en

# International Linguistics Olympiad

Last revised: June 28th, 2026

Sample problems - Solutions

**Problem 1.**

(a)

| | |
|---|---|
| არგენტინა | **Argentina** |
| კოლუმბია | **Columbia** |

Commentary

In this question, one has only to decipher a different alphabet. For that, one can note that **Peru** and **Uruguay**, in Georgian, have the same amount of characters as their translations; furthermore, the repetition of **u** in **Uruguay** assures us that Georgian is written left-to-right. So we can do the relation one-to-one. **Brazil**, nevertheless, has more letters than the version in English, but thanks to the two other names, we already know some letters:

```
_ R A _ I _ I A
```

This should probably be **Brasilia** or **Brazilia**. With those letters, we can guess the names of the other two countries:

```
A R G E _ _ I _ A
_ _ L U _ B I A
```

which can only be **Argentina** and **Colombia** (**Columbia**).

**Problem 2.**

- Structure: [Art. possessed] [Art. possessor] Possessor Possessed
- Articles:

| | SG | PL |
|---|---|---|
| possessor | **tu** | **tōn** |
| possessed | **ho** | **hoi** |

- Noun endings:

| | SG | PL |
|---|---|---|
| possessor | **-u** | **-ōn** |
| possessed | **-os** | **-oi** |

**(a)** 1. E. 2. F. 3. B. 4. C. 5. A. 6. H. 7. G. 8. D.

**(b)** *the houses of the merchants* = **hoi tōn emporōn oicoi**
*the donkeys of the slave* = **hoi tu dulu onoi**

Commentary

This is a typical problem of syntax. In order to align the Ancient Greek sentences with the English sentences, you have figure out the content words (*master*, *son*, *donkey*, *house*, and *slave*) and the singulars (SG) and plurals (PL). In order to get started, you need an anchor. Once you have an anchor, you can figure out the rest by logic and process of elimination.

Various anchors are possible. Three are described here:

i. Notice that four English sentences contain the word *master* or *masters* and that four Greek sentences contain words that start with **cyr**. No other word occurs four times. Therefore, *master* would be **cyr**.

ii. Count singulars and plurals. For example, in five English sentences, the second noun is plural and five Greek sentences have the word **ton**.

iii. Although you can do this problem without recognising any words, you might have recognised a few. For example **adelphoi** looks like **Philadelphia**, the city of brotherly love. If you know that **phil** means *love* as in *bibliophile* (book lover), then you would know that **adelphoi** means *brother*. You might also notice that **emporoi** reminds you of the word *emporium*, which is a market place.

**Vocabulary:**

- **hyi** = *son*
- **dul** = *slave*
- **cyri** = *master*
- **oic** = *house*
- **on** = *donkey*
- **adelph** = *brother*
- **empor** = *merchant*

**Order of words**

Each sentence starts with two articles, which are followed by two nouns. The first article starts with **h**. The second article starts with **t**. The first noun is the owner (possessor), and the second noun is the thing that is owned (possessed).

**Number (singular and plural)**

For the owner (first noun in Greek; second noun in English): **ōn** is plural and **u** is singular.
For the owned (second noun in Greek; first noun in English): **oi** is plural and **os** is singular.

**Matching of articles and nouns**

The first article has an ending that matches the owned noun: **ho** is singular and **hoi** is plural.

| **ho ... dulos** | **hoi ... cyrioi** |
|---|---|
| *the ... slave* (SG) | *the ... masters* (PL) |

The second article matches the owner: **tu** is singular and **tōn** is plural.

| **tu cyriu** | **tōn hyiōn** |
|---|---|
| *the master* (SG) | *the sons* (PL) |

So the translations are:
*the houses of the merchants* = **hoi tōn emporōn oicoi**

- Start with **hoi** because the owned noun (*houses*) is plural.
- The next word is **tōn** because the owner (*merchants*) is plural.
- The next word is the owner, which will be the root **empor** with the plural ending **ōn**.
- The next word is the owned noun, which will be the root **oic** with the plural ending **oi**.

*the donkeys of the slave* = **hoi tu dulu onoi**

- Start with **hoi** because the owned noun (*donkeys*) is plural.
- The next word is **tu** because the owner (*slave*) is singular.
- The next word is the owner, which will be the root **dul** with the singular ending **u**.
- The next word is the owned noun, which will be the root **on** with the plural ending **oi**.

**Problem 3.**

| if the singular ends in | add for the plural |
|---:|---|
| **l** | **-s** |
| **t** | **-z** |
| **x** | **-es** |
| vowel | **-s** |

**(a)** (1) **concordaus**, (2) **chicolatz**, (3) **chuntas**, (4) **eclixes**, (5) **ferfetz**

**Problem 4.**

Each character represents a combination of a vowel and a consonant, the vowel being marked on the first three dots and the consonant on the last three dots:

| | ∅ | **a** | **e** | **i** | **o** | **u** |
|---|---|---|---|---|---|---|
| ∅ | |  |  |  |  |  |
| **h** |  |  | | | | |
| **k** |  |  |  |  |  |  |
| **m** |  | | | |  | |
| **n** |  |  | | |  | |
| **r** |  |  | |  | | |
| **s** |  |  | | | | |
| **t** |  |  | | | | |

where the first row and column (highlighted) represent the individual characters and in order to obtain a CV syllable, we simply overlap the two components.

**(a)** a. **haiku** c. **katana** e. **koi**
b. **sake** d. **kimono** f. **atari**

**(b)** g. **karate** h. **anime**

**(c)** i.  j. 

Commentary

This is another writing system problem, but in this case it is not an alphabet. The word **karaoke**, in tenji, has four characters, which may lead us to think that each character represents a syllable (**ka-ra-o-ke**). Counting syllables of the other words can confirm that tenji is a *syllabary*.

Inside the syllable structure, however, we must understand how consonants and vowels are represented. From **karaoke**, we can see that **ka** and **ra** have the same upper-left dot (  ), differing only on the second dot position; furthermore, **ka** and **ke** have the same second dot position (down-right –  ). This is confirmed for there is a word starting with **a** (**atari**) and word f indeed starts with  . So the vowels are represented in the three dots at the upper-left part of the diagram.

The other three dots represents the variety of consonants.

**Problem 5.**

- Word order: Adverb Tense–Verb Subject Adjective *my*
- The same word is used for adjective/adverb/verb:
  - **kwa:** = *grow* (Verb), *tall* (Adj)
  - **ro:h** = *ripen* (Verb)
  - **li:ʔ** = *beautiful* (Adj), *beautifully* (Adv)
  - **ne** = *yellow* (Adj, V)
  - **dʒö** = *turn out well* (V), *good* (Adj), *well* (Adv)
- Tense: **kala-** = past simple, **miła-** = present perfect

**(a)** *beautiful*, *beautifully*

**(b)** *ripe*

**(c)** 1. **kalali:ʔ mo:h dʒö**
2. **dʒö miłane kwi: ro:h kya**

**(d)** 3. *The yellow corn has ripened.*
4. *The corn grew beautifully.*

Commentary

This is another syntax problem, in a model we call Rosetta Stone: some sentences are presented with translations and, with that, we can understand part of the grammar of the language.

In this case, the word order is not so obvious. We can start by marking the substantives: *corn* (x4) and *pineapples* (x2). After this, we can easily identify the pronoun *my* (x3). We can even paint the words, like this:

| | |
|---|---|
| **kalakwa: kwi: li:ʔ** | *The beautiful corn grew.* |
| **miładʒö mo:h kya** | *My pineapples have turned out well.* |
| **li:ʔ kalane kwi: kwa: kya** | *My tall corn yellowed beautifully.* |
| **dʒö kalaro:h mo:h ne kya** | *My yellow pineapples ripened well.* |
| **kaladʒö kwi:** | *The corn turned out well.* |
| **miłakwa: kwi:** | *The corn has grown.* |

Then the verbs. From the last two sentences, it is obvious that they have internal structure: verbs in the past simple receive **kala-**; verbs in the present perfect receive **miła-**.

The adjectives come after the substantives, as in **mo:h ne** / *pineapple yellow* and **kwi: li:ʔ** / *corn beautiful*. To use an adjective as a verb, one just have to use a verb prefix, as in **ne – kalane** / *yellow - yellowed* and **kwa: – kalakwa: – miłakwa:** / *tall - grew - has grown*.

The adverb comes in the beginning of the sentence, as in **li:ʔ** / *beautifully* and **dʒö** / *well*. (Don't mistake: the *well* in *turned out well* is part of the verb). Adverbs, adjective and verb nucleus have all the same form.

**Problem 6.**

**(a)** iii.

**(b)** iv.

Commentary

None of the adjectives are real English words. There are two classes of adjectives: "bad" and "good". We will refer to this property of adjectives as "polarity".

Each sentence links two or more adjectives as follows: "X and Y" indicates that X and Y have the same polarity. "X but Y" means that they have opposite polarities. Furthermore, "X and not Y" indicates opposite polarities, "even though X, Y" also indicates opposite polarities, while "not only X but also Y" associates adjectives of the same polarity.

The sentence about Diane shows that **strungy** and **struffy** are positive (desirable) quantities. By identifying other occurrences of the same words in other sentences, one can label each adjective as either positive or negative. In the end, one can see that there are seven positive adjectives (**strungy**, **struffy**, **cloovy**, **frumsy**, **danty**, **cluvious**, and **brastic**) and five negative ones (**weasy**, **blitty**, **sloshful**, **slatty**, **molistic**).

1. Only sentence iii. includes adjectives of the right polarities, given the structure of the sentence.

2. Only answer iv. (**frumsy**) is on the positive list above.

**Problem 7.**

- Word order: Noun Preposition Location
- Two words for *under*:
  - **zir-e** is used when the upper item completely covers the lower one;
  - **pāin-e** is used when the upper item doesn't cover the lower one completely, more or less as *below* in English.

**(a)** 1. *the stool at the table*
2. *the book under the bookcase*

**(b)** 3. **zir-e** (if the stone is, say, in a river, that is, completely covered by water)
or
**pāin-e** (if it's, say, at a waterfall)

4. **zir-e** (if the box is buried, say, under the roots of the tree)
or
**pāin-e** (if the box, say, lies on the ground)

**Problem 8.**

1. Basic words:

| | | | | |
|---|---|---|---|---|
| 1 = **bir** | 3 = **üš** | 5 = **bes** | 8 = **segiz** | 30 = **otız** |
| 2 = **eki** | 4 = **tört** | 7 = **žeti** | 10 = **on** | 50 = **elüw** |

2. `X` + `Y` = `X Y` `X` = {10, 30, 50}; `Y` = 1-9

3. *and* =

   - **pen** after voiceless consonants
   - **men** after vowels and sonorant consonants
   - **ben** after other voiced consonants

**(a)** 1-F, 2-A, 3-B, 4-I, 5-E, 6-H, 7-D, 8-C, 9-G

**(b)** (1) **segiz** (2) **men** (3) **žeti** (4) **eki** (5) **pen**

**(c)** 10. **bes pen otız segiz** 11. **on men tört** 12. **žeti men elüw üš** 13. **otız segiz ben bes**

**Problem 9.**

1. Word order: Modifier - Noun
2. Seven types of promotion:
   - [Weapon] *Soldier* ⇒ [Weapon] *General*
   - [Left/Right] *General* ⇒ [Left/Right] *Army*
   - [Left/Right] *Chariot* ⇒ [Left/Right] *Iron Chariot*
   - [Domestic Animal] *Soldier* ⇒ *Running* [Domestic Animal]
   - [Domestic Animal] *General* ⇒ *Dashing* [Domestic Animal]
   - *Running* [Wild Animal] ⇒ *Dashing* [Wild Animal]
   - [Element] *General* ⇒ *White Elephant*
3. Vocabulary:
   - Weapons: **tō** = *sword*, **kyū** = *bow*, **do** = *crossbow*
   - Domestic Animals: **gyū** = *ox*, **ba** = *horse*, **ton** = *pig*
   - Wild Animals: **rō** = *wolf*, **roku** = *stag*, **yū** = *bear*
   - Elements: **tes** = *iron*, **ki** = *wood*, **seki** = *stone*
   - Left/Right: **u** = *right*, **sa** = *left*

**(a)**

| | | | |
|---|---|---|---|
| (1) **sōroku** | (9) **gyūshō** | (17) *Horse General* | (25) *Dashing Pig* |
| (2) *Dashing Stag* | (10) *Dashing Ox* | (18) **honba** | (26) *Iron General* |
| (3) **tōhei** | (11) **kyūshō** | (19) **sasha** | (27) **sashō** |
| (4) *Sword Soldier* | (12) **hakuzō** | (20) **satessha** | (28) *Left General* |
| (5) **sōgyū** | (13) *White Elephant* | (21) *Left Iron Chariot* | (29) *Right Chariot* |
| (6) *Running Ox* | (14) **doshō** | (22) **bahei** | (30) **sōrō** |
| (7) **ushō** | (15) *Crossbow General* | (23) *Running Horse* | (31) *Running Wolf* |
| (8) *Right Army* | (16) **bashō** | (24) **honyū** | (32) **hakuzō** |

Commentary

We note the repeated elements **hei** '*soldier*' (3, 6, 8) and **shō** '*general*' (2, 7, 13, 18); **do** '*crossbow*'(8), **gyū** '*ox*' (3), **ki** '*wood*' (7), **kyū** '*bow*' (6), **seki** '*stone*' (18), **tō** '*sword*' (2), **ton** '*pig*' (13). The element **hon** is repeated several times in the animal rows. We can assume that it means '*dashing*', a meaning repeatedly seen in the glosses. Then **ro** is '*wolf*' (17) and **roku** is '*stag*' (1). The modifier precedes the head throughout; consequently **sō** is '*running*' and **yū** is '*bear*' (12). We can also derive **tes** '*iron*', **u** '*right*' and **sha** '*chariot*'. Then **gun** is '*army*' (4) and **sa** is '*left*' (15). The only other thing left is **ba**, which has to mean '*horse*' (11).

Relying on the similarities in the meaning, we can distinguish several patterns of promotion. Each pattern groups together men whose unpromoted ranks have names in which one part is shared while the other varies, albeit in a limited way.

The shared part is affected by the promotion (usually in a way that makes some intuitive sense). The other part is not, except in the case of the three material *Generals*, all of which promote in the same way.

**Problem 10.**

| Tupinambá | Guaraní Mbya | |
|---|---|---|
| **s** | **h** | |
| **b** | **v** | (only in the middle of the word) |
| **pu** | **ku** | |
| final consonant | ∅ | (final consonant disappears from Tupinambá to Guaraní) |
| **Vn** / **Vng** / **Vnga** | **Ṽ** | (when the word finishes in vowel + nasal consonant, the consonant disappears in Guaraní and is replaced by nasalisation of the vowel) |

**(a)**

| | | | | |
|---|---|---|---|---|
| (1) **peté** | (6) **porã** | (11) **ybaté** | (16) *jaguar* | (21) **manduvi** |
| (2) **henú** | (7) **juru** | (12) **uvixá** | (17) **jaguá** | |
| (3) **pyrã** | (8) **ku'a** | (13) *you sleep* | (18) **akuã** | |
| (4) **teju** | (9) **ybyrá** | (14) **erekér** | (19) *to want* | |
| (5) **a'é** | (10) **erepytá** | (15) **arukã** | (20) **potár** | |

**(b)** 1-J, 2-M, 3-K, 4-D, 5-C, 6-I, 7-A, 8-F, 9-E, 10-N, 11-G, 12-O, 13-H, 14-L, 15-B

Commentary for task (b)

A good way to start pairing the cities is grouping the names by its more general physical feature: *river* (**í**), *soil/land* (**ibí**), *rock* (**itá**):

| | | | | | |
|---|---|---|---|---|---|
| **I-úna** | *great river* | **Ibi-úna** | *beautiful land* | **Ita-ipu** | *great rock* |
| **I-guaçu** | *black river* | **Ibi-tinga** | *black soil* | **Ita-uçu** | *white rock* |
| **I-piranga** | *red river* | **Ibi-poranga** | *white soil* | **Ita-tinga** | *sound in the rock* |
| **Tijuípe** | *lizard river* | | | | |

Among those, the different one is **Tijuípe**, that doesn't start with **i**, but should be the *lizard river* because it has *lizard* (**teju**) in the name. Actually, the name is **teju** (*lizard*) + **í** (*river*) + **pe** (locative particle). Apart from that, **una** is the particle that appear both in land and river, so it must be *black*. Furthermore, *red* and *beautiful* are in the original table. So there is one left among the rivers (*great* / **guaçu**) and one among the lands (*white* / **tinga**). This last conclusion gives us two of the rocks, leaving only the *sound of water in the stones* (**ita** + **i** +**pu**).

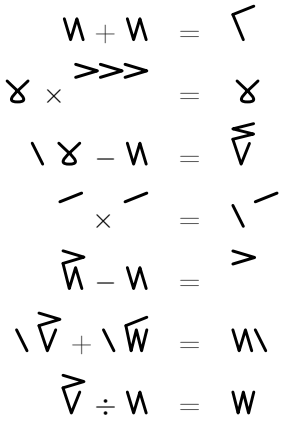
With all that, there are only four names left:

| | |
|---|---|
| **Pirajuí** | *turtle's burrow* |
| **Pindamonhangaba** | *alligartor's/yacare's burrow* |
| **Jacarecoara** | *fish of the yellow river* |
| **Jericoaquara** | *place for producing fishing hooks* |

*Yacare* leaves no doubt that **coara/quara** is *burrow*, and **jericoa** is *turtle*. The river should appear once more, in **pirajuí** – *the river* (**í**) *of the yellow* (**ju**) *fish* (**pira**). The last one is **pinda-monhangaba**.

**Problem 11.**

**(a)**



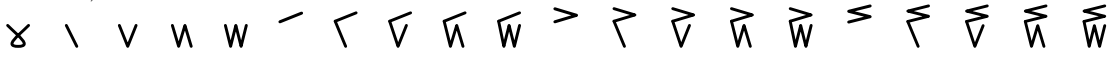
**(b)** The date will depend on when you are solving this problem. This problem was first used on April 2nd, 2011, which is  .

Commentary

The problem presents a different number system. We can go in the order of operations presented:

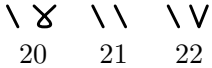
1. In the first operation, we see that two bars are equal the sum of one bar with another. In the lack of further divisions of the bar, we can assume the bar is 1.
2. In the second operation, a new element appears: the dash (horizontal stroke). It is evident that one dash = 5 bars.
3. Operations 3-5 confirm that, saying that we can also add dashes, and multiply the numbers.
4. Operation 6 says that (5+4) × (5+2) = 9 × 7 = 63 is represented as 3 3 (the repetition of the numeral with a space between them strongly suggests that this is a positional number system). We discover that the numbers of the second position are counted from 20 to 20.
5. Operation 7 introduces the zero (the neutral element of sums).

Formally, we say that the system of positional notation has base 20 and a sub-base 5. In other words, the numbers from 0 to 19 are:

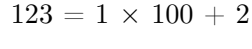


0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

After that, we start to count using a second house:



20 21 22 23 etc.

So the first number, right to left, counts as the units; the second position is multiplied by 20, as the third position is multiplied by $20^2 = 400$ and so on. So, in the same way that, in the indo-arabic system, $123 = 1 \times 100 + 2 \times 10 + 3$, in the Inuktitut system,  $= \times 400 + \times 20 + = 443$.

**Problem 12.**

1. Basic words:

| | | | |
|---|---|---|---|
| 2 = **bi** | 4 = **lau** | 7 = **zazpi** | 10 = **hamar** |
| 3 = **hiru** | 5 = **bost** | 9 = **bederatzi** | 20 = **hogei** |

2. Compound numbers:

- **hama-**`X` = 10 + `X` $\quad$ `X` < 10
- `X`**-r-ogeita** `Y` = 20×`X` + `Y` $\quad$ `Y` < 20

**(a)** (1) **hogei**, (2) **bederatzi**

**(b)** l. 93, m. 60

**(c)** 39 = **hogeita hamabederatzi**
77 = **hirurogeita hamazazpi**
80 = **laurogei**

Commentary

The equalities in the problem are:

$$\begin{aligned}
(1) \quad 2 \times 2 &= 4 \\
(2) \quad 2 \times 5 &= 10 \\
(3) \quad 2 \times 10 &= 20 \\
(4) \quad 3 \times 5 &= 15 \\
(5) \quad 3 \times 10 &= 30 \\
(6) \quad 5 \times 5 &= 25 \\
(7) \quad 5 \times 7 &= 35 \\
(8) \quad 7 \times 9 &= 63 \\
(9) \quad 7 \times 10 &= 70 \\
(10) \quad 4 \times 5 &= 20 \\
(11) \quad 9 \times 10 &= 90
\end{aligned}$$

**Problem 13.**

1. Structure: [Name1] [Name2 (genitive)] [Relationship] [Copula]
2. Copula: **da** for singular subject, **dira** for plural subject
3. Genitive: Suffix **-en** (after consonant) or **-ren** (after vowel)
4. Relationships:
   - A woman's *sister* is **ahizpa**, a man's *sister* is **arreba**
   - A man's *brother* is **anaia**, a woman's *brother* is **neba**
   - *Wife* is **emaztea**, *husband* is **senarra**. *Spouses* (or *married couple*) is **senar-emazteak**, literally 'husband-wife-s'
   - **Seme-alabak** means *children* (of different sexes, literally 'son-daughter-s'); **seme** is *son*; therefore, **alaba** means *daughter*
5. **eta** = *and*

**(a)** Ines (Mikel's wife), Kontxi (Monika's sister), Felix (Mikel's brother), Andres (Emilio's son)

**(b)** Monika is **ahizpa** to Kontxi; therefore, Kontxi is female.

**(c)** 1. **Monikaren**, 2. **seme-alabak dira**, 3. **arreba da**, 4. **neba da**, 5. **alaba da**, 6. **Mirenen**

**Problem 14.**

1. If `X` is a man:
   - `X Y`**-(s)son/-arson** = `X` is a son of `Y`
   - `X Y`**-(s)son** `Z`**-(s)sonar** = `Z` is a grandparent of `X`
2. If `X` is a woman:
   - `X Y`**-(s)dóttir** = `X` is a daughter of `Y`
   - `X Y`**-dóttir** `Z`**-dóttir** = `Z` is a grandparent of `X`
3. When the progenitor (`Y` or `Z`) is a man, there is an extra **s** before **-son/-dóttir**, a genitive case indicator

**(a)** **Jón Oddson Bergmann**

**(b)** **Steinunn**. She had three children: **Daniel**, **Sara**, and **Margret**, none of them had children.

**(c)** Three: **Christian**, **Hrafn**, and **Viktoria**.

**(d)** Three: **Daniel**, **Sara**, and **Margret**.

**(e)** **Stefan Gunnarsson Gunnarssonar**. He received only names of his father and his father's father.

**(f)** **Guðmundur (Evasson /Christiansson)(Emilsonnar /Kristínsonnar/Viktorssonar) (Kvaran)**

**(g)** **Hrafnildur Björnsdóttir (Annassonar)**

Commentary

There are no family names in Iceland, these ones that you pass from father to son in a vertical lineage. They have only *patronymics* – the names that indicate the first name of your father, your mother, your grandparents, etc.

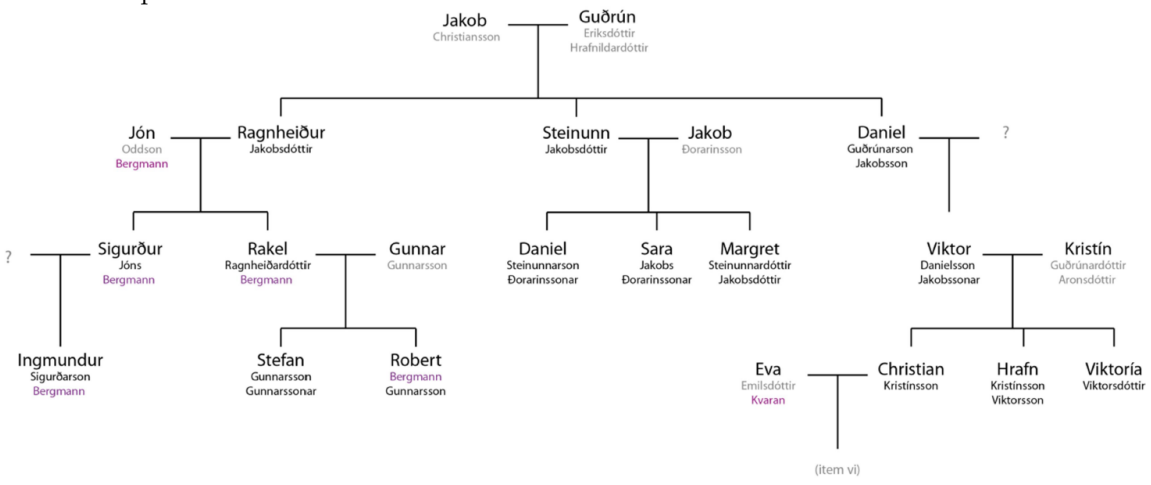
Aside from the rules above, there are no rules on how the name should be composed: only the parents decide if the son will carry or not the name of father, mother, or any of the four grandparents.

Furthermore, there were some hints in the problem: **Jakob** and **Guðrun** had three children and all of them had children. **Viktor** (item 3) and **Steinunn** (item 4) both have children. **Christian** and **Eva** (item iv) are married. With that, we can discover that:

- **Jakob C.** and **Guðrún** had three kids: **Ragnheiður Jakobsdóttir**, **Steinunn Jakobsdóttir** and **Daniel Guðrúnarsson**.
  - **Ragnheiður** married **Jón Oddson Bergmann**, son (or grandson, or great-grandson) of a foreigner, probably German, Dutch or Swedish. This is because **Bergmann** is a family name (that means, in German, literally *mountain man*), that passed to their children and grandchildren. They had two kids: **Sigurður Jóns Bergmann** and **Rakel Ragnheiðardóttir Bergmann**.

    - **Sigurður** had a relationship with somone (that was not in the pary) and had a son: **Ingmundur Sigurðarson Bergmann**.
    - **Rakel** married **Gunnar Gunnarson**, a man that has the same name as his father. They had two kids: **Stefan Gunarsson Gunarssonar** and **Robert Bergmann Gunnarsson**.
- **Steinunn** married another **Jakob**, the **Þorarinsson**. Together they had three children: **Daniel Steinunnarson Þorarinssonar**, **Sara Jakobs Þorarinssonar**, and **Margret Steinunnardóttir Jakobsdóttir**. As far as we know, none of the three married or had children.
- **Daniel G.** had a relationship with someone (also not in the party) and had one son, **Viktor Danielsson Jakobssonar**.
    - **Viktor** married **Kristín Guðrúnardóttir Aronsdóttir** (daughter of another **Guðrún**, that was not in the story so far, that was wife, daughter or daughter-in-law of a man called **Aron**), they had three kids: **Christian Kristínsson**, **Hrafn Kristínsson Viktorsson**, and **Viktoría Viktorsdóttir**.
        - **Christian** married **Eva Emilsdóttir Kvaran** (also descendant of an imnmigrant, family name **Kvaran**) and, as said in item 6, they are waiting the first great-greatgrandchild of this beautiful family.

We can put all in a tree:



**Problem 15.**

**(a)** A = Pita, B = Butokang, C = Sulung, D = Tola, E = Sala

**(b)** **Arongo pera kana awa ieno, Pita pera kana ata ieno.**
**Arongo pera kana awa ilau ieno, Sulung pera kana ata auta ieno.**
**Arongo pera kana ilau ieno, Butokang pera kana auta ieno.**

Commentary

The ananlysis of the given examples suggests that **auta**, **ilau**, **ata**, and **awa** are the significant words, which probably represent directions. For reference, **X pera kana** means *X's house*, and **ieno** means *is located*.

We can see that **auta** and **ilau** appear to be opposed, and that **ata** and **awa** are also opposed. We thus hypothesize that they represent two axes of dimenstions, and we support this hypothesis by observing that their compounds are intermediate directions, such as **awa ilau** vs. **ata auta**, and **awa auta** vs. **ata ilau**. In fact, these compounds may occur in either order; for example, **ilau awa** and **auta ata** are also directions. **Ilau awa** is similar but not identical to **awa ilau**, in the same way as *north-north-west* is similar but not identical to *west-north-west*.

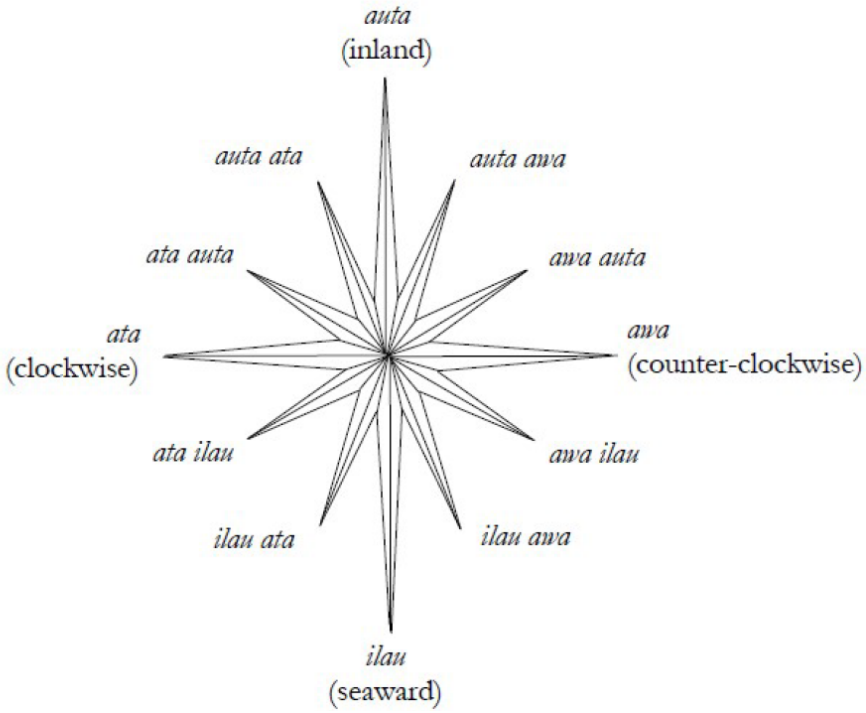
When we analyze the relative locations of the houses of Onkau, Kulu, and Mombwa, we may be tempted to assume that **auta** is *North*, **ilau** is *South*, **awa** is *East*, and **ata** is *West*. This assumption works until about halfway through the problem, but then we should notice contradictions: either these directions are very imprecise or some houses are in the sea.

When we reach a contradiction, we should try discarding some of the underlying assumptions; in this case, we discard the assumption that the islanders reckon the traditional directions, that is, North, South, East, and West. Instead, we should consider other directional possibilities that may occur to the islanders.

In fact, **auta** means *inland* or *upland*, which is the same thing on a cone-shaped volcanic island, and **ilau** means *seaward*. Furthermore, **ata** means *clockwise around the island*, and **awa** means *counterclockwise*. The compound direction **awa auta** thus means *inland in a counterclockwise direction*.

An alternative approach to solving this problem is as follows. We may be fairly certain that the directions form two axes, **auta**/**ilau** and **ata**/**awa**. Instead of placing islanders on the given map, as soon as we have a hunch where they live, we can work out an abstract two-dimensional map indicating the relative locations of the houses.

Then, by comparing it to the given map, we can see that the only way to reconcile the two maps is to "wrap" the abstract map around the island, that is, to curve the Cartesian grid of houses into a polar grid centered on the volcano.




Note that some of the directions are irrelevant to the problem, and we have included them only for completeness. Also note that the angle between **auta** and North depends on a specific location, which means that this compass would rotate with respect to the traditional North/South compass as we walk around the island.

If you have solved this difficult problem, you are probably able to examine and revise your initial assumptions, which is an essential research skill.

**Problem 16.**

Verb structure:

1. Negation marker: **n(d)(a)**
   - **d** is removed if the root contains any nasal sounds (**$\tilde{V}$**, **m**, **n**)
   - **a** is removed if a vowel follows
2. Subject: **a** = 1SG, **ja** = 1PL, **pe** = 2PL, **o** = 3SG
3. Root
4. Tense and Negation:

| | past | present | future |
|---|---|---|---|
| affirmative | **ma** | ∅ | **ta** |
| negative | **(r)ima** | **(r)i** | **mo'ãi** |

**i** → **ri** / **i** _

**(a)**
15. *I was eating*
16. *he will be waking up*
17. *I will not be taking*
18. *you are not crying*
19. *I wasn't catching*

**(b)**
20. **napembokapui**
21. **ndopuraheiri**
22. **jakaruta**
23. **ndapuraheimo'ãi**

**Problem 17.**

1. Numbers: 1 = **mä**, 2 = **paya**, 3 = **kimsa**
2. Fish: *small* = **challwalla**, *medium* = **challwa**, *big* = **hach'a challwa**
3. Sentence structure:
   - 1 type of fish: [Number] [Fish]–**wa challwataxa.**
   - >1 types: {[Number] [Fish]}$_x$ Number Fish–**mpiwa challwataxa.**

**(a)** 1-G, 2-D (lying!), 3-A, 4-C, 5-B, 6-F, 7-E
Correct sentence: **Kimsa challwalla paya hach'a challwampiwa challwataxa.**
or
**Paya hach'a challwa kimsa challwallampiwa challwataxa.**

**Problem 18.**

**(a)**

| | | | | |
|---|---|---|---|---|
| 1. | **kiwen suno jelo** | T. | *gold* | stone bright yellow |
| 2. | **tomo tawa telo** | G. | *boat* | house movement water |
| 3. | **jan Powi** | J. | *Boris* | person Boris |
| 4. | **ilo suno** | D. | *flashlight* | tool light |
| 5. | **telo jelo** | L. | *piss* | water yellow |
| 6. | **jan ilo** | F. | *robot* | person tool |
| 7. | **jan toki** | A. | *prophet* | person word |
| 8. | **supa lape** | N. | *bed* | surface sleep |
| 9. | **supa moku** | S. | *dinner table* | surface eat |
| 10. | **ma tomo** | M. | *city* | land house |
| 11. | **wile moku** | I. | *hungry* | will eat |
| 12. | **tawa** | P. | *movement* | |
| 13. | **nasin linja** | O. | *orthodoxy* | path straight |
| 14. | **wile pona** | B. | *well-intentioned* | will good |
| 15. | **telo kiwen** | E. | *ice* | water hard(=as stone) |
| 16. | **lipu toki** | K. | *book* | collection word |
| 17. | **wile lawa** | R. | *dominant* | wishing control(=head) |
| 18. | **linja lawa** | C. | *hair* | line head |
| 19. | **tomo moku** | Q. | *restaurant* | house eat |
| 20. | **linja kiwen** | H. | *thorn* | line hard |

**(b)**

- **kiwen** = *rocky, solid*
- **suno** = *light,bright, sun*
- **jelo** = *yellow*
- **tomo** = *house, vehicle*
- **tawa** = *movement*
- **telo** = *water*
- **jan** = *person*
- **ilo** = *thing, tool*
- **toki** = *word, to speak*
- **supa** = *horizontal surface*
- **lape** = *to sleep*
- **moku** = *to eat*
- **lipu** = *collection*
- **wile** = *will, desire*
- **ma** = *land, soil, earth*
- **nasin** = *path*
- **linja** = *(straight) line*

**(c)** *good language*

Commentary

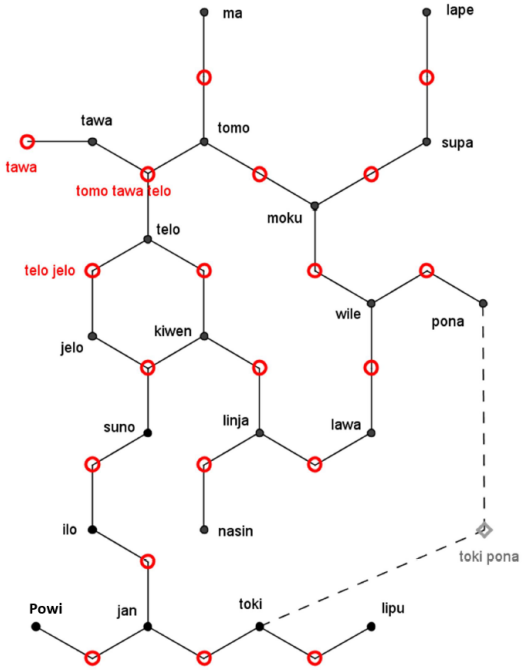
This is a typical semantics problem that comes in a chaos-and-order (or Kibuzi) form: some words in a language and their translations out of order to be paired. So we map the morphology of the words in the language and map the semantics of their translations and try to match it.

The mapping in the Toki Pona side is easy to do, as the words are easy compositions. All terms but three are composed by two words; two are composed by three words and one is a single term (**tawa**). Furthermore, if we count we see that each "primitive" word occurs not more

than three times. With that in mind, we can draw a map, where the words of the assignment are marked as red circles and the primitive words are black dots.

From the English side, we do not have a so clear map, but we know the language, so we can try to decompose the words in smaller semantic unities:

- *piss*: liquid, yellow, warm, stinky, etc.
- *gold*: stone, yellow, bright, valuable, etc.
- *bed*: horizontal surface, comfortable, used to sleep, etc.
- *book*: made with paper sheets, full of words, knowledge, etc.




In the beginning, we don't know which characteristics are important for the problem, so we might think on many different possibilities. The aim would be to have a graph in a similar shape on that one with Toki Pona words, so we can pair one-by-one. This can be a lot of work, and we don't even have to actually draw the graph, but at least we know it can be done: for example, the graph above doesn't have any symmetry, no point identical to any other one.

It would do better to start from some specific part. For example, we could start with the closed circuits, like the hexagon in the left part, composed by **jelo**, **telo**, **kiwen** and their combinations (**telo jelo**, **telo kiwen**, and **kiwen suno jelo**). To match them with English, we must find three words that each two share at least one characteristic. We could note that *gold* and *piss* are yellow, *ice* and *gold* are stones, *ice* and *piss* have water as main component. Furthermore, one of them must appear in a fourth word (could water in *boat* or stone in *thorn*, for example).

Also, there is one proper name (*Boris*) that is easy to pair with the only word that has a capital letter (**jan Powi**). From that we can assume that **jan** means *person*, *human being*. Also, **toki pona** should have some relation with *language*, *word*, etc.