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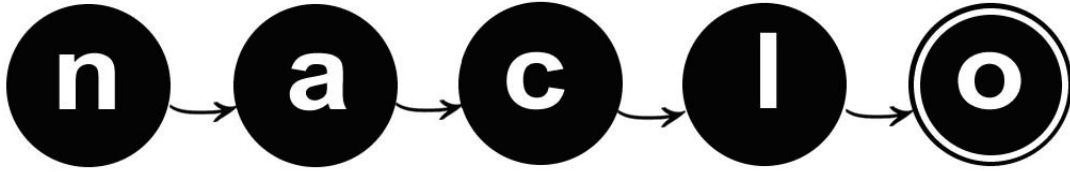
***The Eighth
Annual***

**North American
Computational
Linguistics
Olympiad**

2014

www.naclo.cs.cmu.edu

**Open Round
January 30, 2014**



Welcome to the eighth annual North American Computational Linguistics Olympiad! You are among the few, the brave, and the brilliant, to participate in this unique event. In order to be completely fair to all participants across North America, we need you to read, understand, and follow these rules completely.

Rules

1. The contest is three hours long and includes eight problems, labeled A to H.
2. Follow the facilitators' instructions carefully.
3. If you want clarification on any of the problems, talk to a facilitator. The facilitator will consult with the jury before answering.
4. You may not discuss the problems with anyone except as described in items 3 & 12.
5. Each problem is worth a specified number of points, with a total of 100 points. In this year's open round, no points will be given for explanations. Instead, make sure to fill out all the answer boxes properly.
6. We will grade only work in this booklet. All your answers should be in the spaces provided in this booklet. **DO NOT WRITE ON THE BACK OF THE PAGES.**
7. Write your name and registration number on each page:
Here is an example: Jessica Sawyer #850
8. The top 100 participants (approximately) across the continent in the open round will be invited to the second round.
9. Each problem has been thoroughly checked by linguists and computer scientists as well as students like you for clarity, accuracy, and solvability. Some problems are more difficult than others, but all can be solved using ordinary reasoning and some basic analytic skills. You don't need to know anything about linguistics or about these languages in order to solve them.
10. If we have done our job well, very few people will solve all these problems completely in the time allotted. So, don't be discouraged if you don't finish everything.
11. If you have any comments, suggestions or complaints about the competition, we ask you to remember these for the web-based evaluation. We will send you an e-mail shortly after the competition is finished with instructions on how to fill it out.
12. **DO NOT DISCUSS THE PROBLEMS UNTIL THEY HAVE BEEN POSTED ONLINE! THIS MAY BE SEVERAL WEEKS AFTER THE END OF THE CONTEST.**

Oh, and have fun!

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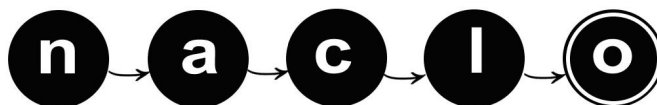
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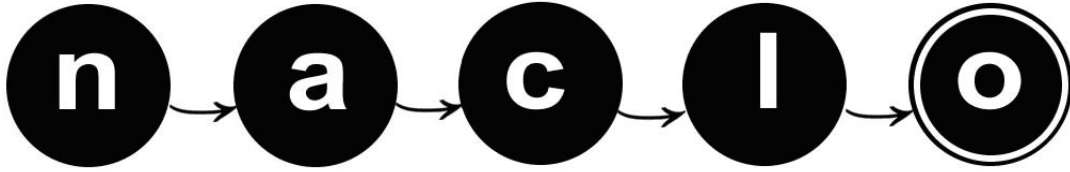
NACLO 2014

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As well as more than 90 high schools throughout the USA and Canada

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The North American Computational Linguistics Olympiad
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Contest Booklet

REGISTRATION NUMBER			

Name: _____

Contest Site: _____

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City, State: _____

Grade: _____

Start Time: _____

End Time: _____

Please also make sure to **write your registration number and your name on each page** that you turn in.

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Signature: _____

YOUR NAME:

REGISTRATION #

(A) What's the Time in Tallinn? (1/2) [10 points]

Tallinn is the capital of Estonia, where about 1 million people speak Estonian, a non-Indo-European language closely related to Finnish.

The following expressions show how to tell the time in Estonian:



Kell on üks.



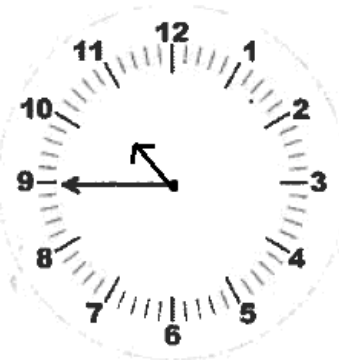
Kell on kaks.



Veerand kaks.



Pool neli.



Kolmveerand üksteist.



Viis minutit üks läbi.

Here are some numbers in Estonian:

6 kuus

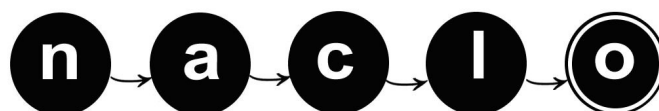
7 seitse

8 kaheksa

10 kümme

AI. Translate the following times into Estonian:

a.	8:45	
b.	4:15	
c.	11:30	
d.	7:05	
e.	12:30	



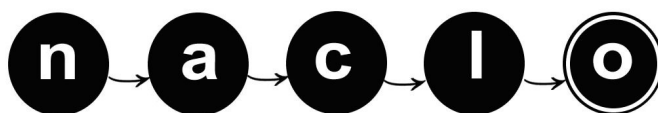
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REGISTRATION #

(A) What's the Time in Tallinn? (2/2)

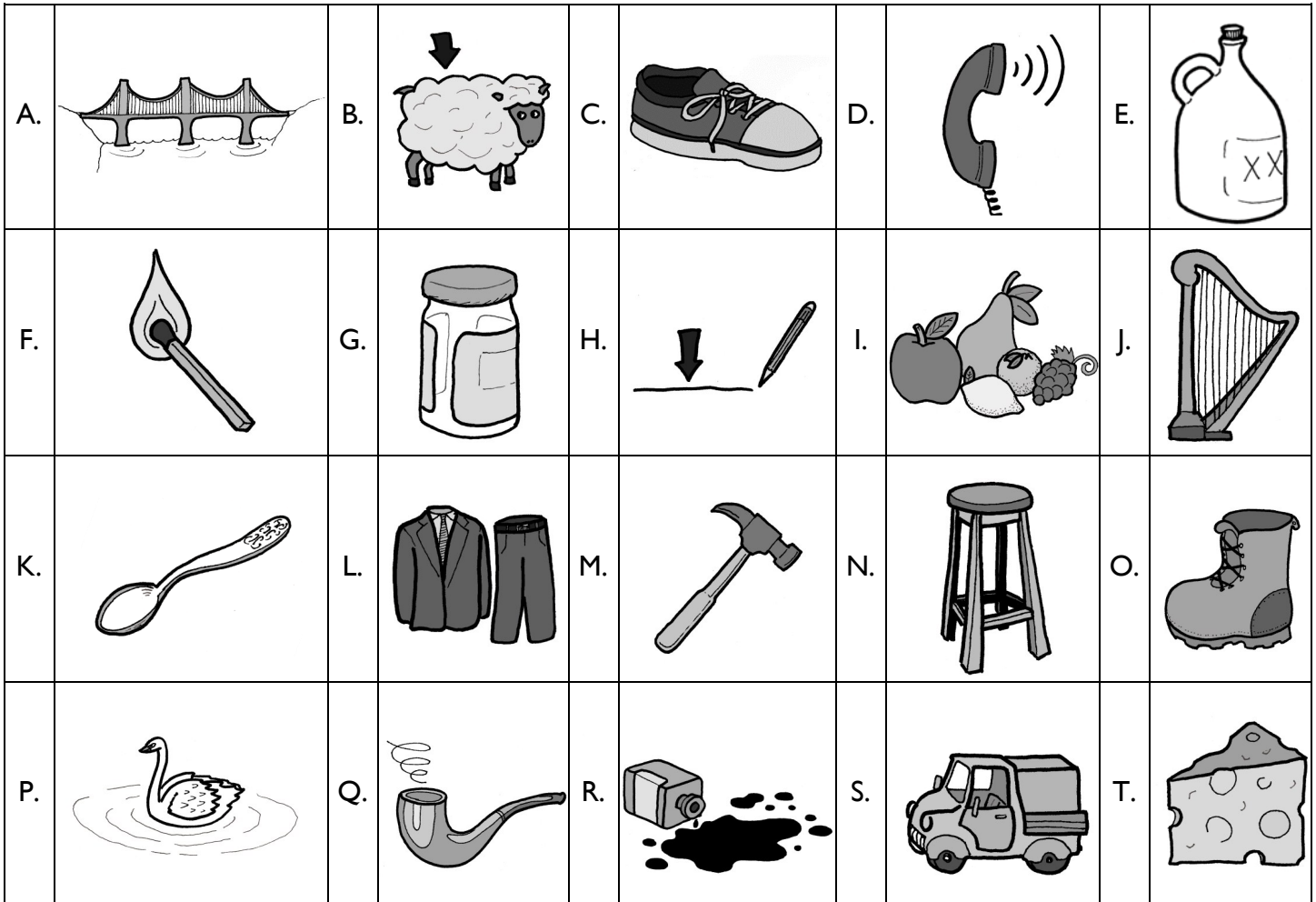
A2. What do the following Estonian time expressions mean?

a.	Kakskümmend viis minutit üheksa läbi.		:	
b.	Veerand neli.		:	
c.	Pool kolm.		:	
d.	Kolmveerand kaksteist.		:	
e.	Kolmkümmend viis minutit kuus läbi.		:	



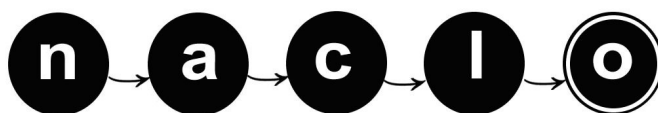
(B) Māori Loanwords (1/2) [15 points]

The Māori language, or “te reo Māori”, is the language of the Māori, the indigenous people of New Zealand. It is one of the official languages of New Zealand, along with English and New Zealand Sign Language, and over several centuries it has borrowed many English words. These words are often adapted to better fit the sounds of the Māori language.



B1. Below are 20 Māori words that have been adapted from English words. Note that Māori uses a line over vowels to mark them as long. Can you match each word below to the picture that illustrates it?

1.	hāma	6.	māti	11.	raina	16.	tīhi
2.	hāpa	7.	paipa	12.	taraka	17.	tūru
3.	hū	8.	piriti	13.	terewhono	18.	wāna
4.	hūtu	9.	pūnu	14.	tiā	19.	whurutu
5.	iniki	10.	pūtu	15.	tiaka	20.	wūru



YOUR NAME:

REGISTRATION #

(B) Māori Loanwords (2/2)

B2. Many English loanwords in Māori deal with introduced Western professions and titles. To what English words do the following Māori words correspond?

hekeretari	
pirinihehe	
pirihimana	
tiati	

B3. What countries are these?

Iharaira	
Kiupa	
Peina	
Tiamani	
Tiapana	

B4. For each of these English words, predict what the Māori form would be:

beef	
bull	
cart	
clock	
lease	
meat	
seal	
street	
time	
watch	



YOUR NAME:

REGISTRATION #

(C) Levenshtein's Fine Signs (1/2) [15 points]

Levenshtein's Fine Signs, a commercial signage company, is a favorite of new business owners for its ability to cheaply adjust a location's existing signage to reflect the new business name. Instead of replacing the entire sign, Mr. Levenshtein replaces signs letter-by-letter whenever possible. Since Mr. Levenshtein offers "by-the-letter" pricing, he can offer very low prices when the name of the new business is very similar to the name of the old business.

Here, for example, are two recent jobs that Mr. Levenshtein completed:

Original Name	New Name	Price:
BOB'S RAFTS	BARB'S CRAFTS	\$17
FRESH SALSA	FIRE SALE	\$18

C1. How much does Mr. Levenshtein charge for each of the following changes?

Adding a letter:	\$
Removing a letter:	\$

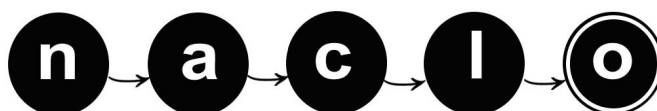
C2. How much would Mr. Levenshtein charge to change this sign?

Original Name	New Name	Price:
RICH'S HARDWARE	KOICHI'S KARAOKE	\$

C3. Each month next summer, Mr. Levenshtein will try out a new pricing scheme, where he discounts particular kinds of changes or offers additional kinds of changes beyond just addition and deletion. Here are the May, June, and July prices for particular changes.

Original Name	New Name	May	June	July
BOB'S RAFTS	BARB'S CRAFTS	\$15	\$17	\$20
FRESH SALSA	FIRE SALE	\$16	\$18	\$10
POST OFFICE	COFFEE SHOP	\$38	\$30	\$36
HARDWOOD FLOORS	HOLLYWOOD FLOWERS	\$30	\$35	\$38
CORNER MALL	CORN MAZE	\$14	\$15	\$10

(Note: For this puzzle, you can treat spaces as insignificant, as if BOB'S RAFTS were just BOB'SRAFTS.)



YOUR NAME:

REGISTRATION #

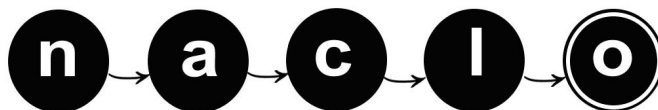
(C) Levenshtein's Fine Signs (2/2)

A. How much would Mr. Levenshtein charge to make the following change, in each month?

Original Name	New Name	May	June	July
DEADEYE SALOON	PAYDAY LOANS	\$	\$	\$

B. Three new business owners are looking to change their signage. For each business, in what month should they buy their sign in order to minimize costs?

Original Name	New Name	Best month to buy:
FROZEN YOGURT	FREE YOGA	
ITALIAN FOOD	IRANIAN FOOD	
CORNER MALL	ORNERY LLAMAS	



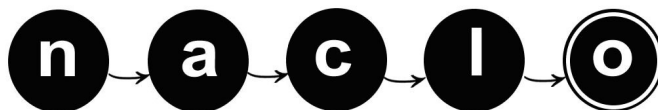
YOUR NAME:

REGISTRATION #

(D) Wheel of Fortune Cookies (2/2)

D2. Below, invent your own three-word “Before and After” chains. Each pair of words should be much more common than you'd expect from the frequencies of its individual words, but the whole triplet should be rare. You don't have to stick just to nouns; you can use any words.

1. _____
2. _____
3. _____



YOUR NAME:

REGISTRATION #

(E) Visible Speech (I/I) [10 points]

Alexander Melville Bell (father of Alexander Graham Bell) invented Visible Speech as a more detailed and systematic writing system for English, to help deaf students learn to pronounce spoken language more accurately.

Bell had found that English spelling was not very useful in teaching spoken English to deaf students, since words' spelling and pronunciation often don't correspond. So in order to represent pronunciation for students who had never heard the words in question, he devised an alphabet that tried to directly represent the articulatory gestures -- the mouth shapes and movements -- that speakers use.

E1. The following words in Visible Speech represent *boot*, *cogs*, *peaks*, and *tap*, but not in that order. Which is which?

ɒfɑʊ	
θlɔ	
ɔʔp	
ɑʃeʊ	

E2. What English words are represented by the following?

θʔɑ	
ɒfʊ	
ʊʃe	
ɒfʊ	

E3. Write the following words in Visible Speech.

keep						
tease						
spook						



YOUR NAME:

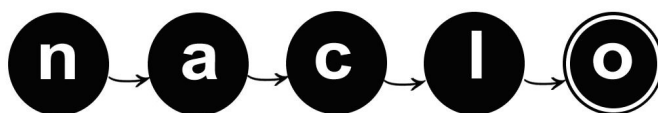
REGISTRATION #

(F) Lontara (1/3) [20 points]

Buginese is a language of the southern region of Sulawesi, the third largest island of Indonesia.

It is written using a script called *Lontara*. The script's name comes from the Malay word for palm, *lontar*. The long, thin leaves of the palm were once used to create scroll-like manuscripts.

This is a passage from the epic Indonesian creation myth *Sureq Galigo*, written in Buginese using the Lontara script:



(F) Lontara (2/3)

Here is the same passage, translated into English:

There is no one to call the gods Lord, or to offer praise to the underworld. Why Lord don't you have one of your children descend, and incarnate him on the earth; do not leave the world empty and the earth uninhabited. You are not a god, Lord, if there are no humans under the heavens, above the underworld, to call the gods Lord.

F1. The Buginese text of the passage has been chopped up into several pieces and scrambled up. These lines are pieces of the same passage in Buginese, but written in the Latin alphabet (i.e. the alphabet used to write English) instead of the Lontara script. Your task is to unscramble them.

Unscramble the pieces: figure out the correct order for the fragments A through J, and write them in order here, one letter per blank. Note that sentences E and F appear twice in the text, but here have different punctuation.

A.	ajaq naonro lobbang linoé
B.	lé namasuaq mua na sia
C.	makkatajangeng ri atawareng.
D.	mappaleq wali ri pérétiwi.
E.	mattampa puang lé ri batara,
F.	mattampa puang lé ri batara.
G.	ri awa langiq, lé ri ménéqna pérétiwié,
H.	tabareq-bareq ri atawareng,
I.	tammaga puang muloq séwa rijajiammu,
J.	teddévata iq, puang, rékkua masuaq tau

1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Notes about spelling: *e* is the vowel *u* in *mud*. *é* is the vowel *e* in *bed*. *q* is the sound in the middle of *uh-oh*.

F2. Translate these English words into Buginese. Write your translations with the *Latin alphabet* only; you do not need to use the Lontara script.

lord																			
underworld																			
earth																			



YOUR NAME:

REGISTRATION #

(F) Lontara (3/3)

F3. Some Buginese words and their meanings are given below, in the Latin alphabet. Write each word using the *Lontara script*.

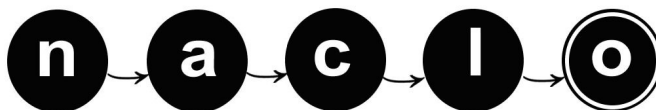
Sulawesi (an island of Indonesia)									
--------------------------------------	--	--	--	--	--	--	--	--	--

La Galigo (another name for Sureq Galigo)									
--	--	--	--	--	--	--	--	--	--

Tompoq Tikkaq ("land of the rising sun")									
---	--	--	--	--	--	--	--	--	--

Amparita (a town in Sulawesi)									
----------------------------------	--	--	--	--	--	--	--	--	--

Tenriabéng (a character in the Sureq Galigo story)									
---	--	--	--	--	--	--	--	--	--



(G) Cameroon Pidgin English (1/3) [5 points]

Speakers of mutually unintelligible languages with the need to communicate with each other often create *pidgin languages*. Pidgins are languages developed by speakers of distinct languages which come into contact but share no common linguistic background. Pidgin languages typically consist of linguistic features of the contact languages, and their vocabulary is typically derived from the socially or economically dominant language. Cameroon Pidgin English (CPE for short) is a pidgin language spoken in Cameroon, West Africa. The language has borrowed heavily from English.

There is no standard orthography (spelling conventions) for CPE. The data are presented in one of the ways in which CPE is represented orthographically; notice that o and o represent different vowels. For example,

go	'go'	do	'door'
man	'man'	dai	'die' or 'dead'
basiket	'basket'	fashon	'behavior'
haus	'house'	nes	'nurse'
bet	'bed'	sinek	'snake'
du	'do'	buk	'book'
kol	'cold'	sipun	'spoon'
siton	'stone'	kain	'kind'
shet	'shirt'	simen	'cement'

It is typical for speakers in a complex multilingual situation, as is the one which creates pidgin languages, to find creative ways to extend the usefulness of a small borrowed vocabulary. One way to accomplish this goal is by metaphorically extending borrowed words, as in the examples below, which are CPE compound words derived metaphorically from the English word *eye*.

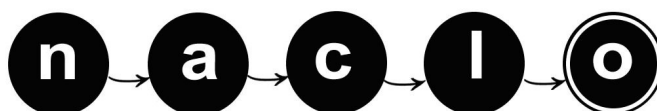
ai <u>k</u> on	'interior of corn kernel'	bat ai	'evil eye'
benben ai	'cross-eyed'	bik ai	'greedy'
<u>l</u> ong ai	'covetous'	tr <u>o</u> ng ai	'courageous'

In this task, you are presented with CPE vocabulary items derived in a similar fashion from the English words *hand* (CPE *han*), *head* (CPE *het*), *heart* (CPE *hat*), *mouth* (CPE *maut*), *black* (CPE *blak*), and *dry* (CPE *drai*).

Your task is to match the CPE compounds to their likely English translations.

GI. CPE compound words derived from the English word *hand*. Choose from the following translations.

CPE compound	Translation
open han	A. one of a pair
tai han	B. generous
wan han	C. mean



(G) Cameroon Pidgin English (2/3)

G2. CPE compound words derived from the English word *head*. Choose from the following translations.

CPE compound	Translation
bik het	A. stubborn
klin het	B. innocent
tr <u>o</u> ng het	C. intelligent

G3. CPE compound words derived from the English word *heart*. Choose from the following translations.

CPE compound	Translation
bat hat	A. kindness/generosity
blak hat	B. calmness
gut hat	C. wickedness
kul hat	D. cleverness/craftiness
k <u>o</u> ni hat	E. hatred

G4. CPE compound words derived from the English word *mouth*. Choose from the following translations.

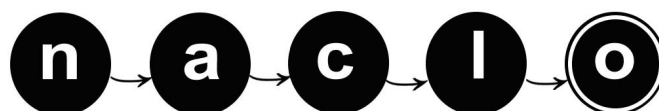
CPE compound	Translation
bik maut	A. ability to persuade/flattery
k <u>o</u> ni maut	B. haughtiness/bragging
swit maut	C. dishonesty

G5. CPE compound words derived from English *black*. Choose from the following translations.

CPE compound	Translation
blak ai	A. wickedness
blak bush	B. heart of a forest
blak hat	C. dizziness

G6. CPE compound words derived from English *dry*. Choose from the following translations.

CPE compound	Translation
drai ai	A. unsubstantiated statements
drai han	B. thirst
drai nek	C. poverty
drai t <u>o</u> k	D. insomnia



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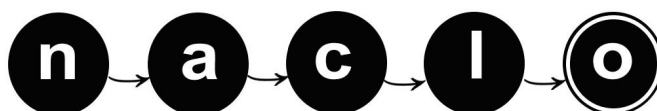
(G) Cameroon Pidgin English (3/3)

G7. Answer the following questions. Did you notice...

A. ... the two different ways to say 'generous' in CPE? Write them below in the CPE orthography.

B. ... that English consonant clusters of borrowed English words are preserved in some contexts but simplified or elaborated in others? What are the most likely CPE words for the following borrowed English words?

stick										
market										
service										
old										
green										



(H) Bertrand and Russell (1/3) [10 points]

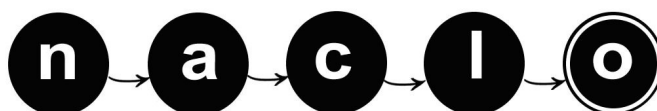
Teachers can be hard to understand sometimes. Case in point, the math teacher, Mr. Whitehead. Just this morning, he told the class, “It's not the case that if at least one student studied for the test, then every student failed the test.” What does that even mean?

Well, the two new kids in the class, Bertrand and Russell, have come up with a plan to make sense of Mr. Whitehead's statements. They call it first-order logic (FOL), a way to map these confusing statements into an unambiguous representation. Bertrand says the whole system is built the idea of propositions, a statement that is either true or false. Propositions can be statements about people or things like *studied_for(John, test)* or *is_hard(test)*. Propositions can also be combined to make more complex statements with the following symbols:

Symbol	Example statement	Interpretation	Explanation
\neg	$\neg \textit{studied_for}(\textit{John}, \textit{test})$	John did <u>not</u> study for the test.	The statement is true if and only if John did not study for the test.
\wedge	$\textit{is_hard}(\textit{test}) \wedge \textit{is_long}(\textit{test})$	The test is long <u>and</u> hard.	This statement is true whenever the test is long and the test is hard.
\vee	$\textit{is_hard}(\textit{test}) \vee \textit{is_long}(\textit{test})$	The test is long <u>or</u> hard.	This statement is true if the test is long, or the test is hard, or both.
\Rightarrow	$\textit{studied_for}(\textit{John}, \textit{test}) \Rightarrow \textit{aced}(\textit{John}, \textit{test})$	<u>If</u> John studied for the test, <u>then</u> he aced it.	This is true if the statement on the right side of the arrow is always true whenever the statement on the left side of the arrow is true. If the statement on the left is false, then the whole statement is true by default (if John didn't study, we don't know how he did on the test).

“But,” says Russell, “the most important part of first-order logic is the quantifiers.” Quantifiers allow you to make general statements like Mr. Whitehead loves to do.

Symbol	Example statement	Interpretation	Explanation
\forall	$[\forall x : \textit{student}(x) \Rightarrow \textit{studied_for}(x, \textit{test})]$	Every student studied for the test.	The \forall symbol makes a statement about every possible object (whether a student or not). It temporarily gives it the name x to make such a statement. We use the \Rightarrow symbol because we don't want to make any claims about whether non-students studied.
\exists	$[\exists x : \textit{student}(x) \wedge \textit{aced}(x, \textit{test})]$	There exists at least one student who aced the test.	The \exists symbol makes the claim that there is at least one (possibly more) object in the universe, temporarily called x , that satisfies the statement listed.



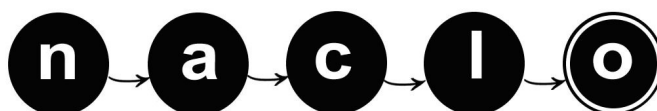
(H) Bertrand and Russell (2/3)

Bertrand and Russell also note that there are also a couple other things we can say about individuals (but not propositions or quantifiers). For example, if the names Jonathan and Jon both refer to the same person, we can say $Jon = Jonathan$. If we want to emphasize that John and Jon are different people, we can say $John \neq Jon$.

HI. Translate Mr. Whitehead's statements into first-order logic by finding the proposition below that is equivalent to each statement and writing the letter of the proposition in the blank. Each statement has exactly one correct answer; not every proposition will be used.

	Everyone either passed or failed the test.
	Every student did not pass the test.
	Exactly one student passed the test.
	A student did not pass the test.
	It is not the case that if at least one student studied for the test, then every student failed the test.

A.	$[\exists_x : student(x) \wedge \neg passed(x, test)]$
B.	$[\exists_x : student(x) \wedge passed(x, test) \wedge [\forall_y : (student(y) \wedge passed(y, test)) \Rightarrow x = y]]$
C.	$[\exists_x : student(x) \wedge passed(x, test) \wedge [\exists_y : student(y) \wedge passed(y, test) \wedge x = y]]$
D.	$[\forall_x : passed(x, test) \vee failed(x, test)]$
E.	$\neg ([\exists_x : student(x) \wedge studied_for(x, test)] \Rightarrow [\forall_x : student(x) \Rightarrow failed(x, test)])$
F.	$[\exists_x : passed(x, test) \wedge failed(x, test)]$
G.	$[\forall_x : \neg student(x) \Rightarrow passed(x, test)]$
H.	$[\exists_x : student(x) \wedge studied_for(x, test)] \Rightarrow \neg [\forall_x : student(x) \Rightarrow failed(x, test)]$
I.	$\neg [\exists_x : student(x) \wedge \neg passed(x, test)]$
J.	$[\forall_x : student(x) \Rightarrow \neg passed(x, test)]$

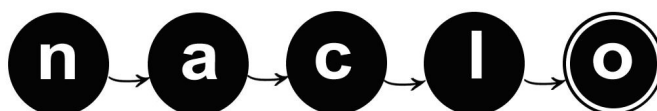


(H) Bertrand and Russell (3/3)

H2. Translate first-order logic propositions into their equivalent English sentences by finding the statement below that is equivalent to each proposition and writing the letter of the statement in the blank. Each proposition has exactly one correct answer; not every statement will be used.

	$[\forall_x : student(x) \Rightarrow studied_for(x, test)] \vee [\forall_y : student(y) \Rightarrow passed(y, test)]$
	$[\forall_x : student(x) \Rightarrow [studied_for(x, test) \vee passed(x, test)]]$
	$[\forall_x : (test(x) \wedge long(x)) \Rightarrow hard(x)]$
	$[\exists_x : test(x) \wedge (long(x) \vee hard(x))]$
	$[\forall_x : test(x) \wedge \neg (long(x) \wedge hard(x)) \Rightarrow \neg [\forall_y : student(y) \Rightarrow failed(y, x)]]$

A.	There is a test that is long or hard.
B.	If a test is not long and not hard, then every student did not fail it.
C.	Every student studied for or passed the test.
D.	Every test that is long is also hard.
E.	Every student studied for the test or every student passed the test.
F.	If there is a test that is hard or not long, then at least one student failed it.
G.	Every test is long and hard.
H.	If a test is not both long and hard, then not every student failed it.



YOUR NAME:

REGISTRATION #

Extra Page - Enter the Problem Name Here: _____

