CS 162 HW 3

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May 2025

Question 1

The following are advantages of pre-training:

- Pretraining helps large language models learn basics of syntax and semantics before task- and domain-specific training.

- A common choice for a model pretraining objective is multiple choice question answering.

- A common choice for a model pretraining objective is masked token or span prediction.

- Pretraining enables users to perform previously unseen tasks without additional training through in-context learning.

Question 2

PetaFLOP-days

Question 3

Residual Connections

Question 4

- Long-short Term Memory RNN

- Encoder-Decoder Transformation

Question 5

Viterbi Algorithm

Question 6

The time complexity is $O(N^2 \cdot T)$. Each node scans all other nodes for optimal paths for the length of the sequence.

Question 7

- The (DT) rolling (JJ) beach (JJ) ball (NN) hit (VBD) Naomi's (NNP) cinnamon (JJ) roll (NN).

- The (DT) heavy (JJ) gray (JJ) rain (NN) hid (VBD) the (DT) world (NN) from (IN) view (NN).

Question 8

- The (O) rolling (B-NP) beach (I-NP) ball (I-NP) hit (B-VP) Naomi's (B-NP) cinnamon (B-NP) roll (I-NP).

- The (O) heavy (B-NP) gray (I-NP) rain (I-NP) hid (B-VP) the (O) world (B-NP) from (B-PP) view (B-NP).

Question 9

a) See attached code

b) The following accuracies are:

   (a) NLTK: 0.616

   (b) My Model: 0.231

c) The prediction is: ['PPSS', 'VB', 'PPO', 'AT', 'JJ', 'NN']

d) If unseen words occur in the sentence, their probabilities would default to 0. We can fix this through smoothing (add-one smoothing, backoff smoothing, etc.).

Question 10

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	NN	VB
food	12/32	3/13
we	14/32	1/13
eat	6/32	9/13

- Initial probability for NN - 0.4 Initial Probability for VB - 0.6

-

$$\text{(NN, NN)} \qquad 0.4 \cdot \frac{14}{32} \cdot 0.2 \cdot \frac{6}{32} = 0.035$$

$$\text{(NN, VB)} \qquad 0.4 \cdot \frac{14}{32} \cdot 0.8 \cdot \frac{9}{13} = 0.097$$

$$\text{(VB, VB)} \qquad 0.6 \cdot \frac{1}{13} \cdot 0.3 \cdot \frac{9}{13} = 0.010$$

$$\text{(VB, NN)} \qquad 0.6 \cdot \frac{1}{13} \cdot 0.7 \cdot \frac{6}{32} = 0.006$$

Thus the most probable sequence is (NN, VB).

Question 11

The following are true:

- RLHF can reduce undesirable model behaviors by aligning models with human preferences.

Question 12

- **Precision**: $\frac{\text{TP}}{\text{TP+FP}} = \frac{10}{11} \approx 0.909$

- **Recall**: $\frac{\text{TP}}{\text{TP+FN}} = \frac{10}{11} \approx 0.909$

- **F1 Score**: $2 \cdot \frac{\text{Precision·Recall}}{\text{Precision+Recall}} = 2 \cdot \frac{0.909 \cdot 0.909}{0.909 + 0.909} \approx 0.909$

Question 13

The following are not closed parts of speech:

- Nouns

- Proper Nouns

- Verbs

- Adverbs

- Adjectives

Question 14

One advantage of the dependency view of syntax over the constituent view of syntax is that the dependency view models relationships between discontinuous words.

Question 15

The following can be learned and optimized during training:

- Emission probabilities (i.e. observation likelihoods)

- The initial probability distribution

Question 16

The following are ethical concerns that can arise from machine translation:

- Machine translation can have political objectives. During the Cold War, Engilsh-Russian translationw as promoted due to political objectives. The movitve is never purely science based.

- Translation data can be accessed - leading to a form of "surveilance capitalism"

- Cultural differences can influence the way language is understood (some languages have gendered words which can throw off the context)

Question 17

a)

Amharic	English
ሚሼል የተወለደችበት ከተማ ህዝብ ብዛት 145,826 ነው። በቁጥር 145,826 ያለው የ5ቱ ዋጋ ስንት ነው	The population of the city where Michelle was born is 145,826. What is the value of one-fifth of the number 145,826?
አሊቪያ ከታች የሚታየውን የቁጥር ንድፍ ለመፍጠር (11 አክል) የሚለውን ህግ ተጠቅማለች። 10,21,32,43,54 ስለ ቁጥሩ ንድፍ የትኛው አባባል ትክክል ነው	Olivia uses the rule 'to create a number sequence by adding 11' for the sequence shown below. For the number sequence 10, 21, 32, 43, 54, which pattern is correct?
በአጠቃላይ 30 ተጫዋቾች በአንድ ፓርክ ውስጥ የቅርጫት ኳስ ይጫወታሉ። በእያንዳንዱ ቡድን ውስጥ በትክክል 5 ተጫዋቾች ይኖራሉ። የሚፈለጉትን የቡድኖች ብዛት እንዴት ማግኘት እንደሚቻል በትክክል የሚያብራራው የትኛው አነጋገር ነው	In total, 30 players play soccer in one park. Each team has exactly 5 players. Which statement correctly explains how to find the number of teams needed?
አንድ ሱቅ 107 የተለያየ ቀለም ይሸጣል። በማከማቻ ውስጥ የእያንዳንዱ ቀለም 25 ቆርቆሮዎች አሏቸው ። በማከማቻው ውስጥ ያለው የቀለም ቆርቆሮዎች ብዛት ከዚህ በታች ያለውን መግለጫ በመጠቀም ማግኘት ይቻላል። 107 × 25። በማከማቻ ውስጥ ምን ያህል የቀለም ቆርቆሮዎች አሉት	A store sells 107 different colors. Each color has 25 crayons in the box. Using the description below, you can find the total number of crayons in the box by calculating 107 × 25. How many crayons are there in the box?
የትኛው አገላለፅ ከ 5 x 9 ጋር እኩል ነው	Which expression is equal to 5 x 9?
የህዝብ ቁጥር መጨመር መጠን የሚገኘው በመቀነስ ነው	The way to find the total population is by subtraction.
በሶስተኛው ደረጃ የስነ ህዝብ ሽግግር ምሳሌ፤ ከሚከተሉት ውስጥ የትኛው እውነት ነው	An example of demographic transition at the third stage: which of the following is true?
በዩናይትድ ስቴት ውስጥ የአካባቢ መንግስታት የሚሰጡትን አገልግሎቶች በተመለከተ ከሚከተሉት መግለጫዎች ውስጥ ትክክል ያልሆነው የትኛው ነው	Regarding the services provided by local governments in the United States, which of the following descriptions is incorrect?
አሰራርን ለማስኬድ የውጭ ሶስተኛ ወገን አገልግሎት አቅራቢን የመቅጠር ልምድ ይባላል	Outsourcing is the practice of hiring an external third-party service provider to perform a process.
ከሚከተሉት እቃዎች ውስጥ ቁሳዊ ያልሆነ ባህል ምሳሌ የሚሆነው የትኛው ነው	Among the following items, which one is an example of a non-material culture?

BLEU Score of 36.95

	Amharic	English
	ሚሼል የተወለደችበት ከተማ ህዝብ ብዛት 145,826 ነው። በቁጥር 145,826 ያለው የ5ቱ ዋጋ ስንት ነው	The city where Michelle was born has a population of 145,826. What is the value of the 5 in the number 145,826?
	አሊቪያ ከታች የሚታየውን የቁጥር ንድፍ ለመፍጠር (11 አክል) የሚለውን ህግ ተጠቅማለች። 10,21,32,43,54 ስለ ቁጥሩ ንድፍ የትኛው አባባል ትክክል ነው	Olivia uses the rule 'add 11' to create the following number sequence. Which pattern for the number sequence 10, 21, 32, 43, 54 is correct?
	በአጠቃላይ 30 ተጫዋቾች በአንድ ፓርክ ውስጥ የቅርጫት ኳስ ይጫወታሉ። በእያንዳንዱ ቡድን ውስጥ በትክክል 5 ተጫዋቾች ይኖራሉ። የሚፈለጉትን የቡድኖች ብዛት እንዴት ማግኘት እንደሚቻል በትክክል የሚያብራራው የትኛው አነጋገር ነው	A total of 30 players are playing basketball in a park. Each team has exactly 5 players. Which statement correctly explains how to find the number of teams needed?
b)	አንድ ሱቅ 107 የተለያየ ቀለም ይሸጣል። በማከማቻ ውስጥ የእያንዳንዱ ቀለም 25 ቆርቆሮዎች አሉቸው ።በማከማቻው ውስጥ ያለው የቀለም ቆርቆሮዎች ብዛት ከዚህ በታች ያለውን መግለጫ በመጠቀም ማግኘት ይቻላል። 107 × 25። በማከማቻ ውስጥ ምን ያህል የቀለም ቆርቆሮዎች አሉት	A store sells 107 different colors. In the storage, there are 25 bottles of each color. The total number of color bottles in storage can be found using the expression 107 × 25. How many color bottles are there in storage?
	የትኛው አገላለፅ ከ 5 x 9 ጋር እኩል ነው	Which expression is equal to 5 × 9?
	የህዝብ ቁጥር መጨመር መጠን የሚገኘው በመቀነስ ነው	The population growth rate is found by subtracting.
	በሶስተኛው ደረጃ የስነ ህዝብ ሽግግር ምሳሌ፣ ከሚከተሉት ውስጥ የትኛው እውነት ነው	In the third stage of demographic transition, which of the following is true?
	በዩናይትድ ስቴት ውስጥ የአካባቢ መንግስታት የሚሰጡትን አገልግሎቶች በተመለከተ ከሚከተሉት መግለጫዎች ውስጥ ትክክል ያልሆነው የትኛው ነው	In the United States, regarding the services provided by local governments, which of the following statements is incorrect?
	አሰራርን ለማስኬድ የውጭ ሶስተኛ ወገን አገልግሎት አቅራቢን የመቅጠር ልምድ ይባላል	The practice of hiring an external third-party service provider to carry out operations is called outsourcing.
	ከሚከተሉት እቃዎች ውስጥ ቁሳዊ ያልሆነ ባህል ምሳሌ የሚሆነው የትኛው ነው	Which of the following items is an example of a non-material culture?

BLEU Score of 47.05

	Amharic	English
	ሚሼል የተወለደችበት ከተማ ህዝብ ብዛት 145,826 ነው። በቁጥር 145,826 ያለው የ5ቱ ዋጋ ስንት ነው	The government has a population of 145,826 people, compared to 145,
	አሊቪያ ከታች የሚታየውን የቁጥር ንድፍ ለመፍጠር (11 አክል) የሚለውን ህግ ተጠቅማለች። 10,21,32,43,54 ስለ ቁጥሩ ንድፍ የትኛው አባባል ትክክል ነው	The government has been criticized for its lack of a political voice in the country, which is
	በአጠቃላይ 30 ተጫዋቾች በአንድ ፓርክ ውስጥ የቅርጫት ኳስ ይጫወታሉ። በኢያንዳንዱ ቡድን ውስጥ በትክክል 5 ተጫዋቾች ይኖራሉ። የሚፈለጉትን የቡድኖች ብዛት እንዴት ማግኘት እንደሚቻል በትክክል የሚያብራራው የትኛው አነጋገር ነው	No Output
c)	አንድ ሱቅ 107 የተለያየ ቀለም ይሸጣል። በማከማቻ ውስጥ የእያንዳንዱ ቀለም 25 ቆርቆሮዎች አሲቸው ።በማከማቻው ውስጥ ያለው የቀለም ቆርቆሮዎች ብዛት ከዚህ በታች ያለውን መግለጫ በመጠቀም ማግኘት ይቻላል። 107 × 25። በማከማቻ ውስጥ ምን ያህል የቀለም ቆርቆሮዎች አሉት	No Output
	የትኛው አገላለፅ ከ 5 x 9 ጋር እኩል ነው	The slums are a bit crowded, but the slums are
	የህዝብ ቁጥር መጨመር መጠን የሚገኘው በመቀነስ ነው	The government is a splinter group that has been criticized for its lack of political
	በሶስተኛው ደረጃ የስነ ህዝብ ሽግግር ምሳሌ፤ ከሚከተሉት ውስጥ የትኛው እውነት ነው	The government has been criticized for its lack of a political voice in the country.
	በዩናይትድ ስቴት ውስጥ የአካባቢ መንግስታት የሚሰጡትን አገልግሎቶች በተመለከተ ከሚከተሉት መግለጫዎች ውስጥ ትክክል ያልሆነው የትኛው ነው	The government has been criticized for its lack of political leadership and for its inability to provide
	አሰራርን ለማስኬድ የውጭ ሶስተኛ ወገን አገልግሎት አቅራቢን የመቀጠር ልምድ ይባላል	The government has been criticized for its lack of a political voice in the country.
	ከሚከተሉት እቃዎች ውስጥ ቁሳዊ ያልሆነ ባህል ምሳሌ የሚሆነው የትኛው ነው	The government has been criticized for its lack of a political voice in the country.

BLEU Score of 0.265