

# Fourth International Olympiad in Theoretical, Mathematical and Applied Linguistics

## Solutions of the Problems of the Individual Contest

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### Problem #1

The word order is SOV.

Nouns are followed by **ki** {this is actually an article}.

Interrogative sentences end by **he**.

The subject and object markers on the verb are as follows:

	subject	object
1sg	wa-	ma-
2sg	ya-	ni-
3sg	0	0
3pl	-pi	wičha-

If there is an object prefix as well as a subject prefix, they come in this order.

The number of the nouns is not expressed by the nouns themselves, only by the verbs.

**tuwa** means 'who' as well as 'someone'.

Coordinating constructions use the two conjunctions **na** and **čha**: **na** means that the subject is the same, **čha** indicates different subjects (or: coordinated predicates are joined by **na**, clauses within a composite sentence by **čha**; or any other statement to the same effect).

### Assignment 1.

1. I came and the Indians called the bears.
2. The man killed you and called me.
3. The man killed you and he called me. (So it is rendered in English at any rate; we can't be sure whether 'he' can be 'the man' from the first clause or has to be someone else.)
4. He killed you.

### Assignment 2.

1. Whom did he kill? 2. Who killed him?

There is not enough evidence to support the existence of other translations.

### Assignment 3.

1. lakhota ki hokšita ki ktepi čha matho ki hi
2. yahi na lakhota ki yakte
3. tuwa wačho he
4. wičhaša ki hipi čha tuwa wičhakte

Problem: *Pyotr Arkadiev* Solution: *Alexander Piperski*

**Problem #2**

**1. Articles.** The problem features words with the articles *el* (pl. *els*) and *la* (pl. *les*). Clearly these articles precede masculine and feminine nouns, respectively; this can be seen, among other things, from the words meaning ‘(male) follower’ and ‘(female) follower’.

**2. Stress.** We can see that the mark ` is placed over *e*, *o*, *a* and the mark ´ over *i*, *u*. Examining the words ending in *-s*, we notice that the stress marks in them are placed on the last syllable or the third one from the end. We can assume that in such words the stressed syllable is usually the penultimate, and the stress is explicitly marked when it is not. In all other words stress usually falls on the last syllable, and is marked when it does not.

**3. Plural.** We see that the ending *-s* mentioned in the statement of the problem is not added to words whose singular form already ends in *s*. Also, in the problem there are words with the plural ending *-os*. Let us divide all words into groups according to their gender, final consonant and plural ending:

Final consonant	Plural in <i>-s</i> (0 after <i>s</i> )		Plural in <i>-os</i>	
	masculine	feminine	masculine	feminine
<b>-s</b>	<i>el cactus</i> <i>el pàncrees</i>	<i>la càries</i> <i>la trencadís</i>	<i>el gimnàs</i> <i>el permís</i> <i>el vas</i>	
<b>-x</b>	<i>el apèndix</i> <i>el índex</i>	<i>la hèlix</i>	<i>el flux</i> <i>el suffix</i> <i>el teix</i>	
<b>-ç</b>		<i>la faç</i> ( <i>la sequaç</i> )	<i>el contumaç</i> <i>el pedaç</i> ( <i>el sequaç</i> )	

We see that feminine nouns can only have the ending *-s* (0 after *s*) in the plural, while masculine nouns get *-os* if they are stressed on the last (or only) syllable, *-s* (0 after *s*) otherwise.

**Assignment 1.**

<i>el bastaix</i>	<b><i>els bastaixos</i></b>
<i>el troleibús</i>	<b><i>els troleibusos</i></b>
<b><i>la clos</i></b>	<i>les clos</i>
<i>el iris</i>	<b><i>els iris</i></b>
<i>el llaç</i>	<b><i>els llaços</i></b>
<i>el ònix</i>	<b><i>els ònixs</i></b>
<i>la pelvis</i>	<b><i>les pelvis</i></b>
<i>el pis</i>	<b><i>els pisos</i></b>
<i>el sequaç</i>	<i>els sequaços</i>
<i>la sequaç</i>	<i>les sequaçs</i>
<b><i>el tastaolletes</i></b>	<i>els tastaolletes</i>
<i>la xeix</i>	<b><i>les xeixs</i></b>

Theoretically one might derive the forms *\*la clo* and *\*el tastaollete*, but those are poorly compatible with the statement of the problem, which talks of nouns ending in the letters *s*, *x* or *ç* only. The forms *\*el sequaços* and *\*la sequaçs* are also wrong, because it is hinted that the words for ‘(male) follower’ and ‘(female) follower’ are only differentiated by their articles in the singular.

**Assignment 2.** The marks ` and ´ are used when the stress falls on a non-default syllable.

**Assignment 3.** When there is no ` or ´ mark, the stress is penultimate if the word ends in *s*, otherwise it is final.

Problem and solution: *Boris Iomdin*

**Problem #3**

The ‘hook’ that each word has in the middle or at the right edge (if the word is written by two characters) marks a vowel. The little circle on top of it indicates brevity (accordingly, the absence of a circle indicates length). From the words ‘passion’ and ‘turn around’, which contain a character not found anywhere else, we see that the direction of the script is left to right and the ‘rare character’ stands for **k**. The other characters in these words are **m** (the final consonant in ‘passion’) and **η** (in ‘turn around’). No word but ‘have’ begins with **m**, so we derive the character for **n**. And so on; each consonant has its letter, except for final **m** after a short vowel; there is also a special character for the absence of an initial consonant.

**Assignment 1.**

ka:m	‘passion’	a:c	‘passion’
am	‘suck (a breast)’	cam	‘suck (a breast)’
pī̇m	‘delta’	pȯm	‘delta’
nȯm	‘lead, guide’	aη	‘lead, guide’
ηȯm	‘inarticulately’	pėη	‘inarticulately’
ηī̇k	‘turn around’	mī̇n	‘turn around’
caη	‘trim, rough-hew’		

To write the words in the Roman script, we need to determine the rules that govern the choice of the vowel: since it is always written by the same character, its quality will have to depend on the consonants (and, possibly, its quantity). Here is a summary of what we observe:

	short vowel		long vowel
	final <b>m</b>	final <b>η</b>	
initial <b>p, m, n</b> or <b>η</b>	<b>ȯ</b> pȯm, nȯm, ηȯm	<b>ė</b> pėη	<b>i̇</b> pī̇m, mī̇n, ηī̇k
initial <b>c, k</b> or zero	<b>a</b> am, cam, aη, caη		<b>a:</b> a:c, ka:m

**Assignment 2.**

kam	‘spoke (in a wheel)’	ca:m	‘Cham’
ka:k	‘crow’	nī̇:m	‘name’
ηėη	‘bright red’	mȯm	‘robust’

Problem: *Sergei Dmitrenko* Solution: *Svetlana Burlak*, ed. by *Ivan Derzhanski*

## Problem #4

The problem features nouns and personal pronouns. Three pronouns are given in the data, the fourth (required in Assignment 2) will have to be constructed by analogy:

	Sg	Pl
1 <sup>st</sup> person	bi	(bu)
2 <sup>nd</sup> person	si	su

All expressions in the problem denote something (**X**) belonging to someone or something else (**Y**). The possessor (**Y**) comes first, unmarked. The possessee (**X**) receives a suffix (-i, -ni, -u) indicating the possessor's person and number. This marker may be preceded by the suffix -ŋi, which indicates that the possession is alienable (that is, the possessed and the possessor are not in a part-whole relationship). Two occurrences of the vowel i merge into i: on a suffix boundary.

If there are two possessors with different possessee (e.g., 'thy son's shoulder'), each gets the appropriate suffixes. If there are two possessors with the same possessee ('my boar head', 'your cow thigh'), the possessee gets a suffix which indicates the current possessor, that is, the one of which it is not a part.

Let us summarise all of this in a table:

possessor	possessee	examples
Sg (1 <sup>st</sup> or 2 <sup>nd</sup> person)	Y X-(ŋi)-i	bi wo:i, si bogdolo <i>i</i> bi mo:ŋi:, si ja:ŋi: bi nakta diliŋi:, si b'ataŋi: bogdoloni
Sg (3 <sup>rd</sup> person)	Y X-(ŋi)-ni	ja: xabani, dili tekpu <i>ni</i> b'ata zä:ŋi <i>ni</i> si b'ataŋi: bogdoloni
Pl (1 <sup>st</sup> or 2 <sup>nd</sup> person)	Y X-(ŋi)-u	su zä:ŋi <u>u</u> , su ja: wo:ŋi <u>u</u>

## Assignment 1.

su b'ataŋiu zä:ŋini	your son's money
si tenku bugdiŋi:	thy stool leg
si tenkuŋi: bugdini	thy stool's leg

## Assignment 2.

the boy's thigh	b'ata wo:ni
our boar	bu naktan <i>iu</i>
my daughter's tree	bi azigan <i>i</i> mo:ŋini

## Assignment 3.

bi xabai	Yes: 'my udder' (a cow speaking, shall we say, in a fairy-tale)
su b'ataŋiu bugdiŋini	Yes: 'your son's leg' (not his own, though, but perhaps a chicken's leg belonging to him)
si igi	No ('my tail' would be si igi:)

## Assignment 4.

bi tekpu <i>i</i>	'my skin' (the skin of my body)
bi tekpuŋi:	'my skin' (e.g., an animal's skin belonging to me)

Problem and solution: *Boris Iomdin*

**Problem #5**

It is easy to tell what all nouns and the only verb mean. All common nouns denoting people have the prefix **m-** in the singular and the prefix **va-** in the plural.

There are two possible orders of the Subject, Verb, Direct Object and Indirect Object:

(1) S V DO IO

(2) S V IO DO

The verb *buy* has the structure (a/va)(m/va)guli, with the first prefix denoting the number of S and the second, of IO; DO's number is not marked at all in the verb. We have no examples where both S and IO are plural.

Clearly one or both prefixes may be omitted; however,

(\*) If IO is marked in the verb, so shall S.

If the word order is (1), both S and IO must be marked. If the word order is (2), they may but need not be, as long as (\*) is fulfilled.

Assignment:

Clearly sentences (11) mean 'The woman bought the beer for Mwangi'. This can be said correctly in the following four ways:

Mdala amguli ugimbi Mwangi

Mdala amguli Mwangi ugimbi

Mdala aguli Mwangi ugimbi

Mdala guli Mwangi ugimbi

The errors are:

(11a) word order (1), but neither S nor IO marked in the verb.

(11b) only IO marked, breaking (\*).

(11c) word order (1), but only S marked.

Sentences (12) mean 'Kamau bought the goat for the grandmothers'. That is:

Kamau avaguli mene vabuya

Kamau avaguli vabuya mene

Kamau aguli vabuya mene

Kamau guli vabuya mene

The errors are:

(12a) the numbers of both S and IO incorrectly marked.

(12b) word order (1), but neither S nor IO marked in the verb.

(12c) only IO marked, breaking (\*). (Or else: IO not marked, which word order (2) allows, but number of S marked incorrectly).

Problem: *Olga Fyodorova* Solution: *Alexander Berdichevsky*