Problem 1: LINKER

The questions below pertain to the LINKER discourse-guided event extraction system [Huang and Riloff, AAI 2012]. Consider the following story that contains five sentence:

S1: A large tornado damaged 12 homes in Alabama yesterday.
S2: Several people were also hurt by the massive tornado.
S3: The injured people were taken to the hospital.
S4: The tornado hit central Huntsville near the hospital.
S5: Huntsville did not get enough early warning of the tornado to flee.

(a) Show the lexical bridge features that LINKER would create for the sentence pair S4 and S5.

S4	S5	Lexical Bridge Feature
tornado	Huntsville	<tornado, Huntsville>
tornado	warning	<tornado, warning>
tornado	tornado	<tornado, tornado>
Huntsville	Huntsville	<Huntsville, Huntville>
Huntsville	warning	<Huntsville, warning>
Huntsville	tornado	<Huntsville, tornado>
hospital	Huntsville	<hospital, Huntsville>
hospital	warning	<hospital, warning>
hospital	tornado	<hospital, tornado>
hit	did	<hit, did>
hit	get	<hit, get>
hit	flee	<hit, flee>

Table 1: Lexical bridge features between S4 and S5

(b) Show the discourse focus features that the LINKER event extraction system would produce *for each adjacent pair* of sentences in the story above. Be sure to indicate which sentence pair (e.g. S1+S2) each feature was generated from.

Current Sentence NP	Previous Sentence NP	Discourse Focus Feature
the massive tornado (S2)	A large tornado (S1)	<tornado, PP(by), Subject>
The injured people (S3)	Several People (S2)	<people, Subject, Direct Object>
the hospital (S4)	the hospital (S3)	<hospital, Direct Object, Direct Object >
Huntsville (S5)	central Huntsville (S4)	<Huntsville, Subject, Direct Object>
the tornado (S5)	The tornado (S4)	<tornado, Direct Object, Subject>

Table 2: Discourse Focus Features for S1-S5

(c) Suppose the role filler extractors produce the following extractions:

S1: DAMAGE = "12 homes", LOCATION = "Alabama"
S2: VICTIM = "Several people"
S3: VICTIM = "The injured people"
S4: LOCATION = "central Huntsville"
S5: LOCATION = "Huntsville"

If the sentence classifier labels sentences S2, S3 and S4 as event contexts, what will LINKER's final output be?

The LINKER's final output will be the role filler extractors produced from sentences S2, S3, and S4.

VICTIM = "Several people" and "The injured people"
LOCATION = "central Huntsville"

Problem 2: Event Extraction

(a) Indicate whether that are any trigger words that violate the *One Trigger Sense Per Cluster* heuristic. List all instances of a trigger word that violate this heuristic, and specify the document in which the violation occurs.

Violating Trigger Word	Document
attack	D2
shot	D4

Table 3: *One Trigger Sense Per Cluster* violations

(b) Indicate whether there are any entities that violate the *One Argument Role Per Cluster* heuristic. For the purposes of this question, consider any entity to be the head noun of a noun phrase (e.g., "tourist", "Paris", and "assailant" are the entities in D1). List all instances of entities that violate this heuristic, and specify the document in which the violation occurs.

Entity	Document
tourist	D7
employee	D7

Table 4: *One Argument Role Per Cluster* violations

Problem 3: Opinion Extraction

For each sentence below, indicate whether it should be labeled as OPINION-PROPOSITION, OPINION-SENTENCE, or NON-OPINION by the opinion extraction system developed by [Bethard et al. 2004]. If you answer OPINION-PROPOSITION, then please underline the portion of the sentence that contains the opinion proposition.

(a) A decision by authorities in California will halt ride-hailing company Uber from operating a fleet of self-driving cars.

   NON-OPINION

(b) There have already been a number of deaths involving autopilot systems.

   NON-OPINION

(c) Tesla and Uber ought to proceed more cautiously with the public rollout of automation than they have so far.

   OPINION-SENTENCE

(d) A researcher at Google claims **driverless cars will have a significant impact on society.**

   OPINION-PROPOSITION (opinion proposition bolded in the sentence)

(e) Google is working with insurance companies, such as Allstate, to figure out how to deal with accidents.

   NON-OPINION

(f) Allstate has warned Google that **if producers do not move slowly than they will inevitably create a backlash against the technology.**

   OPINION-PROPOSITION (opinion proposition bolded in the sentence)

(g) Washington should resist the temptation to slap onerous regulations on a promising industry.

   OPINION-SENTENCE

(h) **"The risks of self-driving cars are still too unclear to justify wide-scale deployment at this time"** argued an attorney for the U.S. government.

   OPINION-PROPOSITION (opinion proposition bolded in the sentence)

(i) The promise of fewer accidents and the freedom that self-driving cars would bring to people with disabilities are compelling reasons to rapidly move forward with this technology.

   OPINION-SENTENCE

Problem 4: Opinion Frames

My friend Joe and I finally visited the new Italian restaurant called "Viva Italy!", which was quite good. I had the manicotti, which was extremely flavorful. Joe had lasagna and a caesar salad. He said that the lasagna had a wonderfully rich sauce, but the lettuce in the salad was wilted and the salad dressing was oily.

Show all of the opinion frames ("opinion units") that should be produced by the opinion extraction system developed by [Kobayashi et al. 2007] for the review above.

Opinion Holder	<writer>
Subject (Target)	<"Viva Italy!">
Aspect	<>
Evaluation	<quite good>

Table 5: Opinion Frame One

Opinion Holder	<writer>
Subject (Target)	<the manicotti>
Aspect	<flavor>
Evaluation	<extremely flavorful>

Table 6: Opinion Frame Two

Opinion Holder	<Joe>
Subject (Target)	<lasagna>
Aspect	<sauce>
Evaluation	<wonderfully rich>

Table 7: Opinion Frame Three

Opinion Holder	<Joe>
Subject (Target)	<caesar salad>
Aspect	<lettuce>
Evaluation	<wilted>

Table 8: Opinion Frame Four

Opinion Holder	<Joe>
Subject (Target)	<caesar salad>
Aspect	<salad dressing>
Evaluation	<oily>

Table 9: Opinion Frame Four

Problem 5: Coreference Chains

$$MUC\ Recall = \sum_{i \in N_k} (|k_i| - |p(k_i)|) / \sum_{i \in N_k} (|k_i| - 1) \tag{1}$$

$$MUC\ Precision = \sum_{i \in N_r} (|r_i| - |p(r_i)|) / \sum_{i \in N_r} (|r_i| - 1) \tag{2}$$

(a) Compute recall and precision for the response chains above using the MUC scoring metric. Be sure to show all your work, including the partitions for each chain!

To compute recall, first we will compute the partitions intersecting k_i with the response chains:

$$p(k_1) = \{\{a\}, \{b, c\}, \{d\}\}$$
$$p(k_2) = \{\{e\}, \{f\}\}$$
$$p(k_3) = \{\{g, h\}, \{i, j\}, \{k\}\}$$
$$p(k_4) = \{\{n\}, \{m\}\}$$
$$p(k_5) = \{\{o\}\}$$

Using eq. 1, we will first compute the numerator

$$\sum_{i \in N_k} (|k_i| - |p(k_i)|) = (4 - 3) + (2 - 2) + (5 - 3) + (2 - 2) + (1 - 1) = 3$$

Next we use eq. 1 again and compute the denominator

$$\sum_{i \in N_k} (|k_i| - 1) = (4 - 1) + (2 - 1) + (5 - 1) + (2 - 1) + (1 - 1) = 9$$

Combining these gives us the MUC recall

MUC recall: 3/9 = 0.3333

The compute precision, first we will compute the partitions intersecting r_i with the key chains:

$$p(r_1) = \{\{a\}, \{g, h\}\}$$
$$p(r_2) = \{\{b, c\}\}$$
$$p(r_3) = \{\{d\}, \{e\}, \{k\}\}$$
$$p(r_4) = \{\{f\}, \{o\}\}$$
$$p(r_5) = \{\{i, j\}, \{n\}\}$$
$$p(r_6) = \{\{m\}\}$$

Using eq. 2, we will first compute the numerator

$$\sum_{i \in N_r} (|r_i| - |p(r_i)|) = (3-2) + (2-1) + (3-3) + (2-2) + (3-2) + (1-1) = 3$$

Next we use eq. 2 again and compute the denominator

$$\sum_{i \in N_r} (|r_i| - 1) = (3-1) + (2-1) + (3-1) + (2-1) + (3-1) + (1-1) = 8$$

Combining these gives us the MUC precision

> **MUC precision: $3/8 = 0.375$**

(b) Compute recall and precision for the response chains above using the B^3 scoring metric. Be sure to show all your work!

To compute the B^3 recall, we will compute the recall for each entity E in a gold key chain k_i, take their sum, and divide by the total number of entities.

To compute the recall for an entity E, we find the response chain r_j that contains E and take the cardinality of their intersection divided by the cardinality of k_i.

$$recall\ a = (|k_1| \cap |r_1|)/|k_1| = 1/4$$
$$recall\ b = (|k_1| \cap |r_2|)/|k_1| = 2/4$$
$$recall\ c = (|k_1| \cap |r_2|)/|k_1| = 2/4$$
$$recall\ d = (|k_1| \cap |r_3|)/|k_1| = 1/4$$
$$recall\ e = (|k_2| \cap |r_3|)/|k_2| = 1/2$$
$$recall\ f = (|k_2| \cap |r_4|)/|k_2| = 1/2$$
$$recall\ g = (|k_3| \cap |r_1|)/|k_3| = 2/5$$
$$recall\ h = (|k_3| \cap |r_1|)/|k_3| = 2/5$$
$$recall\ i = (|k_3| \cap |r_5|)/|k_3| = 2/5$$
$$recall\ j = (|k_3| \cap |r_5|)/|k_3| = 2/5$$
$$recall\ k = (|k_3| \cap |r_3|)/|k_3| = 1/5$$
$$recall\ m = (|k_4| \cap |r_6|)/|k_4| = 1/2$$
$$recall\ n = (|k_4| \cap |r_5|)/|k_4| = 1/2$$
$$recall\ o = (|k_5| \cap |r_4|)/|k_5| = 1/1$$

Finally we take the sum of the entity recalls and divide by the total number of entities in the gold key chains

$$1/14 * (1/4 + 2/4 + 2/4 + 1/4 + 1/2 + 1/2 + 2/5 + 2/5 + 2/5 + 2/5 + 1/5 + 1/2 + 1/2 + 1/1) = 1/14 * 6.3 = 0.45$$

> **B^3 recall: $6.3/14 = 0.45$**

Computing the B^3 precision is similar but we swap the role of the key and response chains. First we will compute the precision of each entity E

$$precision \ a = (|r_1| \cap |k_1|) \ |r_1| = 1/3$$
$$precision \ g = (|r_1| \cap |k_3|) \ |r_1| = 2/3$$
$$precision \ h = (|r_1| \cap |k_3|) \ |r_1| = 2/3$$
$$precision \ b = (|r_2| \cap |k_1|) \ |r_2| = 2/2$$
$$precision \ c = (|r_2| \cap |k_1|) \ |r_2| = 2/2$$
$$precision \ d = (|r_3| \cap |k_1|) \ |r_3| = 1/3$$
$$precision \ e = (|r_3| \cap |k_2|) \ |r_3| = 1/3$$
$$precision \ k = (|r_3| \cap |k_3|) \ |r_3| = 1/3$$
$$precision \ f = (|r_4| \cap |k_2|) \ |r_4| = 1/2$$
$$precision \ o = (|r_4| \cap |k_5|) \ |r_4| = 1/2$$
$$precision \ i = (|r_5| \cap |k_3|) \ |r_5| = 2/3$$
$$precision \ j = (|r_5| \cap |k_3|) \ |r_5| = 2/3$$
$$precision \ n = (|r_5| \cap |k_4|) \ |r_5| = 1/3$$
$$precision \ m = (|r_6| \cap |k_4|) \ |r_6| = 1/1$$

Finally we take the sum of the entity precisions and divide by the total number of entities in the response chains

$$1/14*(1/3+2/3+2/3+2/2+2/2+1/3+1/3+1/3+1/2+1/2+2/3+2/3+1/3+1/1) = 1/14*25/3$$

B^3 **precision: $25/42 = 0.595$**