

## ▼ CS 584-A: Natural Language Processing

### Student information

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### Homework 4

#### Goals

The goal of HW4 is for you to get hands-on experience of utilizing pre-trained and large language model for the machine reading comprehension task. The questions are open questions and there is no fixed solution. Different data selection and processing, parameter initialization, data split strategies will lead to different predictions and results. Therefore, during the grading, the specific values in the results are not required. It is important that you focus on implementing and setting up the pipelines of applying these models to solve the tasks.

## ▼ Task: Machine Reading Comprehension

### ▼ 1. Data preparation

#### 1.1 Data download and preprocessing

```
# Import the necessary libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
!pip install transformers datasets
from datasets import load_dataset
```

```
Requirement already satisfied: transformers in /usr/local/lib/python3.10/dist-packages (4.35.2)
Requirement already satisfied: datasets in /usr/local/lib/python3.10/dist-packages (2.15.0)
Requirement already satisfied: filelock in /usr/local/lib/python3.10/dist-packages (from transformers) (3.13.1)
Requirement already satisfied: huggingface-hub<1.0,>=0.16.4 in /usr/local/lib/python3.10/dist-packages (from transformer
Requirement already satisfied: numpy>=1.17 in /usr/local/lib/python3.10/dist-packages (from transformers) (1.23.5)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from transformers) (23.2)
Requirement already satisfied: pyyaml>=5.1 in /usr/local/lib/python3.10/dist-packages (from transformers) (6.0.1)
Requirement already satisfied: regex!=2019.12.17 in /usr/local/lib/python3.10/dist-packages (from transformers) (2023.6.
Requirement already satisfied: requests in /usr/local/lib/python3.10/dist-packages (from transformers) (2.31.0)
Requirement already satisfied: tokenizers<0.19,>=0.14 in /usr/local/lib/python3.10/dist-packages (from transformers) (0.
Requirement already satisfied: safetensors>=0.3.1 in /usr/local/lib/python3.10/dist-packages (from transformers) (0.4.0)
Requirement already satisfied: tqdm>=4.27 in /usr/local/lib/python3.10/dist-packages (from transformers) (4.66.1)
Requirement already satisfied: pyarrow>=8.0.0 in /usr/local/lib/python3.10/dist-packages (from datasets) (9.0.0)
Requirement already satisfied: pyarrow-hotfix in /usr/local/lib/python3.10/dist-packages (from datasets) (0.6)
Requirement already satisfied: dill<0.3.8,>=0.3.0 in /usr/local/lib/python3.10/dist-packages (from datasets) (0.3.7)
Requirement already satisfied: pandas in /usr/local/lib/python3.10/dist-packages (from datasets) (1.5.3)
Requirement already satisfied: xxhash in /usr/local/lib/python3.10/dist-packages (from datasets) (3.4.1)
Requirement already satisfied: multiprocessing in /usr/local/lib/python3.10/dist-packages (from datasets) (0.70.15)
Requirement already satisfied: fsspec[http]<=2023.10.0,>=2023.1.0 in /usr/local/lib/python3.10/dist-packages (from datas
Requirement already satisfied: aiohttp in /usr/local/lib/python3.10/dist-packages (from datasets) (3.8.6)
Requirement already satisfied: attrs>=17.3.0 in /usr/local/lib/python3.10/dist-packages (from aiohttp->datasets) (23.1.0)
Requirement already satisfied: charset-normalizer<4.0,>=2.0 in /usr/local/lib/python3.10/dist-packages (from aiohttp->da
Requirement already satisfied: multidict<7.0,>=4.5 in /usr/local/lib/python3.10/dist-packages (from aiohttp->datasets) (
Requirement already satisfied: async-timeout<5.0,>=4.0.0a3 in /usr/local/lib/python3.10/dist-packages (from aiohttp->dat
Requirement already satisfied: yarl<2.0,>=1.0 in /usr/local/lib/python3.10/dist-packages (from aiohttp->datasets) (1.9.2)
Requirement already satisfied: frozenlist>=1.1.1 in /usr/local/lib/python3.10/dist-packages (from aiohttp->datasets) (1.
Requirement already satisfied: aiosignal>=1.1.2 in /usr/local/lib/python3.10/dist-packages (from aiohttp->datasets) (1.3
Requirement already satisfied: typing-extensions>=3.7.4.3 in /usr/local/lib/python3.10/dist-packages (from huggingface-h
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from requests->transformers) (3.
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from requests->transformer
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests->transformer
Requirement already satisfied: python-dateutil>=2.8.1 in /usr/local/lib/python3.10/dist-packages (from pandas->datasets)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas->datasets) (2023.3.p
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.8.1->pandas-
```

```
# Load the dataset
dataset = load_dataset('squad_v2')
dataset
```

```
DatasetDict({
  train: Dataset({
    features: ['id', 'title', 'context', 'question', 'answers'],
    num_rows: 130319
  })
  validation: Dataset({
```



```
# Statistics about the context length
context_lengths = [len(item) for item in selected_data['context']]
max_context_length = max(context_lengths)
min_context_length = min(context_lengths)
avg_context_length = round((sum(context_lengths) / len(context_lengths)), 0)

# Statistics about the question length
question_lengths = [len(item) for item in selected_data["question"]]
max_question_length = max(question_lengths)
min_question_length = min(question_lengths)
avg_question_length = round((sum(question_lengths) / len(question_lengths)), 0)

# Statistics about the answer length
answer_lengths = [len(item['text'])[0]) for item in selected_data['answers']]
max_answer_length = max(answer_lengths)
min_answer_length = min(answer_lengths)
avg_answer_length = round((sum(answer_lengths) / len(answer_lengths)), 0)

# Create the elements of the statistics table
table_elements = {
    'Type' : ['Context', 'Question', 'Answer'],
    'MaxLength' : [max_context_length, max_question_length, max_answer_length],
    'MinLength' : [min_context_length, min_question_length, min_answer_length],
    'AvgLength' : [avg_context_length, avg_question_length, avg_answer_length]
}

# Print the statistics table
statistics_table = pd.DataFrame(table_elements)
statistics_table
```

	Type	MaxLength	MinLength	AvgLength
0	Context	694	694	694.0
1	Question	64	30	47.0
2	Answer	19	4	13.0

From the table, we can see that the maximum, minimum, and average length of the context are the same because these 15 question-answer pairs are the questions and answers from the same context.

## ▼ 2. Question answering

### 2.1 Use the pre-trained RoBERTa model to solve the question answering task on the data

```
from transformers import AutoTokenizer, RobertaForQuestionAnswering
import torch

# Load pre-trained RoBERTa tokenizer and model for question answering
tokenizer = AutoTokenizer.from_pretrained("deepset/roberta-base-squad2", truncation=True, max_length=512, padding="max_length")
model = RobertaForQuestionAnswering.from_pretrained("deepset/roberta-base-squad2")

# Loop through each data sample and perform question answering
for i in range(15):
    context = selected_data['context'][i]
    question = selected_data['question'][i]

    # Tokenize input
    inputs = tokenizer(question, context, return_tensors="pt")

    with torch.no_grad():
        outputs = model(**inputs)

    # Get the answer start and end indices
    answer_start_index = torch.argmax(outputs.start_logits)
    answer_end_index = torch.argmax(outputs.end_logits)

    # Decode answer tokens
    predict_answer_tokens = inputs.input_ids[0, answer_start_index : answer_end_index + 1]
    decoded_answer = tokenizer.decode(predict_answer_tokens, skip_special_tokens=True)

    # Print the required output
    print(f"Question: {question}")
    print(f"Answer Start Index: {answer_start_index}, Answer End Index: {answer_end_index}")
    print(f"Predicted Answer Tokens: {predict_answer_tokens}")
    print(f"Decoded Answer: {decoded_answer}")
    print()
```

Predicted Answer Tokens: tensor([1184])  
Decoded Answer: Texas

Question: In which decade did Beyonce become famous?  
Answer Start Index: 89, Answer End Index: 90  
Predicted Answer Tokens: tensor([4525, 29])  
Decoded Answer: 1990s

Question: In what R&B group was she the lead singer?  
Answer Start Index: 104, Answer End Index: 106  
Predicted Answer Tokens: tensor([23313, 18, 7442])  
Decoded Answer: Destiny's Child

Question: What album made her a worldwide known artist?  
Answer Start Index: 145, Answer End Index: 148  
Predicted Answer Tokens: tensor([34880, 9412, 11, 3437])  
Decoded Answer: Dangerously in Love

Question: Who managed the Destiny's Child group?  
Answer Start Index: 110, Answer End Index: 113  
Predicted Answer Tokens: tensor([ 4101, 16152, 10690, 1634])  
Decoded Answer: Mathew Knowles

Question: When did Beyoncé rise to fame?  
Answer Start Index: 87, Answer End Index: 89  
Predicted Answer Tokens: tensor([ 628, 4525, 29])  
Decoded Answer: late 1990s

Question: What role did Beyoncé have in Destiny's Child?  
Answer Start Index: 94, Answer End Index: 95  
Predicted Answer Tokens: tensor([ 483, 3250])  
Decoded Answer: lead singer

Question: What was the first album Beyoncé released as a solo artist?  
Answer Start Index: 149, Answer End Index: 152  
Predicted Answer Tokens: tensor([34880, 9412, 11, 3437])  
Decoded Answer: Dangerously in Love

Question: When did Beyoncé release Dangerously in Love?  
Answer Start Index: 151, Answer End Index: 151  
Predicted Answer Tokens: tensor([35153])  
Decoded Answer: 2003

Question: How many Grammy awards did Beyoncé win for her first solo album?  
Answer Start Index: 167, Answer End Index: 167  
Predicted Answer Tokens: tensor([292])  
Decoded Answer: five

Question: What was Beyoncé's role in Destiny's Child?  
Answer Start Index: 94, Answer End Index: 95  
Predicted Answer Tokens: tensor([ 483, 3250])  
Decoded Answer: lead singer

Question: What was the name of Beyoncé's first solo album?  
Answer Start Index: 148, Answer End Index: 151  
Predicted Answer Tokens: tensor([34880, 9412, 11, 3437])  
Decoded Answer: Dangerously in Love

```

# Try to change some settings in tokenizer
# Load pre-trained RoBERTa tokenizer and model for question answering
tokenizer = AutoTokenizer.from_pretrained("deepset/roberta-base-squad2", truncation=False, max_length=128, padding=False) #
model = RobertaForQuestionAnswering.from_pretrained("deepset/roberta-base-squad2")

# Loop through each data sample and perform question answering
for i in range(15):
    context = selected_data['context'][i]
    question = selected_data['question'][i]

    # Tokenize input
    inputs = tokenizer(question, context, return_tensors="pt")

    with torch.no_grad():
        outputs = model(**inputs)

    # Get the answer start and end indices
    answer_start_index = torch.argmax(outputs.start_logits)
    answer_end_index = torch.argmax(outputs.end_logits)

    # Decode answer tokens
    predict_answer_tokens = inputs.input_ids[0, answer_start_index : answer_end_index + 1]
    decoded_answer = tokenizer.decode(predict_answer_tokens, skip_special_tokens=True)

    # Print the required output
    print(f"Question: {question}")
    print(f"Answer Start Index: {answer_start_index}, Answer End Index: {answer_end_index}")
    print(f"Predicted Answer Tokens: {predict_answer_tokens}")
    print(f"Decoded Answer: {decoded_answer}")
    print()

    Predicted Answer Tokens: tensor([1184])
    Decoded Answer: Texas

    Question: In which decade did Beyonce become famous?
    Answer Start Index: 89, Answer End Index: 90
    Predicted Answer Tokens: tensor([4525, 29])
    Decoded Answer: 1990s

    Question: In what R&B group was she the lead singer?
    Answer Start Index: 104, Answer End Index: 106
    Predicted Answer Tokens: tensor([23313, 18, 7442])
    Decoded Answer: Destiny's Child

    Question: What album made her a worldwide known artist?
    Answer Start Index: 145, Answer End Index: 148
    Predicted Answer Tokens: tensor([34880, 9412, 11, 3437])
    Decoded Answer: Dangerously in Love

    Question: Who managed the Destiny's Child group?
    Answer Start Index: 110, Answer End Index: 113
    Predicted Answer Tokens: tensor([ 4101, 16152, 10690, 1634])
    Decoded Answer: Mathew Knowles

    Question: When did Beyoncé rise to fame?
    Answer Start Index: 87, Answer End Index: 89
    Predicted Answer Tokens: tensor([ 628, 4525, 29])
    Decoded Answer: late 1990s

    Question: What role did Beyoncé have in Destiny's Child?
    Answer Start Index: 94, Answer End Index: 95
    Predicted Answer Tokens: tensor([ 483, 3250])
    Decoded Answer: lead singer

    Question: What was the first album Beyoncé released as a solo artist?
    Answer Start Index: 149, Answer End Index: 152
    Predicted Answer Tokens: tensor([34880, 9412, 11, 3437])
    Decoded Answer: Dangerously in Love

    Question: When did Beyoncé release Dangerously in Love?

```

From trying to change some settings to see any difference, I found that the answers are the same. I think the answers remained the same because the context is not complex that is easy for the model to understand and provide the correct answers.

## 2.2 Design the prompts to interact with ChatGPT and solve the question answering task on the data

### Prompt Template for ChatGPT about the selected N question-answer pairs

Context: "context"

Question 1: "question 1"

Question 2: "question 2"

Question N: "question N"

Please provide the short answer to each question about the context, and also an explanation of the reasoning for that answer.

### Interaction with ChatGPT about the selected 15 question-answer pairs

Context: 'Beyoncé Giselle Knowles-Carter (/biːˈjɒnseɪ/ bee-YON-say) (born September 4, 1981) is an American singer, songwriter, record producer and actress. Born and raised in Houston, Texas, she performed in various singing and dancing competitions as a child, and rose to fame in the late 1990s as lead singer of R&B girl-group Destiny's Child. Managed by her father, Mathew Knowles, the group became one of the world's best-selling girl groups of all time. Their hiatus saw the release of Beyoncé's debut album, *Dangerously in Love* (2003), which established her as a solo artist worldwide, earned five Grammy Awards and featured the Billboard Hot 100 number-one singles "Crazy in Love" and "Baby Boy".'

- Question 1: When did Beyonce start becoming popular?
- Question 2: What areas did Beyonce compete in when she was growing up?
- Question 3: When did Beyonce leave Destiny's Child and become a solo singer?
- Question 4: In what city and state did Beyonce grow up?
- Question 5: In which decade did Beyonce become famous?
- Question 6: In what R&B group was she the lead singer?
- Question 7: What album made her a worldwide known artist?
- Question 8: Who managed the Destiny's Child group?
- Question 9: When did Beyoncé rise to fame?
- Question 10: What role did Beyoncé have in Destiny's Child?
- Question 11: What was the first album Beyoncé released as a solo artist?
- Question 12: When did Beyoncé release *Dangerously in Love*?
- Question 13: How many Grammy awards did Beyoncé win for her first solo album?
- Question 14: What was Beyoncé's role in Destiny's Child?
- Question 15: What was the name of Beyoncé's first solo album?

Please provide the short answer to each question about the context, and also an explanation of the reasoning for that answer.

### ChatGPT's outputs:

#### 1. When did Beyonce start becoming popular?

- **Answer:** Beyoncé started becoming popular in the late 1990s.
- **Explanation:** The provided context mentions that Beyoncé rose to fame in the late 1990s as the lead singer of the R&B girl-group Destiny's Child.

#### 2. What areas did Beyonce compete in when she was growing up?

- **Answer:** Beyoncé competed in various singing and dancing competitions as a child.
- **Explanation:** The context states that she performed in various singing and dancing competitions during her childhood.

#### 3. When did Beyonce leave Destiny's Child and become a solo singer?

- **Answer:** Beyoncé left Destiny's Child during their hiatus, and her debut solo album, *Dangerously in Love*, was released in 2003.
- **Explanation:** The context mentions that their hiatus saw the release of Beyoncé's debut album in 2003, signifying her transition to a solo career.

#### 4. In what city and state did Beyonce grow up?

- **Answer:** Beyoncé grew up in Houston, Texas.
- **Explanation:** The context states that she was born and raised in Houston, Texas.

#### 5. In which decade did Beyonce become famous?

- **Answer:** Beyoncé became famous in the late 1990s.

- **Explanation:** The context indicates that she rose to fame in the late 1990s.

#### 6. In what R&B group was she the lead singer?

- **Answer:** Beyoncé was the lead singer of the R&B girl-group Destiny's Child.
- **Explanation:** The context explicitly mentions that she was the lead singer of Destiny's Child.

#### 7. What album made her a worldwide known artist?

- **Answer:** Dangerously in Love (2003) made Beyoncé a worldwide known artist.
- **Explanation:** The context specifies that this album, released in 2003, established her as a solo artist worldwide.

#### 8. Who managed the Destiny's Child group?

- **Answer:** Destiny's Child was managed by her father, Mathew Knowles.
- **Explanation:** The context mentions that the group was managed by Beyoncé's father, Mathew Knowles.

#### 9. When did Beyoncé rise to fame?

- **Answer:** Beyoncé rose to fame in the late 1990s.
- **Explanation:** The context states that she rose to fame in the late 1990s as the lead singer of Destiny's Child.

#### 10. What role did Beyoncé have in Destiny's Child?

- **Answer:** Beyoncé was the lead singer of Destiny's Child.
- **Explanation:** The context explicitly mentions that she was the lead singer of the R&B girl-group Destiny's Child.

#### 11. What was the first album Beyoncé released as a solo artist?

- **Answer:** Beyoncé's first solo album was Dangerously in Love (2003).
- **Explanation:** The context specifies that Dangerously in Love (2003) was her debut album as a solo artist.

#### 12. When did Beyoncé release Dangerously in Love?

- **Answer:** Beyoncé released Dangerously in Love in 2003.
- **Explanation:** The context provides the release year of her debut solo album.

#### 13. How many Grammy awards did Beyoncé win for her first solo album?

- **Answer:** Beyoncé won five Grammy Awards for her first solo album, Dangerously in Love.
- **Explanation:** The context mentions that her debut solo album, Dangerously in Love (2003), earned her five Grammy Awards.

#### 14. What was Beyoncé's role in Destiny's Child?

- **Answer:** Beyoncé was the lead singer of Destiny's Child.
- **Explanation:** The context explicitly states that she was the lead singer of the R&B girl-group Destiny's Child.

#### 15. What was the name of Beyoncé's first solo album?

- **Answer:** Beyoncé's first solo album was titled Dangerously in Love.
- **Explanation:** The context provides the title of her debut solo album.

You can see the pictures of interaction with chatgpt in the link: <https://drive.google.com/drive/folders/111jspKOhvRvCIOTLV4Aj8tli-pKaby?usp=sharing>

### 2.3 Design the prompts to interact with Claude 2 and solve the question answering task on the data

#### Prompt Template for Claude 2 about the selected N question-answer pairs (Same as the template used for ChatGPT)

Context: "context"

Question 1: "question 1"

Question 2: "question 2"

Question N: "question N"

Please provide the short answer to each question about the context, and also an explanation of the reasoning for that answer.

#### Interaction with Claude 2 about the selected 15 question-answer pairs

Context: 'Beyoncé Giselle Knowles-Carter (/biːˈjɒnsɛɪ/ bee-YON-say) (born September 4, 1981) is an American singer, songwriter, record producer and actress. Born and raised in Houston, Texas, she performed in various singing and dancing competitions as a child, and rose to fame in the late 1990s as lead singer of R&B girl-group Destiny's Child. Managed by her father, Mathew Knowles, the group became one of the world's best-selling girl groups of all time. Their hiatus saw the release of Beyoncé's debut album, Dangerously in Love (2003), which established her as a solo artist worldwide, earned five Grammy Awards and featured the Billboard Hot 100 number-one singles "Crazy in Love" and "Baby Boy".'

Question 1: When did Beyonce start becoming popular?

Question 2: What areas did Beyonce compete in when she was growing up?

Question 3: When did Beyonce leave Destiny's Child and become a solo singer?

- Question 4: In what city and state did Beyonce grow up?
- Question 5: In which decade did Beyonce become famous?
- Question 6: In what R&B group was she the lead singer?
- Question 7: What album made her a worldwide known artist?
- Question 8: Who managed the Destiny's Child group?
- Question 9: When did Beyoncé rise to fame?
- Question 10: What role did Beyoncé have in Destiny's Child?
- Question 11: What was the first album Beyoncé released as a solo artist?
- Question 12: When did Beyoncé release Dangerously in Love?
- Question 13: How many Grammy awards did Beyoncé win for her first solo album?
- Question 14: What was Beyoncé's role in Destiny's Child?
- Question 15: What was the name of Beyoncé's first solo album?

Please provide the short answer to each question about the context, and also an explanation of the reasoning for that answer.

#### Claude 2's outputs:

1. When did Beyonce start becoming popular?

She rose to fame in the late 1990s as lead singer of R&B girl-group Destiny's Child.

2. What areas did Beyonce compete in when she was growing up?

The context states she performed in various singing and dancing competitions as a child.

3. When did Beyonce leave Destiny's Child and become a solo singer?

The context states that during Destiny's Child's hiatus, Beyoncé released her debut solo album Dangerously in Love in 2003. So she left the group and went solo in 2003.

4. In what city and state did Beyonce grow up?

She was born and raised in Houston, Texas.

5. In which decade did Beyonce become famous?

She became famous in the late 1990s.

6. In what R&B group was she the lead singer?

Destiny's Child

7. What album made her a worldwide known artist?

Her debut solo album "Dangerously in Love" in 2003 established her as a solo artist worldwide.

8. Who managed the Destiny's Child group?

Her father, Mathew Knowles, managed the group.

9. When did Beyoncé rise to fame?

She rose to fame in the late 1990s.

10. What role did Beyoncé have in Destiny's Child?

She was the lead singer of Destiny's Child.

11. What was the first album Beyoncé released as a solo artist?

Dangerously in Love

12. When did Beyoncé release Dangerously in Love?

2003

13. How many Grammy awards did Beyoncé win for her first solo album?

Five Grammy Awards

14. What was Beyoncé's role in Destiny's Child?

She was the lead singer of the group.

15. What was the name of Beyoncé's first solo album?

Dangerously in Love



You can see the pictures of interaction with claude 2 in the link: <https://drive.google.com/drive/folders/111jspKOhyvRvCIOTLV4Aj8tli-pKaby?usp=sharing>

### ▼ 3. Results analysis and evaluation

#### 3.1 Manually check if the output answer for each data sample is correct or not

```
# Getting the ground truth of the selected 15 question-answer pair
ground_truth = [item['text'][0] for item in selected_data['answers']]
ground_truth
```

```
['in the late 1990s',
 'singing and dancing',
 '2003',
 'Houston, Texas',
 'late 1990s',
 'Destiny's Child',
 'Dangerously in Love',
 'Mathew Knowles',
 'late 1990s',
 'lead singer',
 'Dangerously in Love',
 '2003',
 'five',
 'lead singer',
 'Dangerously in Love']
```

```

# Define the elements of result table
result_table_elements = {
    'Answer for' : ['Q1', 'Q2', 'Q3', 'Q4', 'Q5', 'Q6', 'Q7', 'Q8', 'Q9', 'Q10', 'Q11', 'Q12', 'Q13', 'Q14', 'Q15'],
    'Ground truth' : ['in the late 1990s',
                      'singing and dancing',
                      '2003',
                      'Houston, Texas',
                      'late 1990s',
                      'Destiny's Child',
                      'Dangerously in Love',
                      'Mathew Knowles',
                      'late 1990s',
                      'lead singer',
                      'Dangerously in Love',
                      '2003',
                      'five',
                      'lead singer',
                      'Dangerously in Love'],
    "RoBERTa's answers" : ['late 1990s',
                           'singing and dancing',
                           '2003',
                           'Texas',
                           '1990s',
                           'Destiny's Child',
                           'Dangerously in Love',
                           'Mathew Knowles',
                           'late 1990s',
                           'lead singer',
                           'Dangerously in Love',
                           '2003',
                           'five',
                           'lead singer',
                           'Dangerously in Love'],
    "ChatGPT's answers" : ['Beyoncé started becoming popular in the late 1990s.',
                           'Beyoncé competed in various singing and dancing competitions as a child.',
                           'Beyoncé left Destiny's Child during their hiatus, and her debut solo album, Dangerously in Love,
                           'Beyoncé grew up in Houston, Texas.',
                           'Beyoncé became famous in the late 1990s.',
                           'Beyoncé was the lead singer of the R&B girl-group Destiny's Child.',
                           'Dangerously in Love (2003) made Beyoncé a worldwide known artist.',
                           'Destiny's Child was managed by her father, Mathew Knowles.',
                           'Beyoncé rose to fame in the late 1990s.',
                           'Beyoncé was the lead singer of Destiny's Child.',
                           'Beyoncé's first solo album was Dangerously in Love (2003).',
                           'Beyoncé released Dangerously in Love in 2003.',
                           'Beyoncé won five Grammy Awards for her first solo album, Dangerously in Love.',
                           'Beyoncé was the lead singer of Destiny's Child.',
                           'Beyoncé's first solo album was titled Dangerously in Love.'],
    "Claude 2's answers" : ["She rose to fame in the late 1990s as lead singer of R&B girl-group Destiny's Child.",
                           'The context states she performed in various singing and dancing competitions as a child.',
                           'The context states that during Destiny's Child's hiatus, Beyoncé released her debut solo album
                           'She was born and raised in Houston, Texas.',
                           'She became famous in the late 1990s.',
                           'Destiny's Child',
                           '""Her debut solo album "Dangerously in Love" in 2003 established her as a solo artist worldwide
                           'Her father, Mathew Knowles, managed the group.',
                           'She rose to fame in the late 1990s.',
                           'She was the lead singer of Destiny's Child.',
                           'Dangerously in Love',
                           '2003',
                           'Five Grammy Awards',
                           'She was the lead singer of the group.',
                           'Dangerously in Love']
}

# Print the result table
result_table = pd.DataFrame(result_table_elements)
result_table

```

From the results in the above table, we can see that all 3 models can correctly answer all questions, thus the general score to answer the