First International Olympiad in Theoretical, Mathematical and Applied Linguistics

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Solutions to the Problems of the Individual Contest

Solution of Problem 1

1. Nouns:

   - Λ̇ 'man', Δ̇ 'woman', i 'boy', Δ 'girl', ⊠ 'letter', ⊫ 'work'.
     - Combinations: Λ̇Δ̇ 'man + woman = husband + wife', iΔ 'boy + girl = brother + sister', Λ̇Δ̇iΔ 'man + woman + boy + girl = family'.
     - Family members are singled out by division and cancellation: $\frac{\dot\Lambda\dot\Delta i\Delta}{\dot\Delta i\Delta}$ 'family/(woman + kids) = father', $\frac{i\Delta}{\Delta}$ 'kids/girl = brother', $\frac{\dot\Lambda\dot\Delta i\Delta}{i\Delta}$ 'family/kids = parents'.
     - Missing (deceased) family members are preceded by a minus sign: $\frac{i\Delta(-\dot\Lambda\dot\Delta)}{(-\dot\Lambda\dot\Delta)}$ 'kids (−parents)/(−parents) = orphans' (apparently orphaned children of one and the same family).
   - İ 'person', (> İ) 'giant'.

2. Pronouns are composed of the character İ or Δ̇ (for feminine gender) and the subscripts 1 to 3, which indicate the person.

3. The plural of nouns and pronouns is expressed by the coefficient n. The plus sign plays the part of the conjunction 'and'.

4. Verbs: ≪ 'talk', ⊫ 'work', t 'hurry', ⟋ 'write', ♡ 'like, love', ⌂ 'eat'. If what the verb denotes is absent or uncharacteristic, a minus sign expresses that: −♡ 'not inclined to affection = wicked'. (We can assume that a characteristic property is expressed by a plus sign, hence +♡ 'good', a concept we need.)

5. Sentence structure:

   - the subject is the base of the power;
   - the predicate is the exponent, whereby negation is expressed by a minus sign (−♡ 'not like') and passive voice by a radical sign ($\sqrt{⟋}$ 'be written'); additional activities can be added or subtracted ($\dot{I}_3^{\,\Vdash\,-t}$ 'he is working and doesn't hurry = he is working without haste');
   - past tense is marked by −t ($\dot{I}_3^{\,\Vdash} - t$ 'he worked'), future tense by +t;
   - the direct object, if there is one, follows an equals sign.

Assignment 1.
9. He loves with an unrequited love (*i. e.* loves without being loved).
10. The taciturn (*or* mute) daughter will write about the father and the mother.
11. You (sg. fem.) worked quickly (*or* hastily) and silently.
12. The letter was eaten by the hungry sister.

Assignment 2.
13. $(\dot\Delta_1 + \frac{\dot\Lambda\dot\Delta}{\dot\Delta})^{\ll} - t = -n\dot{I}_3$
14. $(n\dot{I})^{\Vdash\,-\,♡}$
15. $(\frac{\dot\Delta(-\dot\Lambda)}{(-\dot\Lambda)} + ♡)^{♡} = (< \dot{I}) - \Vdash$
16. $(n\dot{I}_2)^{\sqrt{\ll}} + t$

Solution of Problem 2

All Arabic words in the problem are made according to one of the patterns *1a2a3t*, *i12ā3*, *1u23* and *1u23ēn* (whereby words using the first and the second pattern always come together in this order and words using the other two patterns occur on their own). In these patterns *1-2-3* is one of the triples of consonants *r-b-ʕ*, *s-b-ʕ*, *s-d-s*, *t-l-t*, *t-m-n*, *t-s-ʕ*, *x-m-s*, *ʕ-š-r*. Let us assume that the consonant triples correspond to numbers between 1 and 10 and the arrangements of the vowels indicate certain functions, in particular, *1a2a3t i1'2'ā3'* is either $\frac{n}{n'}$ or $\frac{n'}{n}$ (and in either case *xamast ixmās* $= \frac{n}{n} = 1$), and *1u23* $= \frac{i}{n}$ and *1u23ēn* $= \frac{j}{n}$, for some as yet unknown i and j.

From equality (5) we see that *s-b-ʕ* and *x-m-s* are 5 and 7 (in one order or the other), and from $\frac{j}{5} + \frac{j}{7} = \frac{(7+5)j}{35} = \frac{24}{35}$ it follows that j $= 2$, that is, *1u23ēn* $= \frac{2}{n}$. Since *1u23* is shorter than *1u23ēn*, we can assume that this pattern corresponds to a more basic function, and the only candidate for such a one is $\frac{1}{n}$.

From (1) it follows that *t-l-t* is 3 (and that the numerator precedes the denominator in the Arabic fractions). From (4) we see that *t-m-n* is greater than *s-b-ʕ* by one. From (3) it follows that $3s\text{-}d\text{-}s = 2t\text{-}s\text{-}ʕ$. Thus *t-s-ʕ* is divisible by three. Since the value 3 is already taken, *t-s-ʕ* and *s-d-s* are either 6 and 4 or 9 and 6, respectively, and *t-m-n*, *s-b-ʕ* and *x-m-s* are respectively 8, 7 and 5.

We have yet to use equality (2). Letting *s-d-s* be equal to 4 gets us nowhere ($\frac{7}{3} + \frac{1}{4} = \frac{31}{12}$ can't be reduced to a fraction with a numerator and denominator between 1 and 10), consequently *s-d-s* $= 6$, and $\frac{7}{3} + \frac{1}{6} = \frac{15}{6} = \frac{5}{2} = \frac{10}{4} = ʕ\text{-}š\text{-}r/r\text{-}b\text{-}ʕ$. (The root *r-b-ʕ* '4' is the source of the word *ruba'i* 'quatrain', used also in English.)

Assignment 1. (1) $\frac{1}{8} + \frac{2}{8} = \frac{3}{8}$, (2) $\frac{7}{3} + \frac{1}{6} = \frac{10}{4}$, (3) $\frac{2}{9} + \frac{1}{9} = \frac{2}{6}$, (4) $\frac{5}{5} + \frac{1}{7} = \frac{8}{7}$, (5) $\frac{2}{7} + \frac{2}{5} = \frac{24}{35}$.

Assignment 2. *rubʕ + ʕašart itsāʕ* $= \frac{1}{4} + \frac{10}{9} = \frac{49}{36}$ and *sabaʕt isdās* $= \frac{7}{6}$. Thus either $\sqrt{rubʕ + ʕašart\ itsāʕ} = sabaʕt\ isdās$ or, perhaps, *rubʕ + ʕašart itsāʕ* $= (sabaʕt\ isdās)^2$ (if we don't consider brackets to be a sign).

Solution of Problem 3

There are two types of English expressions in the problem: some (I) consist of a date, a month and a day of the week, others (II) name the number of the day of the week within the month instead of the date. The word order in the Basque expressions of type (I) is ⟨month⟩ ⟨date⟩, ⟨day of the week⟩, whilst in type (II) it is ⟨month⟩ ⟨number of the day⟩ ⟨day of the week⟩. The last word ends in -*a*, whereas the preceding words have no final -*a* (except for the word *hogeita*, which means '20' in compound numerals). The element -*garren* forms ordinal numbers. The word *astea* is not a name of a day of the week (six of those we have seen in examples 1–10, the seventh occurs in Assignment 3). Since Assignment 2 features the word 'week', we can guess that this is the meaning of the word *astea*.

Assignment 1.

urtarrilaren hogeita hirugarrena, larunbata	*the 23rd of January, <u>Saturday</u>*
abenduaren azken astea	*the last <u>week</u> of December*
otsailaren lehenengo osteguna	*the first Thursday of February*
ekainaren bederatzigarrena, igandea	*the ninth of June, Sunday*
abenduaren lehena, <u>asteazkena</u>	*the first of December, Wednesday*
irailaren azken asteazkena	*the last Wednesday of <u>September</u>*
azaroaren hirugarren ostirala	*the third Friday of November*
urriaren azken larunbata	*the last Saturday of October*
irailaren lehena, astelehena	*<u>the first of</u> September, Monday*
<u>urtarrilaren</u> bigarrena, ostirala	*the second of January, Friday*

Assignment 2.

the first Monday of December	*abenduaren lehenengo astelehena*
the 29th of November, Saturday	*azaroaren hogeita bederatzigarrena, larunbata*
the second week of January	*urtarrilaren bigarren astea*
the third of February, Monday	*otsailaren hirugarrena, astelehena*

Assignment 3. *Astelehena* 'Monday', *asteazkena* 'Wednesday'; *asteartea*, the only day of the week not found in in Assignment 1, is 'Tuesday'. All three names are formed from the word *aste* 'week'. *Astelehena* means literally 'first (day) of the week', *asteazkena* 'last (day) of the week'. Tuesday's Basque name can be translated more or less as 'day in the middle of the week'.

No one knows for sure why Basque calls Wednesday 'last day of the week'. In Basque dialects other variants of the names of the days of the week are also found, including loans from Romance languages.

Solution of Problem 4

The Adyghe sentences have the following structure:

(1, 3, 4)	X-*r*	Y-*m*	P-*e*-V.	'He V X P Y.'
(2, 5)	*syda*	Y-*m*	P-*i*-V-*rər?*	'What does he V P Y?'
(6, 7)	X-*r*	*tyda*	*zy*-P-*i*-V-*rər?*	'Where does he V X?'

where X and Y are nouns, V is a verb (or its stem) and P is, in English, one of the prepositions *into, onto* or *under* and in Adyghe it is one of the prefixes *d-, tyr-* or *ɕ-*. As the third schema shows, the Adyghe locative prefix may not correspond to anything in the natural (but imprecise) English translation.

Assignment 1. We specify (at the expense of naturalness):

6. Under what does he put the plate?
7. Onto what does he throw the plate?

Assignment 2. 8. He throws the stool into the stove.
9. Where (into what) does he drop the money?

Assignment 3. 10. *laʁər śanyɕym ɕeʁəuco.*
11. *syda pχwantym ɕiʒərər?*
12. *syda śywanym diʁafərər?*

Assignment 4. 13. *ʔanyr tyda zydiʁəucorər?*   Into what does he put the table?
13′. *ʔanyr tyda zytyriʁəucorər?*   Onto what does he put the table?
13″. *ʔanyr tyda zyɕiʁəucorər?*   Under what does he put the table?

Solution of Problem 5

réassortir	pick again	*assortir*	pick
récurer	clean	*curer*	clean
réformer	reform	‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖	
reformer	form again	*former*	form
réfuter	refute	‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖	
relancer	throw again	*lancer*	throw
rémunérer	remunerate	‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖	
répartir	distribute	‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖	

The table features verbs with two different prefixes: *re-* and *ré-*. All verbs with *re-* indicate a repetition or a renewal of the action named by the verb without a prefix. Contrariwise, if the prefix is *ré-*, then the corresponding prefixless verb either doesn't exist or means the same thing as the prefixed one does. The verbs whose stems begin with vowels are an exception: the prefix they take is *ré-* regardless of the existence and the meaning of a corresponding prefixless verb. There are other exceptions from this rule in French, but on the whole it is fairly reliable.

Note: The vowel in the prefix *ré-* is not unlike the first vowel in *raider*, whereas the one in the prefix *re-* bears a certain similarity to the second, and needs to be fortified when it finds itself next to another vowel.

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