The Seventh Annual North American Computational Linguistics Olympiad 2013
www.naclo.cs.cmu.edu

Invitational Round
March 19, 2013
Contest Booklet

REGISTRATION NUMBER

Name: ___________________________________________

Contest Site: ________________________________________

Site ID: ____________________________________________

City, State: _________________________________________

Grade: ______

Start Times - Morning: ____________ Afternoon: ____________
End Times - Morning: ____________ Afternoon: ____________

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

SIGN YOUR NAME BELOW TO CONFIRM THAT YOU WILL NOT DISCUSS THESE PROBLEMS WITH ANYONE UNTIL THEY HAVE BEEN OFFICIALLY POSTED ON THE NACLO WEBSITE IN LATE MARCH.

Signature: _________________________________________
Welcome to the seventh 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 five hours long and includes ten problems, labeled I to R. You may only work on part I before the break and only on part II after the break.
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 & 11.
5. Each problem is worth a specified number of points, with a total of 100 points. In the invitational round, a fraction of the points on some problems are given for explanations.
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. 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.
9. 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.
10. 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.
11. **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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Part I
Problems I-N
3 Hours
‘Beja’ is the Arabic name for the language which calls itself ‘ti bedawye’, the unwritten language of a group of mainly nomadic tribes that have probably occupied the north-east corner of the Sudan (between the Nile and the Red Sea) for thousands of years. It is classified as an ‘Afro-Asiatic’ language, which means that it is distantly related to Arabic, Hebrew, and Ancient Egyptian. In the following examples, ’ stands for a glottal stop (the middle sound in the word “uh-oh”).

<table>
<thead>
<tr>
<th>Beja Word</th>
<th>English Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ilaga diwiini</td>
<td>The male calf is sleeping</td>
</tr>
<tr>
<td>b. doobaab rhitni</td>
<td>She sees a bridegroom</td>
</tr>
<tr>
<td>c. gwibu</td>
<td>It is a mouse</td>
</tr>
<tr>
<td>d. oomeek kiike</td>
<td>He is not the donkey</td>
</tr>
<tr>
<td>e. tuukaam b’ata</td>
<td>The female camel lay down</td>
</tr>
<tr>
<td>f. iragad winu</td>
<td>The leg is big</td>
</tr>
<tr>
<td>g. tilaga wint kitte</td>
<td>The female calf is not big</td>
</tr>
<tr>
<td>h. uutak tim’ari tamyaa</td>
<td>The man ate the food</td>
</tr>
<tr>
<td>i. yooaab tidbil</td>
<td>She collected some oxen</td>
</tr>
<tr>
<td>j. oofaar rhita</td>
<td>She saw the flower</td>
</tr>
<tr>
<td>k. tidooba kadiwta</td>
<td>The bride is not sleeping</td>
</tr>
<tr>
<td>l. uumeek b’iini</td>
<td>The donkey is lying down</td>
</tr>
<tr>
<td>m. uuyaas ookaam danbiil</td>
<td>The dog is collecting the camel</td>
</tr>
<tr>
<td>n. hataay tamaabu</td>
<td>He has eaten a horse</td>
</tr>
<tr>
<td>o. ooyoo diblaab kiike</td>
<td>He has not collected the ox.</td>
</tr>
<tr>
<td>p. kil’oob kiidbil</td>
<td>He is not collecting a shell</td>
</tr>
<tr>
<td>q. m’ariit tamtiniit kitte</td>
<td>She cannot eat food</td>
</tr>
<tr>
<td>r. ootak kanrifu</td>
<td>He can meet the man</td>
</tr>
<tr>
<td>s. yam kitdibil</td>
<td>She is not collecting water</td>
</tr>
</tbody>
</table>

**Translate:**

11. uukaam ootak rhaabu. __________________________________________

12. faar katamya. __________________________________________

13. hataay tamtiniitu. __________________________________________

14. uutak yam danbiilu. __________________________________________

15. meek rhitniit kitte. __________________________________________
Translate:

16. A man meets the mouse.  
17. The bridegroom is not eating.  
18. The donkey has not eaten the flower.  
19. The mouse is not big.  
10. The female dog cannot collect oxen.  
111. Explain your answers.
The following is a list of Stockholm metro stations, translated into English.

Actually, a few of them are pretty loose translations, and some are a bit over-literal. (We adapted them from a humorous map published by the English-language Swedish newsmagazine *The Local.*) Nonetheless, we think you’ll be able to match up most of them.

Put the appropriate station number next to its English translation.

<table>
<thead>
<tr>
<th>Stockholms Tunnelbana (1/2) [15 points]</th>
</tr>
</thead>
<tbody>
<tr>
<td>____ Abraham’s Mountain</td>
</tr>
<tr>
<td>____ Alder Bay</td>
</tr>
<tr>
<td>____ Alder Village</td>
</tr>
<tr>
<td>____ Axel’s Mountain</td>
</tr>
<tr>
<td>____ Band Pasture</td>
</tr>
<tr>
<td>____ Birch Pasture</td>
</tr>
<tr>
<td>____ Channel Village Mountain Centre</td>
</tr>
<tr>
<td>____ Charles Square</td>
</tr>
<tr>
<td>____ Dark Mountain</td>
</tr>
<tr>
<td>____ Fathertown</td>
</tr>
<tr>
<td>____ Fathertown Beach</td>
</tr>
<tr>
<td>____ Forest Church Garden</td>
</tr>
<tr>
<td>____ Gullmar’s Square</td>
</tr>
<tr>
<td>____ Hall Grove</td>
</tr>
<tr>
<td>____ Hammer Village Heights</td>
</tr>
<tr>
<td>____ Haymarket</td>
</tr>
<tr>
<td>____ Hazel Village Beach</td>
</tr>
<tr>
<td>____ Hazel Village Farm</td>
</tr>
<tr>
<td>____ House Village</td>
</tr>
<tr>
<td>____ Iceland Market</td>
</tr>
<tr>
<td>____ John’s Grove</td>
</tr>
<tr>
<td>____ King’s Garden</td>
</tr>
<tr>
<td>____ Lake Mälaren Heights</td>
</tr>
<tr>
<td>____ Manor</td>
</tr>
<tr>
<td>____ Mary Market</td>
</tr>
<tr>
<td>____ Meadow Village Square</td>
</tr>
<tr>
<td>____ Mount Christine</td>
</tr>
<tr>
<td>____ Mountain Hammer</td>
</tr>
<tr>
<td>____ Odin Square</td>
</tr>
<tr>
<td>____ Pasture Manor</td>
</tr>
<tr>
<td>____ Rink Village</td>
</tr>
<tr>
<td>____ Spring Mountain</td>
</tr>
<tr>
<td>____ Spring Village Farm</td>
</tr>
<tr>
<td>____ St. Eric’s Square</td>
</tr>
<tr>
<td>____ Sture Village</td>
</tr>
<tr>
<td>____ Telephone Square</td>
</tr>
<tr>
<td>____ Tender Village Center</td>
</tr>
<tr>
<td>____ Thorild’s Square</td>
</tr>
<tr>
<td>____ Town Pasture</td>
</tr>
<tr>
<td>____ Western Cottage</td>
</tr>
<tr>
<td>____ Westwood</td>
</tr>
</tbody>
</table>
Soon after Maya Delgado was hired by accounting giant Jensen & Nakamura, she was sent on a consulting assignment abroad. Once at her destination, she was given two boxes (yellow and green) of statements from Jensen & Nakamura’s branch offices in two countries in the region. Each box contained thirteen folders. Maya immediately figured out what the labels on the folders meant. Not only that, but she soon realized that one folder in each box was a fake.

Can you figure out:

**K1.** How do you translate the labels of folders IX and H into English?

**K2.** Which were the fake folders in each box?

Yellow box - which number (I-XIII) ___.

Green box - which letter (A-M) ___.
(K) Putting the Books in Order (2/2)

K3. How does each of the remaining folders from the yellow box match a folder in the green box? Insert the folders (using I-XIII and A-M) into the table on the previous page. How should these folders be ordered logically before being sent home to the Chicago office for further processing?

K4. Explain your answers.
The introduction of the Yesbot onto the corporate scene has revolutionized upper management across the nation. Cost-savvy CEOs have saved billions in salaries by replacing expensive vice presidents and board members with Yesbots, guaranteed to agree with everything the CEO has said.

- “George from accounting has released a factual earnings report!”
- “Yes, sir or ma’am, it is true that George from accounting has released a factual earnings report.”

- “It will be the downfall of the company!”
- “Yes, sir or ma’am, it is true that it will be the downfall of the company.”

- “The press will have a field day!”
- “Yes, sir or ma’am, it is true that the press will have a field day.”

Although shiny and impressive-looking, the Yesbot is not very smart – in fact, it resembles the very first computer programs to attempt to communicate with humans. These systems (such as Eliza) “pretended” to understand the human input and operated on the following principle: for a specific input pattern they generated an output pattern from a set of patterns they could choose from.

The original Yesbot had only one pattern: when a Yesbot hears its owner make a statement (as opposed to a question, command, request, etc.), it says “Yes, sir or ma’am, it is true that...” and then repeats whatever its owner just said.

But reports started coming in that the Yesbots were making mistakes left and right, telling lies and formulating untruths (where “true” means, of course, whatever the owner believes). The Yesbots are quickly recalled and engineers attempt to figure out what went wrong.

L1. Give an example of a sentence that, when said by the CEO, will cause Yesbot to make a mistake.
L2. Provide two examples of words that, when the CEO uses them in a sentence, will sometimes cause Yesbot to make a mistake, but sometimes won’t. Explain why.

L3. Are there any words that will always cause Yesbot to make a mistake, (that is, say a lie) any time the CEO uses them? List any you can, and explain why or why not.
Indonesian (Bahasa Indonesia) is an Austronesian Language widely spoken as a first or second language throughout the countries of Indonesia and East Timor. It is closely related to Malay, which is spoken in Malaysia, Brunei, and Singapore. Swahili (Kiswahili) is a Bantu language spoken natively by many groups living on the coast of East Africa and as a second language throughout Kenya, Tanzania, Uganda, the Comoros, Mozambique, Burundi, Somalia, Rwanda, and the Democratic Republic of the Congo. These two languages are lingua francas, used for trade, business, and education among peoples with different mother tongues.

Though they originated on different continents and come from different language families, Indonesian and Swahili share a substantial amount of vocabulary, thanks primarily to loans from Arabic, but also from English, Portuguese, and German/Dutch. While many of these loans are related to commonly-loaned domains such as technology, religion, or animals (compare the Swahili word for ‘lion,’ simba, with the Indonesian singga), some are for more everyday items such as ‘table’ (Swahili meza, Indonesian meja, from the Portuguese mesa). Below are three tasks related to identifying Indonesian and Swahili cognates, but be careful: not everything is as it seems!

**Swahili:**
1. Aliniuza kitabu.
2. Dada wangu anajifunza kemia.
3. Hijabu ya dada wangu ni rangi ya bluu.
5. Katika Kiswahili unaweza kusema habari gani.
8. Leo ni alhamisi.
9. Leteni vitabu vyenu kwa shule.
11. Nina vitabu kuhusu Wayahudi.
15. Orodha hii inasema kwa wewe ni meskini.
16. Shati la kaka wangu ni wewe ni kijana.
17. Shati lake ni juu ya paja lake.
20. Wilaya hizi ni salama.

**Indonesian:**
A. Bawakan saya buku-tulisku.
B. Bawalah buku-buku ke sekolah.
C. Besok Anda ke Mesri.
D. Di Bahasa Swahili Anda bisa berbicara apa kabar.
E. Dia menjual saya buku.
F. Hari ini hari kamis.
G. Jilbab kakakku adalah biru.
H. Kakakku belajar kemia.
I. Kemeja adikku adalah hijau.
J. Kemejanya di pahanya.
K. Ketika hari jumat saya berdoa.
L. Lingkungan ini selamat.
M. Menurut daftarnya Anda miskin.
N. Saya belajar biologi.
O. Saya bisa berbahasa Swahili.
P. Saya membaca al-kitab kemarin.
Q. Saya punya buku-buku tentang Yahudi-Yahudi.
R. Saya suka bendera Belanda.
S. Saya tidak punya waktu hari jumat.
T. Wilayah-wilayahnya selamat.
(M) Playing the Cognate Game (2/3)

M1. Match the each English sentence with their Indonesian and Swahili translations.

<table>
<thead>
<tr>
<th>English</th>
<th>Swahili</th>
<th>Indonesian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bring me your notebook.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bring your books to school.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>He sold me a book.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>His shirt is on his thigh.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I didn't have time on Friday.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have books about Jews.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I like the Dutch flag.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I speak Swahili.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I study biology.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Swahili you can say what's new.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My brother's shirt is green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My sister studies chemistry.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My sister's headscarf is blue.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On Fridays I pray.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>These districts are safe.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>This list says that you are poor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>This neighborhood is safe.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Today is Thursday.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tomorrow you’re going to Egypt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yesterday I read the Bible.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

M2. In Task 1, there are at least two pairs of "misleading cognates" – words in Indonesian and Swahili that have the same roots but have different meanings in English. What are they, and what do they mean in English?

<table>
<thead>
<tr>
<th>Swahili word</th>
<th>English meaning of Swahili word</th>
<th>Indonesian misleading cognate</th>
<th>English meaning of Indonesian misleading cognate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ n \quad a \quad c \quad l \quad o \]
M3. Translate the following sentences into Swahili and Indonesian:

1. I speak Hebrew.  
   S:  
   I:  

2. I like my sister’s shirt  
   S:  
   I:  

3. He sold me a flag.  
   S:  
   I:  

4. Egypt is safe.  
   S:  
   I:  

5. He sells me a headscarf.  
   S:  
   I:  

6. Today I am reading a book.  
   S:  
   I:  

7. In Swahili you can study the Bible.  
   S:  
   I:  

8. The Dutch are poor.  
   S:  
   I:  

   S:  
   I:  

    S:  
    I:  

   n  a  c  l  o
A decision tree consists of a pivot word, a positive branch, and a negative branch. Each branch has either a decision tree or a final word. A decision tree is applied to a set of words called a context. If a context contains the pivot word (anywhere), then the positive branch is followed. If the context does not, the negative branch is followed. When a final word is reached, the tree has classified the context. Decision trees are used to predict words based on their contexts, and they’re useful in automatic text processing applications.

For instance, to classify which main verb is used in each phrasal verbs below, based on its context of particles, we could use the following decision tree.

take back

take up with

take to

go back on

go up to

N1. The depth of a tree is the most number of words on a path to any final word. The depth of the example tree above is 3 (up, back, on). Draw the decision tree of least depth that correctly classifies the main verbs \{call, check, come\} in the following phrasal verbs, based only on their particles \{across, as, down, in, on, out, to, up, with\}.

call down to
call out to
check in on
check up on
come across as
come down with
come on to
come out with
come up with
N2. The size of a tree is the number of final words it contains. The size of the example tree above is 5. Draw the smallest decision tree that distinguishes between "on" and "up" following "hold" in these excerpts from Shakespeare, using any words in the surrounding sentences as context.

Does he not hold up his head, as it were, and strut in his gait?  
Must have a word anon. Lay hold on him.  
Good people, enter, and lay hold on him.  
The law hath yet another hold on you.  
Come hither, William; hold up your head; come.  
Come on, sirrah; hold up your head; answer your master, be not afraid.  
Lay hold on him, I charge you in the duke's name.  
With her whom here I cannot hold on shore;  
Away, I say; time wears: hold up your head, and mince.  
Like hold on thee. Let go his arm.  
Who twice a day their wither'd hands hold up.  
Canst thou hold up thy heavy eyes a while,
Extra Page - Enter the Problem Name Here: __________
Part 2
Problems O-R
2 Hours
The Warlpiri people in Australia organize themselves into eight different groups, called “skins.” Your skin, which influences your interactions with the Warlpiri people around you, is determined by your parents' skins and does not change during your entire life. In the diagram above, the eight boxes correspond to the eight skins. The horizontal rows indicate marriage correspondences. The arrows point from mother to child.

For example:

- If you are in skin number 7, you must marry someone in skin number 3 (of the opposite gender).
- If you are a female in skin number 6, then all your children will be in skin number 8.

You ask some members of the Warlpiri community about their family relations and they give you the following information. All the information is correct, including the spellings. Based on the data, determine the female names for the eight skins.

For skin number 1, the males are "Jakamarra" and the females are "Nakamarra."

- “I am a Jangala. My daughter is Nampijinpa.”
- “I am a Nakamarra. My brother’s son is Jupurrula.”
- “I am a Nampijinpa. My mother’s grandfathers were Jungarrayi and Jupurrula.”
- “I am a Napangardi. My husband’s sister’s husband’s father’s father’s mother was Napurrula.”
- “I am a Napanangka. Some of my good friends are Napaljarri and Nangala and Nungarrayi. Oh, you wanted me to talk about my family? Oops.”
- “I am a Japanangka. My wife’s father’s mother’s brother’s wife’s father’s mother’s brother’s wife’s father’s mother’s brother’s wife’s father’s mother’s brother’s wife’s father’s mother’s brother’s wife was Napurrula. I know my family tree very well.”

For skin number 2, the males are "Nakamarra" and the females are "Jakamarra."

- “I am a Nakamarra. My brother’s son is Jupurrula.”
- “I am a Jangala. My daughter is Nampijinpa.”
- “I am a Jupurrula. My wife’s father’s mother’s brother’s wife’s father’s mother’s brother’s wife was Napurrula.”
- “I am a Napangardi. My husband’s sister’s husband’s father’s father’s mother was Napurrula.”
- “I am a Napanangka. Some of my good friends are Napaljarri and Nangala and Nungarrayi. Oh, you wanted me to talk about my family? Oops.”
- “I am a Japanangka. My wife’s father’s mother’s brother’s wife’s father’s mother’s brother’s wife’s father’s mother’s brother’s wife’s father’s mother’s brother’s wife’s father’s mother’s brother’s wife’s father’s mother’s brother’s wife was Napurrula. I know my family tree very well.”

For skin number 3, the males are "Jakamarra" and the females are "Nakamarra."

- “I am a Jakamarra. My son is Nampijinpa.”
- “I am a Nakamarra. My brother’s son is Jupurrula.”
- “I am a Jakamarra. My brother’s son is Nampijinpa." (Note: This is a repetition of the previous sentence)
- “I am a Nampijinpa. My mother’s grandfathers were Jungarrayi and Jupurrula.”
- “I am a Napanangka. Some of my good friends are Napaljarri and Nangala and Nungarrayi. Oh, you wanted me to talk about my family? Oops.”
- “I am a Japanangka. My wife’s father’s mother’s brother’s wife’s father’s mother’s brother’s wife’s father’s mother’s brother’s wife’s father’s mother’s brother’s wife’s father’s mother’s brother’s wife’s father’s mother’s brother’s wife was Napurrula. I know my family tree very well.”
(O) Warlpiri Kinship Groups (2/2)

01. ______________________

02. ______________________

03. ______________________

04. ______________________

05. ______________________

06. ______________________

07. ______________________

08. ______________________

09. Explain your answers.
The following is a poem from the Peruvian poet Sisku Apu Rimac ("Sisco who talks to the spirits"). Apu Rimac wrote in both Spanish and in his native language, Quechua. Varieties of Quechua are spoken by roughly 10 million people in the Andes mountains of Peru, Ecuador, and Bolivia. Like the traditional poems and song lyrics that served as Apu Rimac's inspiration, his poetry is frequently melancholy and mournful, and common themes include yearning for a lost love and the nostalgia of urban Quechua for their mountain homelands.

**P1.** We have taken the eight couplets from the Quechua version of the poem, on the right, and scrambled them into a random order. Can you match them up to their English translations on the left? (Note: vicunya, kule, and puku are kinds of animal.)

1. For what, God, Did you create my suffering?
   
   A. Kule kuleq thapanpichus Taytallayri churyawarqqa

2. Did you never know What happiness is?
   
   B. Kunan kuna waqanaypaq Urqun qasan purinaypaq

3. Maybe in the nest of the pukus My dear mother gave birth to me.
   
   C. Wikunyachus mamay karqa Tarukachus taytay karqa

4. Maybe in the cradle of the kules My dear father engendered me
   
   D. Manataqchu yacharqanki Imaynas kawka kayta

5. Like the poor puku I endure the cold winds.
   
   E. Imapaqmi Apu Tayta Nyak'ariya kamarqanki

6. Or the poor kule I cry as I suffer.
   
   F. Puku unya hina Chiri wayra muchunaypaq

7. Perhaps my mother was a vicunya; Perhaps my father was a deer;
   
   G. Puku pukuq qesanpichus Mamallayri wachawarqqa

8. And for these reasons I cry wandering through the highlands.
   
   H. Kule unya kaqlla Nyak'arispa waqanaypaq

**P2.** How would you say the following in Quechua?

<table>
<thead>
<tr>
<th>English</th>
<th>Quechua</th>
</tr>
</thead>
<tbody>
<tr>
<td>poor</td>
<td>Puku unya hina</td>
</tr>
<tr>
<td>suffer</td>
<td>Chiri wayra muchunaypaq</td>
</tr>
<tr>
<td>mother</td>
<td>Puku pukuq qesanpichus</td>
</tr>
<tr>
<td>deer</td>
<td>Mamallayri wachawarqqa</td>
</tr>
<tr>
<td></td>
<td>Imapaqmi Apu Tayta Nyak'ariya kamarqanki</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**YOUR NAME:                                                                                         REGISTRATION #**

(P) Deer Father (1/2) [5 points]
P3. What element in a Quechua sentence marks the sentence as uncertain or merely a possibility?

_________________________________________________________________

P4. What does Apu Tayta mean?

_________________________________________________________________
You are employed by a company that makes Grice’s Grifter Gader (GGG), a small flying robot that helps you cheat at card games. The robot flies above your opponent’s shoulder, looks at their cards, and then telepathically sends a message into your brain. (It’s not the most ethical job in the world, but you took it because, hey, you get to work with flying telepathic robots — nobody could say no to that.)

These gadgets have to abide by the following maxims:

- **Relevance (R)** What GGG says should be relevant to the player’s needs (winning at the card game); it should give the minimum number of facts necessary for the player to make the best play possible (telepathic communication isn’t cheap!)
- **Manner (M)** In addition to giving the minimum number of facts necessary, those facts should be expressed as simply as possible
- **Quantity (N)** GGG should give all needed information, i.e. it should not leave anything out
- **Quality (L)** GGG shouldn’t say things that are wrong (otherwise, what’s the point of cheating)

Linguists believe that humans follow similar rules. For example, when you ask a friend what the weather is like, he would violate the maxim of quantity if he recited the hourly barometric pressure over the previous three days. Because the GGG communicates through telepathic natural language, it should also obey these maxims.

Here’s the game GGG is trying to help a player win. Before each round, the dealer shuffles a deck with forty cards, where each card has one of four suits (club ♣, heart ♥, spade ♠, diamond ♦) and a number from 1 to 10. The player and her opponent each get three cards. The player picks one of her three cards and gives it to the opponent. The opponent gets points equal to the product of the two highest numbers in the same suit (if there are no cards of the same suit, the hand is worth one point). For example:

<table>
<thead>
<tr>
<th>Opponent’s Hand</th>
<th>Player Card</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>4♥ 3♥ 2♥</td>
<td>1♠</td>
<td>4 x 3 = 12</td>
</tr>
<tr>
<td>4♠ 5♥ 9♦</td>
<td>6♠</td>
<td>6 x 4 = 24</td>
</tr>
<tr>
<td>4♠ 5♥ 9♠</td>
<td>10♠</td>
<td>1 (no cards of the same suit)</td>
</tr>
</tbody>
</table>

The GGG can’t see the player’s cards (it hovers above the opponent’s shoulder), so it needs to give the player enough information for her to play the best card no matter what cards she has. For example, if the GGG sees that the opponent has a 4♠ 3♥ 2♦, it can’t just say "play a heart", because the player might not have that in her hand.

---

1 Language is ambiguous. In addition to the ambiguity of syntax and semantics, there are often social conventions that both speakers and listeners assume in a conversation. This was described by the linguist H. Paul Grice in the early 1960s. He proposed that speakers and listeners assume the maxims described in this problem. Because of these maxims, conversation participants are able to make Gricean implicatures. These allow us to extrapolate from incomplete information. For example, if A asks B ‘Where’s Lisa?’ and B replies 'Lisa got the flu,’ the maxim of relevance allows A to assume that Lisa is staying at home because she is sick, even though this was never explicitly stated. Identifying and constructing these logical leaps in this restricted environment is the goal of this problem.
(Q) Grice’s Grifter Gadgets (2/2)

Q1. What’s wrong with my GGG?
You have to debug some defective units. Given an opponent’s hand and the output of a GGG, give the maxims violated (use R, N, L, or M). Each example will violate one maxim.

<table>
<thead>
<tr>
<th>Opponent’s Hand</th>
<th>Output</th>
<th>Maxim Violated</th>
</tr>
</thead>
<tbody>
<tr>
<td>4♥ 3♠ 2♦</td>
<td>He has a four of hearts, a three of spades, and a two of clubs.</td>
<td>__________</td>
</tr>
<tr>
<td>4♥ 3♥ 2♥</td>
<td>He has a four of hearts, a three of hearts, and a two of hearts.</td>
<td>__________</td>
</tr>
<tr>
<td>4♥ 3♥ 2♠</td>
<td>He has hearts, diamonds, and spades.</td>
<td>__________</td>
</tr>
<tr>
<td>6♥ 7♠ 3♦</td>
<td>He has a six of hearts, a seven of spades, a three of diamonds, and the sky is blue.</td>
<td>__________</td>
</tr>
<tr>
<td>2♠ 1♠ 3♠</td>
<td>He has an even prime number of spades, and the smallest odd prime number of clubs.</td>
<td>__________</td>
</tr>
</tbody>
</table>

Q2. Correcting the GGG
Given an opponent’s hand, a maxim violated, and the output of a GGG, replace the underlined portion of the output with text that would fix the violation of the maxim (without violating any others!).

| 4♥ 2♦ 3♥       | He has a four of hearts, a two of diamonds, and a three of hearts. | Relevance | __________ |
| 8♠ 2♣ 10♣      | He has a ten of clubs and an eight of spades. | Quality | __________ |
| 8♠ 2♥ 10♣      | He has an eight of diamonds and a two of hearts. | Quantity | __________ |

Q3. Playing the Game
Given the following statements by a (fully functional) GGG, give a configuration of the opponent’s cards that is consistent with the statement and all the maxims (if there’s more than one possible configuration, just give one).

A. Don’t play a heart. __________________________
B. He has no hearts. __________________________
C. He has clubs and hearts. __________________________
D. He has a three of clubs and a two of spades. __________________________
And you thought that learning the periodical table was hard. Now try doing it in Polish! How about in Polish Sign Language?

The next page lists all chemical elements in English. The seven pages thereafter include the names of 40 of them, written in Polish Sign Language.

Figure out how this language works and then use it to write the names of the following chemical elements: Selenium, Molybdenum, Helium, Xenon, Ytterbium using the key on the last page of the problem. In each box add the numeric code for the sign.

Note: knowledge of Chemistry is not needed to solve this problem.

R1. Selenium
R2. Molybdenum
R3. Helium
R4. Xenon
R5. Ytterbium
### (R) Poles Apart (2/10)

<table>
<thead>
<tr>
<th>Actinium</th>
<th>Fluorine</th>
<th>Nitrogen</th>
<th>Tellurium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>Francium</td>
<td>Nobelium</td>
<td>Terbium</td>
</tr>
<tr>
<td>Americium</td>
<td>Gadolinium</td>
<td>Osmium</td>
<td>Thallium</td>
</tr>
<tr>
<td>Antimony</td>
<td>Gallium</td>
<td>Oxygen</td>
<td>Thorium</td>
</tr>
<tr>
<td>Argon</td>
<td>Germanium</td>
<td>Palladium</td>
<td>Thulium</td>
</tr>
<tr>
<td>Arsenic</td>
<td>Gold</td>
<td>Phosphorus</td>
<td>Tin</td>
</tr>
<tr>
<td>Astatine</td>
<td>Hafnium</td>
<td>Platinum</td>
<td>Titanium</td>
</tr>
<tr>
<td>Barium</td>
<td>Hassium</td>
<td>Plutonium</td>
<td>Tungsten</td>
</tr>
<tr>
<td>Berkelium</td>
<td>Helium</td>
<td>Polonium</td>
<td>Uranium</td>
</tr>
<tr>
<td>Beryllium</td>
<td>Holmium</td>
<td>Potassium</td>
<td>Vanadium</td>
</tr>
<tr>
<td>Bismuth</td>
<td>Hydrogen</td>
<td>Praseodymium</td>
<td>Xenon</td>
</tr>
<tr>
<td>Bohrium</td>
<td>Indium</td>
<td>Promethium</td>
<td>Ytterbium</td>
</tr>
<tr>
<td>Boron</td>
<td>Iodine</td>
<td>Protactinium</td>
<td>Yttrium</td>
</tr>
<tr>
<td>Bromine</td>
<td>Iridium</td>
<td>Radium</td>
<td>Zinc</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Iron</td>
<td>Radon</td>
<td>Zirconium</td>
</tr>
<tr>
<td>Calcium</td>
<td>Krypton</td>
<td>Rhenium</td>
<td></td>
</tr>
<tr>
<td>Californium</td>
<td>Lanthanum</td>
<td>Rhodium</td>
<td></td>
</tr>
<tr>
<td>Carbon</td>
<td>Lawrencium</td>
<td>Roentgenium</td>
<td></td>
</tr>
<tr>
<td>Cerium</td>
<td>Lead</td>
<td>Rubidium</td>
<td></td>
</tr>
<tr>
<td>Cesium</td>
<td>Lithium</td>
<td>Ruthenium</td>
<td></td>
</tr>
<tr>
<td>Chlorine</td>
<td>Lutetium</td>
<td>Rutherfordium</td>
<td></td>
</tr>
<tr>
<td>Chromium</td>
<td>Magnesium</td>
<td>Samarium</td>
<td></td>
</tr>
<tr>
<td>Cobalt</td>
<td>Manganese</td>
<td>Scandium</td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>Meitnerium</td>
<td>Seaborgium</td>
<td></td>
</tr>
<tr>
<td>Curium</td>
<td>Mendelevium</td>
<td>Selenium</td>
<td></td>
</tr>
<tr>
<td>Darmstadtium</td>
<td>Mercury</td>
<td>Silicon</td>
<td></td>
</tr>
<tr>
<td>Dubnium</td>
<td>Molybdenum</td>
<td>Silver</td>
<td></td>
</tr>
<tr>
<td>Dysprosium</td>
<td>Neodymium</td>
<td>Sodium</td>
<td></td>
</tr>
<tr>
<td>Einsteinium</td>
<td>Neon</td>
<td>Strontium</td>
<td></td>
</tr>
<tr>
<td>Erbium</td>
<td>Neptunium</td>
<td>Sulfur</td>
<td></td>
</tr>
<tr>
<td>Europium</td>
<td>Nickel</td>
<td>Tantalum</td>
<td></td>
</tr>
<tr>
<td>Fermium</td>
<td>Niobium</td>
<td>Technetium</td>
<td></td>
</tr>
</tbody>
</table>
(R) Poles Apart (3/10)
(R) Poles Apart (4/10)

7. IX XV VII XXI VI XXI

8. IX I V XVI XIX VI II XXI

9. I II XI VI XXI

10. II VI VII XXI XVII XI VII XXI

11. II I XVIII VI XXI

12. XVII XII XVII I XXI

n a c c l o
(R) Poles Apart (5/10)
(R) Poles Apart (8/10)

31. 

32. 

33. 

34. 

35. 

36. 

n a c l o
(R) Poles Apart (9/10)

37. XIV VI XX II

38. IX I XVIII III

39. XXII VII II

40. XXII XII XXI IX
Numeric Key for Identifying the Signs

I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
XIII
XIV
XV
XVI
XVII
XVIII
XIX
XX
XXI
XXII

n a c i l o
Extra Page - Enter the Problem Name Here: __________