IOL Sample Solutions

Georgian Countries

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).

Ancient Greek

1.

E	1
C	2
D	3
H	4
A	5
B	6
G	7
F	8

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 and plurals. 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 recognizing any words, you might have recognized 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.

Here we will use o: for what, in the problem, is written as ō.

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, and the second noun is the thing that is owned.

Number (singular and plural)

For the owner (first noun in Greek; second noun in English): **o:n** 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 ... cyroi**
the ... slave (singular)	the ... masters (plural)

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

tu cyriu	**to:n hyio:n**
the master (singular)	the sons (plural)

2. So the translations are:

the houses of the merchants

hoi to:n emporo:n oicoi

- Start with "hoi" because the owned noun (houses) is plural.
- The next word is "to:n" because the owner (merchants) is plural.
- The next word is the owner, which will be the root "empor" with the plural ending "o:n".
- 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".

Aragonese

In this question, we have to compare two columns of words: singulars and plurals. With a little examination, one notes that the ending of the plural depends on the ending of the singular. We can thus deduce the following rules:

if the singular ends in	add for the plural
L	-S
T	-Z
X	-ES
vowel	-S

So the table becomes:

valley	bal	bals
stool	banquet	banquetz
hole	clot	clotz
stone	cantal	cantals
awake	concordau	**concordau-s**
chocolate	chicolat	**chicolat-z**
union	chunta	**chunta-s**
unhanded	deixau	deixaus
eclipse	eclix	**eclix-es**
cicada	ferfet	**ferfet-z**
character	personache	personaches
fish	peix	peixes

Japanese Braille

This is another writing system problem, but in this case it is not an alphabet. The word karaoke, in tenji, it 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" 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:

a	i	u	e	o
⠁	⠃	⠉	⠑	⠊

The other three dots represents the variety of consonants. So the answers are:

1.

a. haiku

b. sake

c. katana

d. kimono

e. koi

f. atari

2.

g. karate

h. anime

3.

i. ⠓⠁⠊⠅⠥

j. ⠚⠁

Lalana Chinantec

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: kwɨ: li:ʔ	The beautiful corn grew.
mɨladʒö mo:h kya	My pineapples have turned out well.
li:ʔ kalane kwɨ: kwa: kya	My tall corn yellowed beautifully.
dʒö kalaro:h mo:h ne kya	My yellow pineapples ripened well.
kaladʒö kwɨ:	The corn turned out well.
mɨlakwa: kwɨ:	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 continuous receive **mɨla-**.

The adjectives come after the substantives, as in **mo:h ne** / *pineapple yellow* and **kwɨ: 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: – mɨlakwa:** / *tall – grew – has grown*.

The adverb comes in the beginning of the sentence, as in **li:ʔ** / *beautifully* and **ʤö** / *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.

So the general word order is: (Adverb) Verb – Subject (Adjective) (Possessive)

And the answers are:

1. li:ʔ is beautiful(ly).

2. ro:h is ripe.

3.

a) kalali:ʔ mo:h ʤö

PAST-(become beautiful) **pineapples** (good/well)$_{ADJ}$

b) ʤö mɨlane mo:h ro:h kya

(well)$_{ADV}$ [PRES.PERF-(yellow) **corn** (ripe)$_{ADJ}$ (my)]

4.

c) The yellow corn has ripened.

d) The corn grew beautifully.

Molistic

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 **c** includes adjectives of the right polarities, given the structure of the sentence.

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

Persian

The word order is the same as in English. To solve the question, it was enough to note that there are two words for 'under' in Persian:

- **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.

So the answers are:

1.

a) the stool at the table.

b) the book under the bookcase.

2.

c) sang **zir-e** āb
if the stone is, say, in a river, that is, completely covered by water

sang **pāin-e** āb
if it's, say, at a waterfall

d) ja'abe **pāin-e** deraxt
if the box, say, lies on the ground

ja'abe **zir-e** deraxt
if the box is buried, say, under the roots of the tree

Kazakh

Counting how many times the words appear, we quickly discover the Kazakh numerals:

1	bir	10	on
2	eki	30	otız
3	üš	50	elüw
4	tört		
5	bes	*in numbers >10, the tens precede the units.*	
7	žeti		
8	segiz		

The word 'and' is trickier, as it assumes three forms:

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

1. So the table becomes:

f	i.	***segiz*** ben elüw	**h**	vi.	otız ben ***eki***
a	ii.	bir men bes	**d**	vii.	tört pen žeti
b	iii.	bir ***men*** segiz	**c**	viii.	üš ***pen*** eki
i	iv.	elüw eki men on	**g**	ix.	on üš pen otız
e	v.	***žeti*** men elüw			

2. And the translations:

a) bes pen otız segiz

b) on men tört

c) žeti men elüw üš

d) otız segiz ben bes

Taikyoku Shōgi

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 (call it ξ) varies, albeit in a limited way.

1., 12.	sō-ξ *'Running ξ'*	⟹	hon-ξ *'Dashing ξ'*	ξ: animal ('stag', 'bear')
5., 13.	ξ-shō *'ξ General'*	⟹	hon-ξ *'Dashing ξ'*	ξ: animal ('ox', 'pig')
7., 14., 18.	ξ-shō *'ξ General'*	⟹	hakuzō *'White Elephant'*	ξ: material ('wood', 'iron', 'stone')
4., 15.	ξ-shō *'ξ General'*	⟹	ξ-gun *'ξ Army'*	ξ: side ('left', 'right')
10., 16.	ξ-sha *' ξ Chariot'*	⟹	ξ-tessha *'ξ Iron Chariot'*	ξ: side ('left', 'right')
2., 6., 8.	ξ-hei *'ξ Soldier'*	⟹	ξ-shō *'ξ General'*	ξ: weapon ('sword','bow', 'crossbow')
3., 11.	ξ-hei *'ξ Soldier'*	⟹	sō-ξ *'Running ξ'*	ξ: animal ('ox', 'horse')

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. There is no ordering between the various values of ξ in each pattern. We can use this table to determine what promotes to what, or from what. Only rows (9) and (17) can cause hesitation. We may assume that the Dashing Horse starts off as a General (as do the Ox and the Pig) and the Dashing Wolf as a Running one (as do the Bear and the Stag), because the first animals are tame and the second ones are wild. We are now able to complete the assignment:

1.	***sōroku***	"Running Stag"	⟹	*honroku*	**"Dashing Stag"**
2.	***tōhei***	**"Sword Soldier"**	⟹	*tōshō*	"Sword General"
3.	*gyūhei*	"Ox Soldier"	⟹	***sōgyū***	**"Running Ox"**
4.	***ushō***	"Right General"	⟹	*ugun*	**"Right Army"**
5.	***gyūshō***	"Ox General"	⟹	*hongyū*	**"Dashing Ox"**
6.	*kyūhei*	"Bow Soldier"	⟹	***kyūshō***	"Bow General"
7.	*kishō*	"Wood General"	⟹	***hakuzō***	**"White Elephant"**
8.	*dohei*	"Crossbow Soldier"	⟹	***doshō***	**"Crossbow General"**
9.	***bashō***	**"Horse General"**	⟹	***honba***	"Dashing Horse"
10.	***sasha***	"Left Chariot"	⟹	***satessha***	**"Left Iron Chariot"**
11.	***bahei***	"Horse Soldier"	⟹	*sōba*	**"Running Horse"**
12.	*sōyū*	"Running Bear"	⟹	***honyū***	"Dashing Bear"
13.	*tonshō*	"Pig General"	⟹	*honton*	**"Dashing Pig"**
14.	*tesshō*	**"Iron General"**	⟹	*hakuzō*	"White Elephant"
15.	***sashō***	**"Left General"**	⟹	*sagun*	"Left Army"
16.	*usha*	**"Right Chariot"**	⟹	*utessha*	"Right Iron Chariot"
17.	***sōrō***	**"Running Wolf"**	⟹	*honrō*	"Dashing Wolf"
18.	*sekishō*	"Stone General"	⟹	***hakuzō***	"White Elephant"

Tupí and Guaraní

This kind of question offers comparison between two languages that have some similarities. Here we have to be careful in taking note of each regular correspondence between the columns. Investigating carefully, we can condensate the patterns of transformation in five rules:

1. **s ↔ h**
2. **b ↔ v** (only in the middle of the word)
3. **pu ↔ ku**
4. **final consonant → Ø** (final consonant disappears from tupinambá to guaraní)
5. **· n / · ng / · nga ↔ ˜·**

(when the word finishes in vowel + nasal consonant, the consonant disappears in guarani and is replaced by nasalisation of the vowel)

English	Tupinambá	Guaraní Mbya
rock	itá	itá
soil	ybý	yvý
water	y	y
black	un	ũ
head	akanga	akã
to bring	erur	eru
to hear	endub	endu
to experiment	sa‘ang	ha‘ã
you want	erepotár	erepotá
to heal	pueráb	kuerá
I sleep	aker	aké
boss	ubixab	***uvixá***
rib	arukang	***arukã***
to overcome	opuan	***akuã***
peanut	mandubi	***manduvi***

English	Tupinambá	Guaraní Mbya
to beat	petek	***peté***
to hear	senub	***henú***
red	pyranga	***pyrã***
lizard	teju	***teju***
I say	a‘é	***a'é***
beautiful	porang	porã
mouth	***juru***	juru
half	***ku'a***	ku‘a
wood	***ybyrá***	yvyrá
you stay	***erepytá***	erepytá
high	***ybaté***	yvaté
you sleep	***erekér***	ereké
jaguar	jaguar	***jaguá***
to want	***potár***	potá

2. 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, lefting only the sound of water in the stones (ita + i + pu).

With all that, there is 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* as turtle. The river should appear once more, in *pirajuí* – the river (í) of the yellow (ju) fish (pira). The last one is *pindamonhangaba.*

So we have:

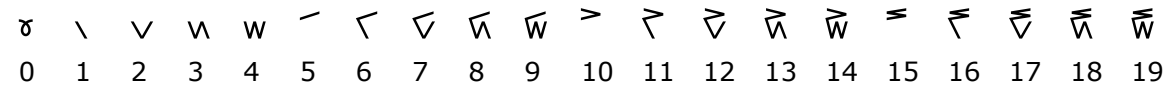
1. Ibiúna (SP)	**_7_** (a) white soil
2. Ibiporanga (SP)	**_15_** (b) great river
3. Iúna (ES)	**_5_** (c) place for producing fishing hooks
4. Tijuípe (BA)	**_4_** (d) lizard river
5. Pindamonhangaba (SP)	**_9_** (e) red river
6. Jacarecoara (MA)	**_8_** (f) turtle's burrow
7. Ibitinga (SP)	**_11_** (g) sound the water does in the rock
8. Jericoaquara (CE)	**_13_** (h) great rock
9. Ipiranga (PR)	**_6_** (i) alligator's/yacare's burrow
10. Tijuaçu (BA)	**_1_** (j) black soil
11. (Usina de) Itaipú (PR)	**_3_** (k) black river
12. Itatinga (SP)	**_14_** (l) fish of the yellow river
13. Itauçu (GO)	**_2_** (m) beautiful land
14. Pirajuí (SP)	**_10_** (n) big lizard
15. (Foz do) Iguaçu (PR)	**_12_** (o) white rock

Inuktitut Numbers

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

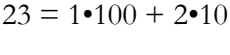
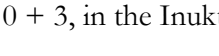
1. In the first operation, we see that two bars are equal the sum of one bar with another. In the lack of further divisions of the bar, we can assume the bar is 1.
2. In the second operation, a new element appears: the dash (horizontal stroke). It is evident that one dash = 5 bars.
3. Operations 3, 4 and 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). So 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:



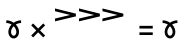
After that, we start to count using a second house:

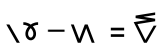
etc.

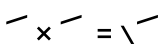
So the first number, right to left, count as the unities; the second position is multiplied by 20, as the third position is multiplied by $20^2 = 400$ and so on. So, in the same way that, in the indo-arabic system, 123 = 1•100 + 2•10 + 3, in the Inuktitut system,  =  = 443.

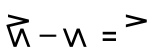
So the results of the operations of the second column are:

 summing the bars, when we go 5, we put a dash on the top

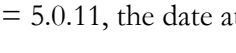
 multiplication by zero is zero

 1 0 is the same as four dashes

 five dashes

 visually obvious...

 Sum the 20s (1+ 1=2) and then the unities: 2 + 4 is 1 bar plus 1 dash; this gives us 4 dashes, so one more 20 (+1 to the left) with 0 dashes. So the number is 3.1

The date will depend on when you are solving this problem. This problem was first used in April 2nd , 2011. As 2011 = 5.0.11, the date at that occasion was  .

Basque Numbers

The following Basque numbers are identified straightforwardly:

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

Numbers from 11 to 19:	**hama-X | 10+X**	(where X is less than 10)
Numbers over 20:	**X-r-ogeita Y | X×20+Y**	(where Y is not greater than 20)

* In compounds 10 is hama (not hamar), 20 is hogeita (not hogei).

** The letter **h** in the beginning of the second word in a compound falls out (e. g., lau-r-hogeita > laurogeita).

bi × bi = lau	2 × 2 = 4
bi × bost = hamar	2 × 5 = 10
bi × hamar = hogei	2 × 10 = 20
hiru × bost = hamabost	3 × 5 = 15
hiru × hamar = hogeita hamar	3 × 10 = 30
bost × bost = hogeita bost	5 × 5 = 25
bost × zazpi = hogeita hama	5 × 7 = 35
bost zazpi × bederatzi = hirurogeita hiru	7 × 9 = 63
zazpi × hamar = hirurogeita hamar	7 × 10 = 70
lau × bost = **hogei**	4 × 5 = 20
bederatzi × hamar = laurogeita hamar	9 × 10 = 90

2.

a) 93

b) 60

3.

c) 39 = 20 + 19 hogeita hamabederatzi

d) 77 = 3×20 + 17 hirurogeita hamazazpi

e) 80 = 4×20 laurogei

Basque Kinship

The Basque sentences are formed in the following way:

Name1 – Name2 (genitive form) **– relationship – copular verb**.

The copula is **da** for singular subjects and **dira** for plural subjects. The genitive form (Mikel's, Kontxi's, ...) has the ending **-en** (after consonants), **-ren** (after vowels).

A woman's 'sister' is **ahizpa**, a man's 'sister' is **arreba**. Similarly, 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'. **Eta** means 'and'.

1.

Ines is Mikel's wife.
Kontxi is Monika's sister.
Felix is Mikel's brother.
Andres is Emilio and Miren's son.

2. We know that Monika is ahizpa to Kontxi; therefore, Kontxi is female.

3.

a) Kontxi **Monikaren** ahizpa da.
b) Inma eta Manu Iboneren **seme-alabak dira**.
c) Ibone Andresen **arreba da**.
d) Manu Inmaren **neba da**.
e) Kontxi Mikelen **alaba da**.
f) Emilio **Mirenen** senarra da.

Icelandic Kinship

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. From observing the names, one can deduce the following rules for Icelandic patronymics:

- If X is man,
  - **X Y-(s)son/-arson** means "X son of Y".
  - **X Y-(s)son Z-(s)sonar** says that, before X being son of Y, Y was son of Z, thus Z is grandfather or grandmother of X.
- If X is woman,
  - **X Y-(s)dóttir** means X daughter of Y".
  - **X Y-dóttir Z-dóttir** means that Z is grandfather or grandmother of X.

- When the progenitor (Y or Z) is a man, there is an extra **-s-** before **-son/-dóttir**, a genitive case indicator.

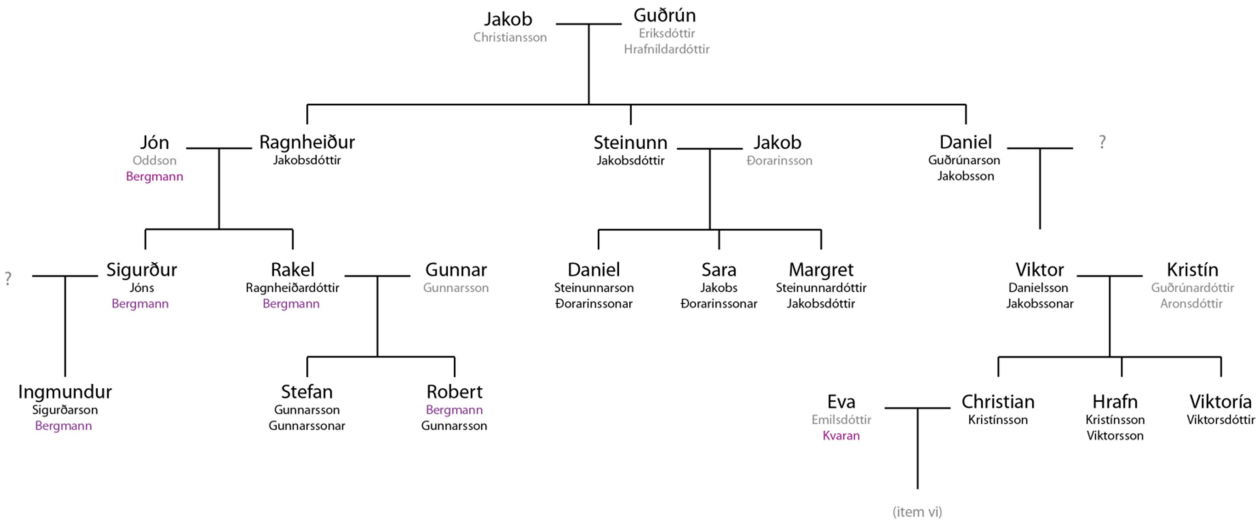
Aside from that, there are no rules on how the name should be composed: only the parents decide if the son will carry or not the name of father, mother or any of the four grandparents.

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 e Eva (item iv) are married. With that, we can discover that:

Jakob C. e **Guðrún** had three kids: Ragnheiður Jakobsdóttir, Steinunn Jakobsdóttir and Daniel Guðrúnarsson.

> **Ragnheiður** married with *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 *Ðorarinsson.* Together they had three children: *Daniel Steinunnarson Ðorarinssonar*, *Sara Jakobs Ðorarinssonar* 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 is said in item 6, they are waiting the first Great-great-grandchild of this beautiful family.

We can put all in a tree:



Thus we can answer the questions:

1. Jón Oddson Bergmann

2. Steinunn. She had three children: Daniel, Sara and Margret, none of them had children.

3. Three: Christian, Hrafn and Viktoria

4. Three: Daniel, Sara and Margret

5. Stefan Gunnarsson Gunnarssonar. He received only names of his father and his father's father.

6. Guðmundur (Evasson /Christiansson)(Emilsonnar /Kristínsonnar/Viktorssonar) (Kvaran)

7. Hrafnildur Björnsdóttir (Annassonar)

Manam

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."

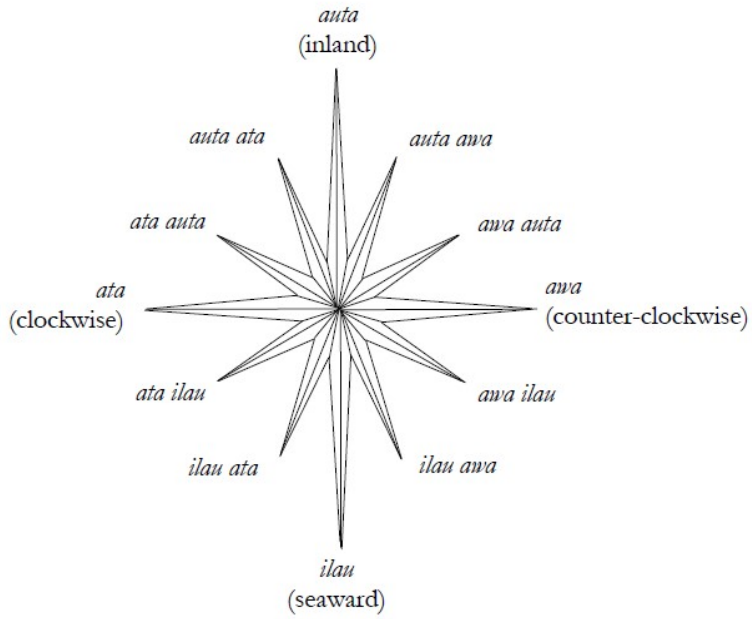
When we analyze the relative locations of the houses of Onkau, Kulu, and Mombwa, we may be tempted to assume that *auta* is North, *ilau* is South, *awa* is East, and *ata* is West. This assumption works until about halfway through the problem, but then we should notice contradictions: either these directions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

1.

A: **Pita** B: **Butokang** C: **Sulung** D: **Tola** E: **Sala**

2.

i. **Arongo pera kana ilau ieno, Butokang pera kana auta ieno.**
ii. **Arongo pera kana ata ieno, Pita pera kana awa ieno.**
iii. **Arongo pera kana awa ilau ieno, Sulung pera kana ata auta ieno.**

Guaraní

The Guarani verb consists of:

a. prefix ***n(d)(a)-***, if negation exists;
b. person and number of the subject: ***a-*** 'I', ***o-*** 'he', ***ja-*** 'we', ***pe-*** 'you (pl.)';
c. root;
d. ***-(r)i***, if negation exists;
e. ending ***-ma*** for past tense or ***-ta*** for future tense.

where:

- the negative prefix should start with ***n*** (rather than ***nd***) in case the root of the verb contains any nasal sound
- the vowel ***a*** is dropped from the negative prefix in case the personal prefix starts with a vowel.
- if a future tense is to be negated, the suffix is ***-mo'ãi,*** rather than **-(r)i-ta*; the negative suffix is *-ri* after the vowel *i; -i* otherwise.

1.	**2.**
a) I was eating	f) ne-pe-mbokapu-i
b) He will be waking up	g) ndo-purahei-ri
c) I will not be taking	h) ja-karu-ta
d) you are not crying	i) nda-purahei-mo'ai
e) I wasn't catching	

Aymara

1.

g	1	
b	2	**(lie!)**
a	3	
c	4	
d	5	
f	6	
e	7	

We need to notice the following patterns in order to solve this problem:
• *challwataxa* is the last word of each sentence, which may mean "caught" or "fished."
• *mä, paya,* and *kimsa* are the numbers.
• *challwa* is the root "fish."
• *–lla* indicates the little fish, whereas *hach'a* indicates the big fish.
• *–mpi* occurs whenever there are two kinds of fish.
• *–wa* occurs at the very end, but before *challwataxa*.

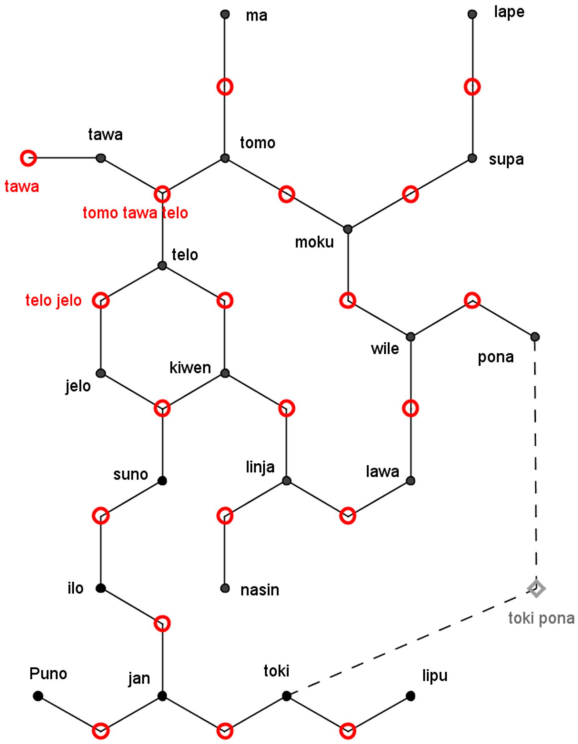
2. There are two possible correct answers:

Kimsa challwalla paya hach'a challwampiwa challwataxa.
Paya hach'a challwa kimsa challwallampiwa challwataxa.

Toki Pona

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 e 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.

Doing all the relations, we come to this list:

kiwen suno jelo	gold	stone – bright – yellow
tomo tawa telo	boat	house – moving – water
jan Powi	Boris	person – Boris
ilo suno	lantern	tool – light
telo jelo	piss	water – yellow
jan ilo	robot	person – tool
jan toki	prophet	person – word
supa lape	bed	surface – sleep
supa moku	dinner table	surface – eat
ma tomo	city	land – houses
wile moku	hungry	will – eat
tawa	movement	movement
nasin linja	orthodoxy	path – straight
wile pona	well-intentioned	will – good
telo kiwen	ice	water – hard (as stone)
lipu toki	book	flexible surface – words

So, the concepts are:

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

With that, we discover that *toki pona* means *good language*.