(C) To Make a Long Story Short (1/5) [15 Points]

Every day, the Internet brings a flood of new information: scientific articles, blog posts, Tweets, news stories, Wikipedia pages, and more. One way we can take advantage of this information without being overwhelmed is through **automatic summarization**, where a computer condenses a long document into a summary that is much shorter. With this summary, you can get the main points of the document without reading the whole thing. You can also read the summaries of many documents to help decide which of the documents are worth reading in their entirety.

Below is a news article that we wish to summarize (written out as a list of numbered sentences):

The Final Word on Language   **𝔗𝔥𝔢 𝔑𝔄𝔠𝔏𝔒 𝔑𝔢𝔴𝔰**   Are Wickelphones making a comeback? Story on G3.

A STICKY SITUATION

SS1: On January 22, Ronald McBubble, president of the Bigger Bubble corporation, was found chewing a stick of gum from rival company Made to Stick.
SS2: The incident set off an uproar among Bigger Bubble faithfuls, with over 10,000 gum enthusiasts in just one week signing a petition for McBubble to step down.
SS3: According to *USA Today*, the nine-year-long "great gum war" may soon be over, as Bigger Bubble's stock price has fallen 50 percent since that fateful day.
SS4: McBubble maintains that the gum was "planted" on him and that the whole incident was "100 percent a set-up."
SS5: Why did he continue chewing after reading the label?
SS6: "Because the gum was too sticky to remove."
SS7: One must hope that McBubble has since managed to render the gum less adhesive, although the fiasco does make for some . . . *sticky* headlines.

How would a computer summarize this story? One approach is to have the computer select a few sentences from the document to serve as the summary. In order to choose which sentences to use, the computer first assigns values to **features** of every sentence. In this context, features are things that you can observe or count that help determine whether the sentence will be useful in a summary.

C1. At the top of the next page, on the left, are definitions of the features that we will use. Further down is a table showing the feature values that would be assigned to each sentence. Unfortunately, some words are missing from the feature definitions! In addition, in the table, the sentences are in scrambled order, and some of the sentence numbers are missing.
    i. Fill in the blanks **a.** through **g.** by choosing words or numbers from the word bank at the top of the next page, on the right. You will not use all of the entries in the word bank; you might use some entries more than once.
    ii. Determine which sentences correspond to **h.** through **k.** You should answer using the sentence numbers that start with SS.

(C) To Make a Long Story Short (2/5)

F1: Assign 1 point if the sentence contains at least one **a.**_____; otherwise, assign 0 points.

F2: Assign 1 point for every proper noun in the sentence.

F3: Take the number of words in the sentence minus **b.**_____. If this value is negative, give the sentence that many points. Otherwise, give the sentence 0 points.

F4: Assign 1 point for every **c.**_____ in the sentence.

F5: Assign 1 point for every **d.**_____ or **e.**_____ that is repeated in at least one other sentence in the story.

F6: Assign 1 point if this sentence is the **f.**_____ or **g.**_____ one in the story; otherwise, assign 0 points.

WORD BANK	
italicized word	capitalized word
underlined word	hyphenated word
common noun	past-tense verb
adjective	verb
number	plural noun
abbreviation	
word that appears in the title	
noun referring to candy or gum	
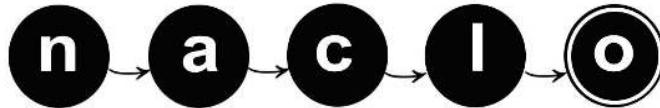
colon	comma		period
first	second		third
last	second-to-last		third-to-last
1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20

Notes: A proper noun is a word or phrase, usually capitalized, that describes a specific entity such as a person, place, or organization. Examples of proper nouns are Brazil and Alice. A common noun is a noun that is not a proper noun. For some terms in the feature definitions, there might be multiple ways to count (e.g., multiple ways to count proper nouns for F2). It is up to you to figure out exactly how the computer is counting each category.

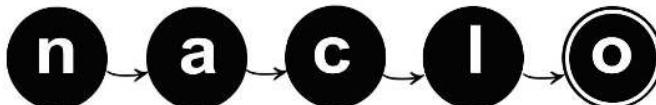| Sentence	Features						Sum of Scores
	F1	F2	F3	F4	F5	F6	
h.	0	1	0	1	2	0	4
SS1	0	4	0	1	1	1	7
i.	0	0	-1	0	0	0	-1
SS3	1	2	0	2	1	0	6
j.	1	1	0	0	2	1	5
k.	0	0	-2	0	2	0	0
SS2	0	2	0	2	2	0	6

The overall score for a sentence is determined by adding together all of its feature values. The sentences with the highest scores are the ones chosen to serve as the summary (in this problem, we will be using the 3 highest-scoring sentences). For this particular article, since sentences SS1, SS2, and SS3 have the highest summed scores (7, 6, and 6), they would comprise the summary. In the summary, the sentences are presented in the same order as they appear in the original story - in this case, SS1 followed by SS2 followed by SS3.

C2. Below are two more news articles and their accompanying feature scores. (The features, F1 through F6, are the same as those used for the previous story.) Unfortunately, due to some serious data corruption, the rows in the tables have been scrambled, and various feature scores have been erased! Your job is to fill in all the blanks.

| *The Final Word on Language* | 𝕿𝖍𝖊 𝕹𝕬𝕮𝕷𝕺 𝕹𝖊𝖜𝖘 | *REPORT:* The elephant is sleeping. More on E1. |

IN HOT WATER

HW1: Specialty soup restaurant Hot Water Village came under scrutiny last week, after an exposé was published in *The Wall Street Journal.*

HW2: No fewer than three sources (including *WikiLeaks*) accused the restaurant of re-serving unfinished soup, salvaged from the bowls of previous customers.

HW3: One witness further claimed, "the bowls are never washed."

HW4: "They're just refilled where the last customers left off, one bowl after another."

HW5: Hot Water Village firmly denies any such wrongdoing, with one spokesperson noting that "these blatantly false accusations degrade our bowls, restaurant, and very soup" and "cause the hot water to flow from my eyes."

HW6: If the accusations are to be believed, Hot Water Village, it seems, has succeeded in implementing not only a farm-to-table but also a *table-to-kitchen* approach.

Sentence	Features						Sum of Scores
	F1	F2	F3	F4	F5	F6	
a.	0	1	b.	1	4	0	6
HW4	c.	0	0	1	2	d.	e.
f.	0	0	g.	h.	1	0	1
HW6	1	i.	0	0	1	1	j.
k.	1	2	0	0	3	l.	m.
n.	1	1	0	o.	4	0	p.

THE STICKY SAGA CONTINUES

SSC1: After suffering a PR disaster and a sorbitol shortage, Ronald McBubble faces tough times ahead.
SSC2: "We really gummed up the works," he notes miserably.
SSC3: Meanwhile, his rival, Chicle "Colonel" Sanders, is experiencing problems of his own, including a disappointing quarterly report.
SSC4: Perhaps most seriously, he is being investigated by the government's Bubble Safety Bureau on two counts of alleged wrapper forgery.
SSC5: One thing is for certain: it's a difficult time to be in the bubblegum business.

Sentence	Features						Sum of Scores
	F1	F2	F3	F4	F5	F6	
q.	0	0	0	1	0	1	2
r.	0	1	0	0	0	0	1
s.	0	0	-1	0	0	0	-1
t.	0	1	0	0	0	1	2
u.	0	1	0	1	0	0	2

C3. Which three sentences make up the summary for "In Hot Water"? You should answer using the sentence numbers that start with HW.

First sentence: [ ]   Second sentence: [ ]   Third sentence: [ ]

C4. Which three sentences make up the summary for "The Sticky Saga Continues"? You should answer using the sentence numbers that start with SSC.

First sentence: [ ]   Second sentence: [ ]   Third sentence: [ ]

The approach illustrated above (selecting a few sentences from the document to serve as the summary) is called **extractive summarization**. An alternative approach is called **abstractive summarization**. Instead of selecting sentences from the story, an abstractive summarization system generates its own summary, without being restricted to the sentences in the original story. This approach is closer to how humans summarize, but it is also more challenging because abstractive summarization systems can often introduce factual errors. On the next page is a one-sentence abstractive summary for the story "A Sticky Situation."

(C) To Make a Long Story Short (5/5)

Abstractive summary: Made to Stick corporation is facing serious problems after its vice president was found chewing a stick of gum from rival company Bigger Bubble on February 22.

C5. This summary contains several types of errors that are common in standard abstractive summary systems. Specifically:

   a. The abstractive summary includes one word that should be deleted. Which word?

   b. In the abstractive summary, there are two phrases that should be swapped (each of these phrases is two or three words long). What are these phrases?

   c. In the abstractive summary, there is a single word that should be replaced with a different word. What word should be replaced, and what word should be its replacement?

   The word that should be replaced is:

   It should be replaced by:

C6. As it turns out, even extractive summary systems can sometimes create factual errors! Consider the extractive summaries that were generated for "A Sticky Situation," "In Hot Water" and "The Sticky Saga Continues." (For "A Sticky Situation," we told you what the summary was: SS1, SS2, and SS3. For the other stories, the summaries are the ones that you specified in your answers to C3 and C4.) In one of those three summaries, there is a single word that has an incorrect meaning in the summary.

   a. Which sentence does this word appear in (you should answer using the sentence numbers that start with SS, HW or SSC)?

   b. Which word is it?

n a c l o