0.052 | 0.040 | 0.041 | 0.002 | 0.164 | 0.109 | 0.113 |
| R-S* | 0.006 | 0.147 | 0.150 | 0.144 | 0.070 | 0.354 | 0.317 | 0.308 |
| R-S4 | 0.005 | 0.075 | 0.082 | 0.079 | 0.038 | 0.129 | 0.119 | 0.117 |
| R-S9 | 0 | 0.041 | 0.038 | 0.039 | 0.006 | 0.139 | 0.105 | 0.108 |
| R-SU* | 0.001 | 0.043 | 0.041 | 0.042 | 0.003 | 0.144 | 0.122 | 0.128 |
| R-SU4 | 0 | 0.048 | 0.049 | 0.051 | 0.005 | 0.158 | 0.136 | 0.143 |
| R-SU9 | 0.001 | 0.043 | 0.041 | 0.042 | 0.007 | 0.140 | 0.106 | 0.108 |
| R-L | 0.003 | 0.066 | 0.062 | 0.064 | 0.019 | 0.188 | 0.160 | 0.165 |
| R-W1.2 | 0.002 | 0.060 | 0.060 | 0.062 | 0.013 | 0.181 | 0.155 | 0.162 |

| SYSTEM | IMTKU2QALab3 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| TYPE | SIMPLE | | | | COMPLEX | | | |
| METHOD | content | text | shortest unit (stem) | shortest unit (root) | content | text | shortest unit (stem) | shortest unit (root) |
| R-1 | 0.004 | 0.067 | 0.043 | 0.050 | 0.010 | **0.146** | 0.059 | 0.075 |
| R-2 | 0 | 0.007 | 0.003 | 0.003 | 0 | 0.022 | 0.007 | 0.008 |
| R-S* | 0.004 | 0.049 | 0.041 | 0.048 | 0.009 | 0.124 | 0.058 | 0.071 |
| R-S4 | 0.003 | 0.028 | 0.026 | 0.030 | 0.006 | 0.043 | 0.022 | 0.027 |
| R-S9 | 0 | 0.006 | 0.002 | 0.003 | 0 | 0.027 | 0.006 | 0.008 |
| R-SU* | 0 | 0.004 | 0.001 | 0.002 | 0 | 0.016 | 0.003 | 0.005 |
| R-SU4 | 0 | 0.004 | 0.001 | 0.002 | 0 | 0.018 | 0.004 | 0.006 |
| R-SU9 | 0 | 0.007 | 0.003 | 0.004 | 0 | 0.028 | 0.006 | 0.009 |
| R-L | 0.001 | 0.013 | 0.006 | 0.008 | 0.002 | 0.037 | 0.012 | 0.016 |
| R-W1.2 | 0.001 | 0.010 | 0.004 | 0.006 | 0.001 | 0.030 | 0.008 | 0.012 |
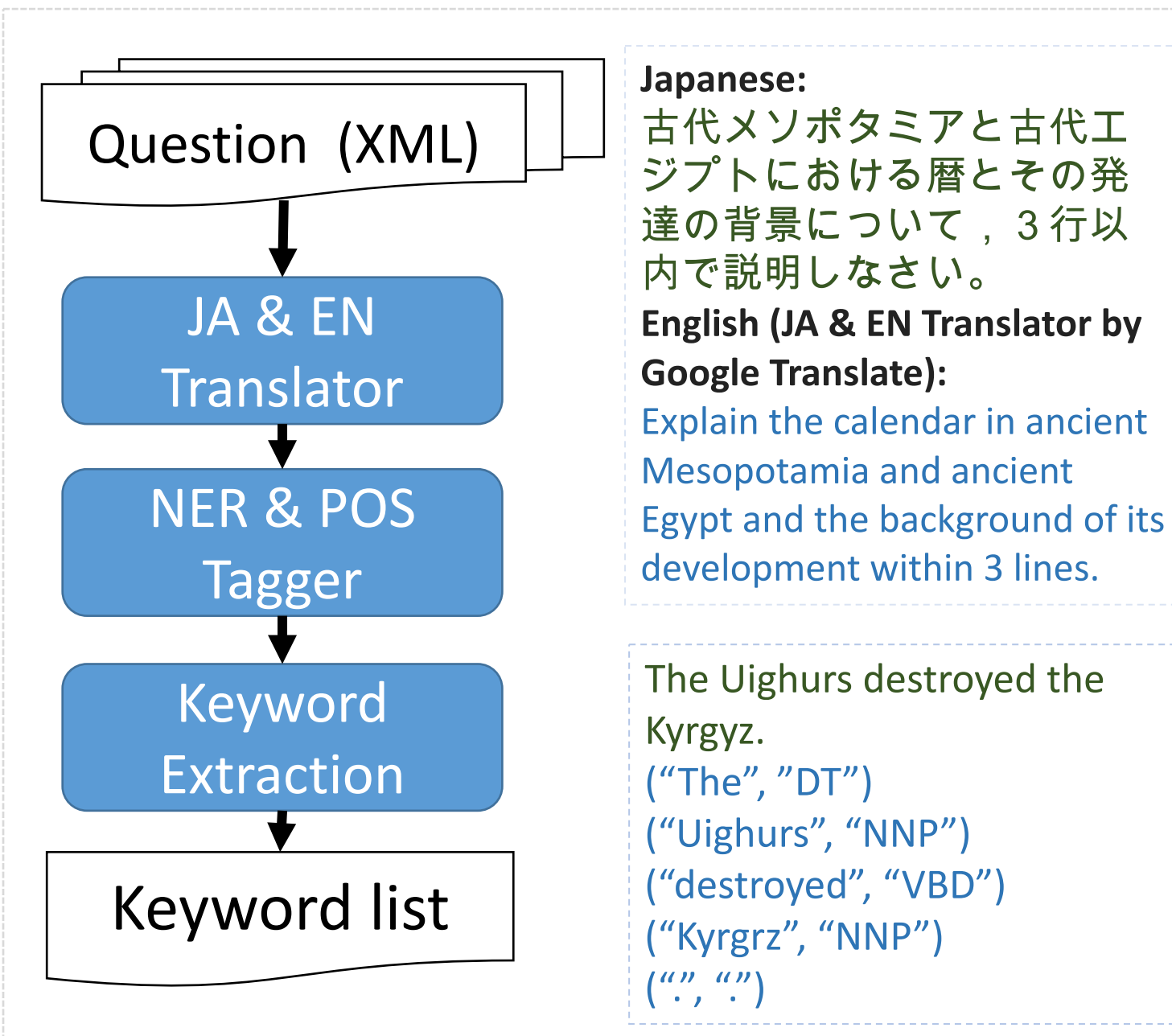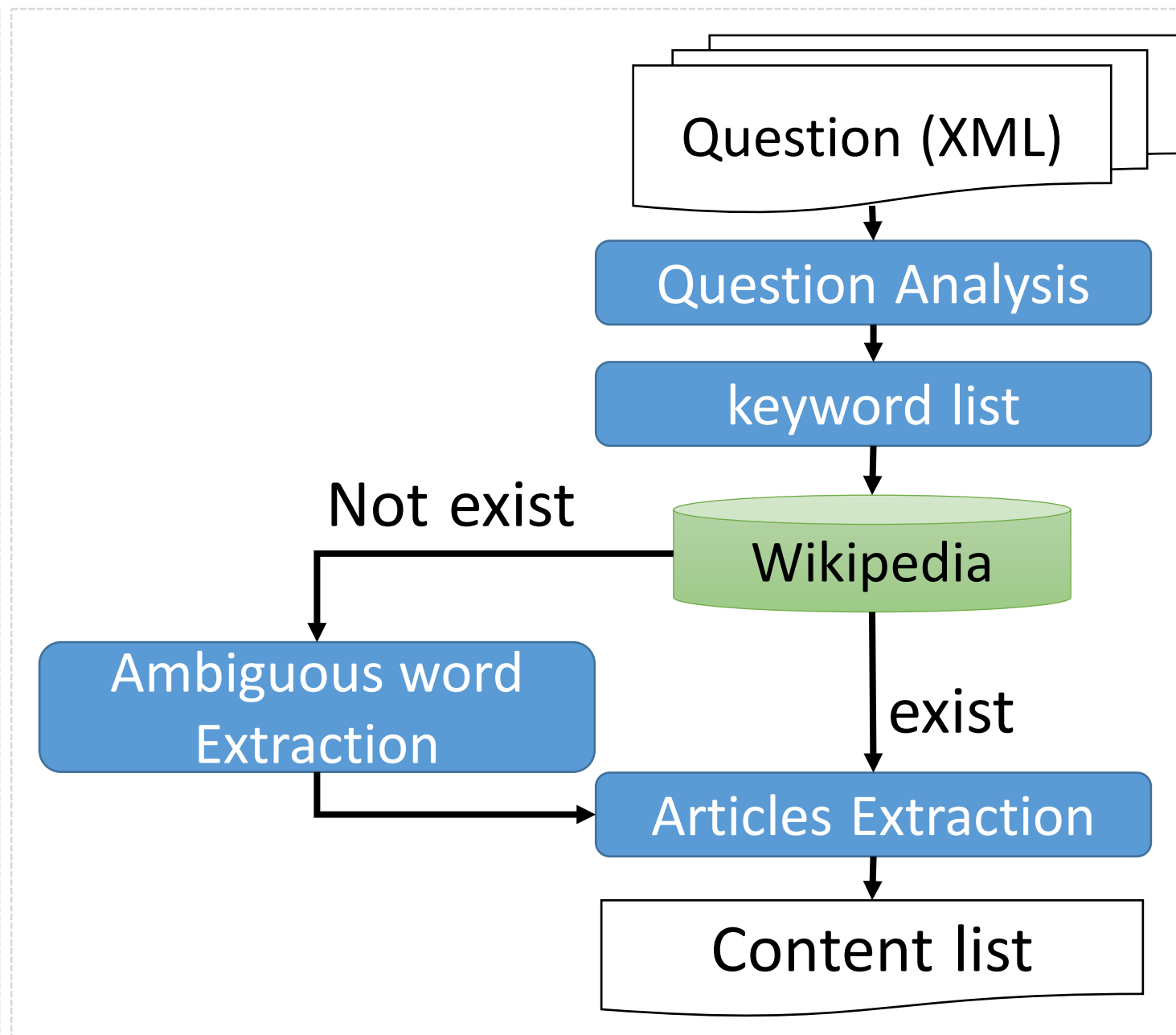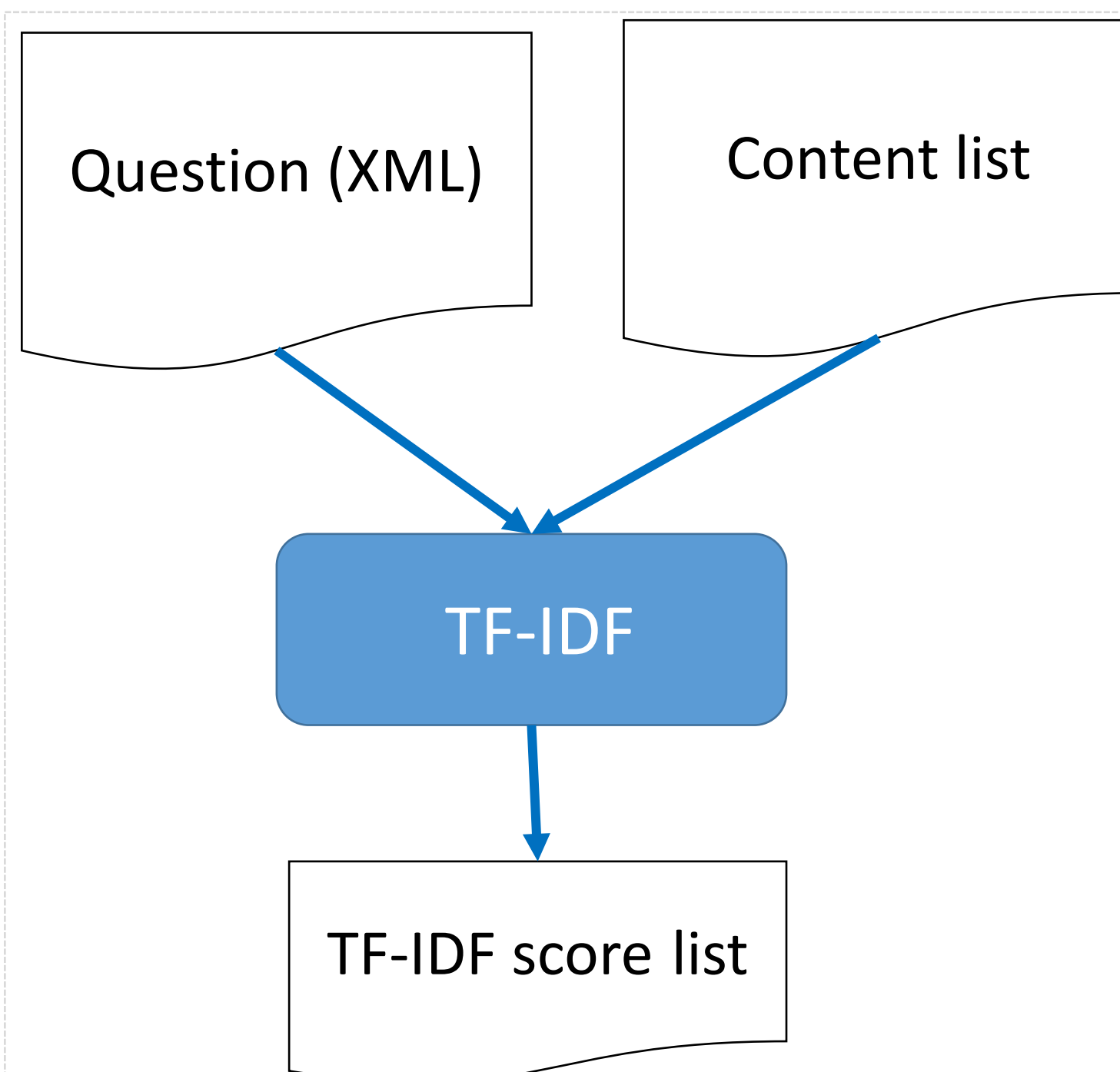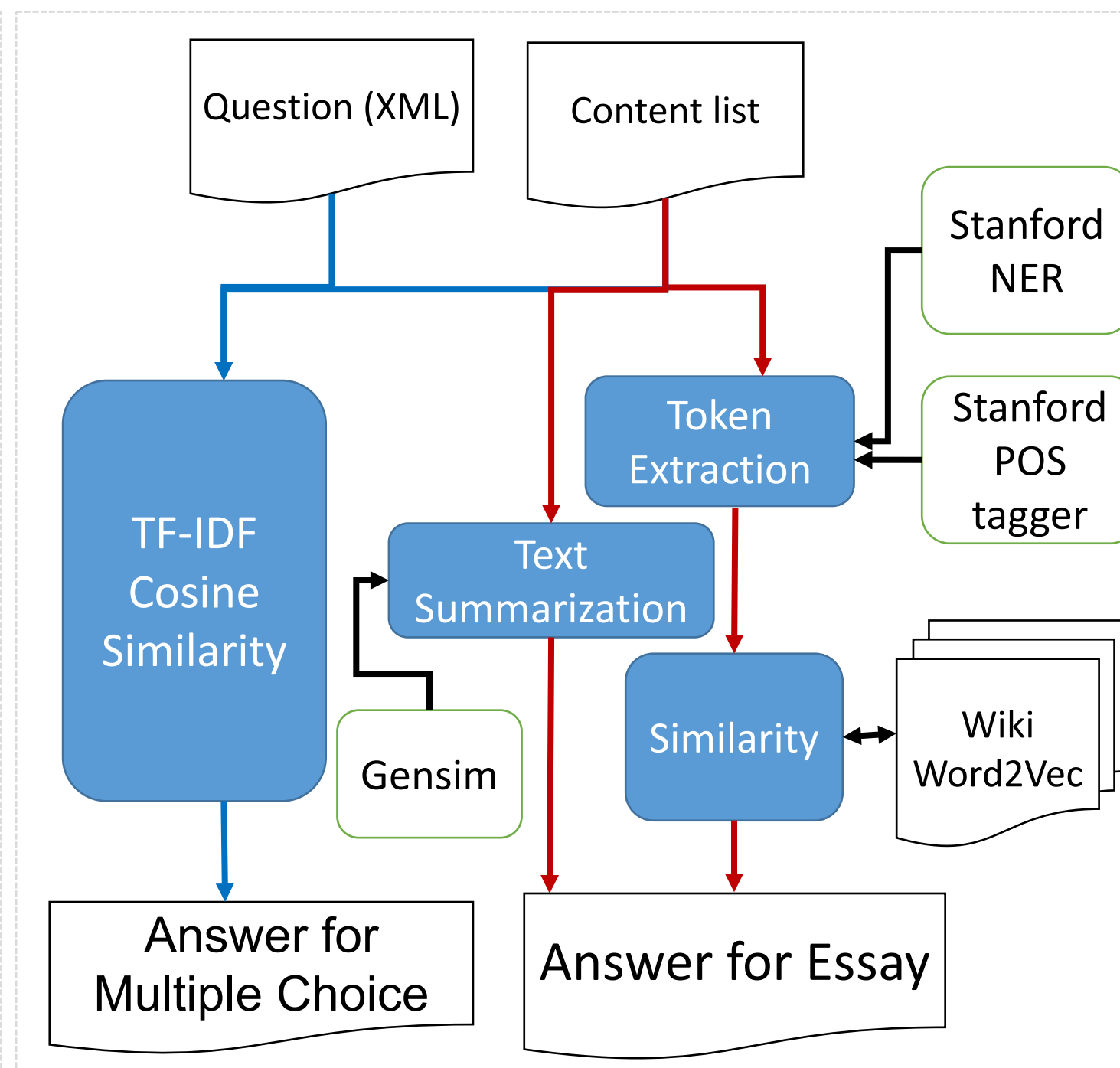
## Discussion

### • Limitations of Essay Subtask

The summaries include some matched words which are compared with the gold-standard answers although the presentations of the orders of words do not have a similar pattern.

### • Limitations of Multiple Choice

Question types remain to be resolved:
- Unique-image questions
- Unique-time questions
- Slot- Filling questions