

**CS6320, Fall 2020**  
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**Homework 7 Solution**

## 1. Coreference Resolution

Apply the Lappin and Leass pronoun resolution algorithm to resolve the pronouns in the following text passage:

*Neil Ferguson is prolific, well-paid and a snappy dresser. Stephen Moss hated him, at least until he spent an hour being charmed in the historian's Oxford study.*

The following salience weights can be used for the computation:

Sentence recency	100
Subject emphasis	80
Existential emphasis	70
Accusative (direct object) emphasis	50
Indirect object and oblique complement emphasis	40
Non-adverbial emphasis	50
Head noun emphasis	80

Solution:

Lappin and Leass pronoun resolution algorithm:

1. Collect the potential referents.
2. Remove referents that do not agree in number, gender
3. Remove referents that do not pass intrasentence syntactic constraints.
4. Compute the total salience value.
5. Select referent with highest salience value.

Sentence 1:

Niall Ferguson is prolific, well-paid and a snappy dresser.

	Sentence Recency	Subject Emphasis	Existential Emphasis	Direct Object Emphasis	Indirect Object Emphasis	Non-adverbial Emphasis	Head Noun Emphasis	Total
Niall Ferguson	100	80				50	80	310

Sentence 2:

Stephen Moss hated him, at least until he spent an hour being charmed in the historian's Oxford study.

Referent	Phrases	Value
Niall Ferguson	{ <i>Niall Ferguson</i> }	$310/2 = 155$

	Sentence Recency	Subject Emphasis	Existential Emphasis	Direct Object Emphasis	Indirect Object Emphasis	Non-adverbial Emphasis	Head Noun Emphasis	Total
Stephen Moss	100	80				50	80	310
him	100			50		50	80	280
he	100	80				50	80	310

Referent	Phrases	Value
Niall Ferguson	{ <i>Niall Ferguson</i> }	155
Stephen Moss	{ <i>Stephen Moss</i> }	310

- New Discourse referent: *him*
  - *Stephen Moss* does not pass syntax filter and hence is eliminated as a potential referent candidate.
  - *Niall Ferguson* is the only remaining referent candidate. Hence, *him* maps to *Niall Ferguson*

Referent	Phrases	Value
Niall Ferguson	{ <i>Niall Ferguson, him</i> }	$155 + 280 = 435$
Stephen Moss	{ <i>Stephen Moss</i> }	310

- New Discourse referent: *he*
  - *Niall Ferguson* has a higher score than *Stephen Moss*
  - Hence, *he* maps to *Niall Ferguson*

Referent	Phrases	Value
Niall Ferguson	{ <i>Niall Ferguson, him, he</i> }	$435 + 310 = 745$
Stephen Moss	{ <i>Stephen Moss</i> }	310

Please note that *he* was mapped incorrectly to *Niall Ferguson*.

## 2. Logic and Semantic Representation (25 points)

*Bill Gates, the founder of Microsoft, generously donates money to charities every year.*

- a. Provide a Davidsonian logic representative of this sentence.

**Solution:**

bill\_NN(x1) & gates\_NN(x2) & nn\_NNC(x3,x1,x2) & \_human\_NE(x3) &  
founder\_NN(x4) & of\_IN(x4,x5) & Microsoft\_NN(x5) & \_organization\_NE(x5)  
& generously\_RB(e1) & donate\_VB(e1,x3,x6,x7) & money\_NN(x6) &  
charity\_NN(x7) & every\_JJ(x8) & year\_NN(x8)

- b. Identify the semantic relations in the sentence. Write them as semantic triples R(x,y). Consider only the semantic relations in the list below.

Semantic Relation	Definition
agent(X,Y)	X is the agent for Y
beneficiary(X,Y)	X is a beneficiary of Y
instrument(X,Y)	X is an instrument in Y
part-whole(X,Y)	X is a part of Y
result(X,Y)	X is the result consumed in/from/of Y
synonymy(X,Y)	X is a synonym/name/equal for/to Y
theme(X,Y)	X is the theme consumed in/from/of Y

**Solution:**

synonymy(Bill Gates, founder)

part-whole(founder, Microsoft)

agent(Bill Gates, donate)

theme(money, donate)

beneficiary(charity, money)

- c. Provide a new logic representation that includes semantic relations.

**Solution:**

bill\_NN(x1) & gates\_NN(x2) & nn\_NNC(x3,x1,x2) & \_human\_NE(x3) &  
founder\_NN(x4) & Microsoft\_NN(x5) & \_organization\_NE(x5) &  
generously\_RB(x6) & donate\_VB(e1) & money\_NN(x7) & charity\_NN(x8) &

every\_JJ(x9) & year\_NN(x10) & synonymy\_SR(x3,x4) & part-whole\_SR(x4,x5)  
& agent\_SR(x3,e1) & theme\_SR(x7,e1) & beneficiary\_SR(x8,x7)

- d. Using the basic semantic relations that you identified for Question 4.b, write the semantic calculus rule to create a new semantic relation:

**Donates-To**(X, Y): X donates to Y

**Solution:**

agent(X,A), theme(Z,A), beneficiary(Y,Z)  $\rightarrow$  Donates-To(X,Y) [A is donate verb/concept]