(J) Strawbery Shortcake (1/1) [Solution]

J1. *small elephants are alleged spies*

J2. 1. E 2. D 3. C 4. B 5. F 6. A

J3. [*st*][*a*][*rt*][*ed*]

(K) Speaking Your Truth (1/1) [Solution]

K1.

1.	**chizaze**	D.	*cat*	← *lynx* + *small*
2.	**dechenkálé**	X.	*wooden board*	← *wood* + *flat*
3.	**dene ké**	O.	*person's shoe*	← *person* + *shoe*
4.	**dene láké**	F.	*fingerprint*	← *person* + *hand* + *shoe*
5.	**dene tthí nédheli**	E.	*fever*	← *person* + *head* + *hot*
6.	**denetthíaze**	Q.	*postage stamp*	← *person* + *head* + *small*
7.	**dzółaze**	J.	*marble*	← *ball* + *small*
8.	**erihtł'ís chené**	N.	*pen*	← *writing* + *stick*
9.	**jíaze**	R.	*raisin*	← *berry* + *small*
10.	**jíegaié**	B.	*beans*	← *berry* + *white*
11.	**jíegaié dhéth**	P.	*pod*	← *bean* + *cover*
12.	**ké sųłiné**	K.	*moccasin*	← *shoe* + *genuine/real*
13.	**kéchogh**	C.	*boot*	← *shoe* + *big*
14.	**sa tł'ulé**	U.	*sunbeam*	← *sun* + *rope*
15.	**setthíghá**	L.	*my hair*	← *my* + *head* + *fur*
16.	**sįla**	M.	*my hand*	← *my* + *hand*
17.	**tł'izi tthoghéchogh**	I.	*hornet*	← *fly* + *yellow* + *big*
18.	**tł'uk'etį**	V.	*violin*	
19.	**tł'uk'etįchogh**	H.	*guitar*	← *violin* + *big*
20.	**tł'ulekálé**	T.	*strap*	← *rope* + *flat*
21.	**tsąba delgai**	S.	*silver*	← *money* + *white*
22.	**tsąba deltthoghi**	G.	*gold*	← *money* + *yellow*
23.	**tsąbakǫ́ę**	A.	*bank*	← *money* + *house*
24.	**tuk'é**	W.	*water well*	← *water* + *hole*

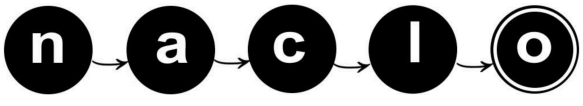
K2. **sa** is both *clock* and *sun*, since both were used to tell time (the word is originally for *sun*, but later expanded to include *clock* in its meaning).

K3.

- **dechentué** ← *tree* + *water* = *sap*
- **denechogh** ← *person* + *big* = *giant*
- **tł'izi tthoghé** ← *fly* + *yellow* = *bee*

K4.

25.	**dlíe**	EE.	*squirrel*	← *squirrel*
26.	**łue**	CC.	*fish*	← *fish*
27.	**łuechogh**	AA.	*blue whale*	← *fish* + *big*
28.	**sas delgai**	DD.	*polar bear*	← *bear* + *white*
29.	**yagolas**	BB.	*butterfly*	← *sky* + *??* (actually: "*little sky worm*")



(L) Hide and Seek in Hunzib (1/1) [Solution]

L1.

íƛ'e — iyáƛ'e	**koxáa — koxabáa**	**ƛ'áq'ə — ƛ'əwáq'e**
óč'ok' — oč'ák'	**ű́q'e — ũwáq'e**	**ű́xel — ũxál**

L2.

dress s. up — **λɬ̃q'ák'**	*put s. on* — **guwák'**	*put the fire on* — **ek'ál**
renew s. — **ɬ̃c'ák'e**	*take s. off* — **ȧáhu**	*warm up* — **ɨxále**

L3. Stress typically falls on the second-to-last vowel (counting a long vowel as two).

1. Verbal plural:
   - If the verb already ends in a long vowel, suffix **-baa**.
   - Otherwise, insert a marker before the last consonant of the verb stem:

-á-	after a consonant;
***V́*-á-**	after an unstressed vowel;
-yá-	after a stressed front vowel;
-wá-	otherwise.

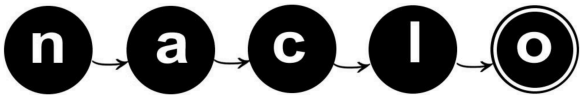
     This marker overrides the inherent stress. Here ***V́*** means that the preceding vowel is deleted.

2. Causative/verbalizer:
   - Causative $=$ { **-k'** after a vowel; **-k'e** after a consonant.
   - Verbalizer $=$ { **-l** after a vowel; **-le** after a consonant.
   - In both cases, after a central vowel that is not low, **e** $\to$ **ə**.

3. Ordering: we first add the causative/verbalizer, and only after do we insert the verbal plural.

L4. We would expect **uhále** and **gič'ák'e**. Irregular forms arise when speakers treat these verbs as a pluralized root with a suffix. That is, the root is pluralized first, and only after that is the causative or verbalizer added. For example, pluralizing the root **gíč'** gives **giyáč'**, so the causative plural was interpreted as **giyáč'k'e**, not the expected **gič'ák'e**.

This pattern was extended to other similar forms by analogy, like seeing the ending of **úhle** as a verbalizer, so that even forms that did not originally behave this way may come to be built by pluralizing the root first.



(M) Can You Speak Aikanã? (1/1) [Solution]

M1.

1. *You trick him and I am thirsty.*
2. *He smells good and you hate him.*
3. *I see him unexpectedly and I dream.* (not ??*I dream him*)

M2.

1. **nãwĩwãpü daweriaeẽ**
2. **amakeana ũpanemeẽ**
3. **ãrüamepü herekaeẽ**

M3.

1. Verb structure: (SUBJ$_1$)—**STEM**$_A$—(SUBJ$_2$)—(OBJ)—LINK $\cdots$ **STEM**$_B$ $\cdots$

2. Subject markers:

Type 1:

†**d-**	*I*
h-	*you*
∅**-**	*he*

†**d-** becomes **n-** before nasal vowels **Ṽ**.

Type 2:

-ka	*I*
-me	*you*
-he	*he* (if no object)
-ke	*he* (if object)

3. Object markers:

-a	*me*
-e	*you*
-∅	*him*

4. Linkers:

-ẽ	**STEM**$_B$
-pü	**STEM**$_A$ (SUBJ$_A$ = SUBJ$_B$)
-na	**STEM**$_A$ (SUBJ$_A$ ≠ SUBJ$_B$)

5. Verb stems:
   - physical states (e.g. **yoane** '*to smell good*') use object markers to mark their subject;
   - all other stems take two different (but related) meanings depending on which type of subject marker (1/2) is used, e.g. **aweria**$_1$ '*to trick*' but **aweria**$_2$ '*to lie*'.
     - The two meanings are usually related, but the meaning shift is not fully predictable.

Additional notes (not relevant to the problem): in reality, the Aikanã system is much more complicated; in fact, there are not two but six sets of subject markers used for different purposes!

(N) A Token of Your Attention (1/2) [Solution]

N1. **(a)** .60 **(b)** .04 **(c)** .48 **(d)** .16

N2. **(e)** .40 **(f)** .20 **(g)** .30 **(h)** .60 **(i)** .20

N3. 1. C 2. D 3. E 4. A 5. B 6. C

N4. *The cat eats the rat on the mat.*

N5. **(j)** 𐑖 **(k)** 𐑚𐑖 **(l)** 𐑒𐑖𐑯 and 𐑒𐑚𐑡 **(m)** 𐑯𐑚𐑤 **(n)** 𐑖𐑓

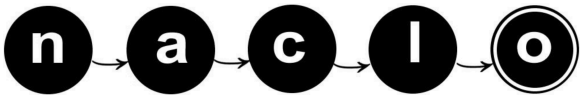
N6.

- Begin by distributing the attention of the verb across the sequence.
- A verb considers the following from most to least important:
  - Itself
  - Its inflection
  - Its subject
  - Its objects or obliques
  - Anything else (e.g., determiners, prepositions, adjectives)
- Only the categories present in the sequence are considered (e.g., a sentence without any objects or obliques has the hierarchy ELSE $<$ SUBJ $<$ INFL $<$ VERB), and each category is worth an incrementally larger value (e.g., INFL is worth three times as much as ELSE in the hierarchy exemplified above).
- Since the attention weights in a row must add up to 1, it's easiest to describe the calculations using algebra (i.e., the lowest category in the hierarchy has value x, the sum of the values in a row are set equal to 1, and x is calculated accordingly).
- Next, we calculate how much attention each token pays to the verb: each token pays twice the amount of attention to the verb as the verb pays to it (e.g., if the verb gives an attention weight of 0.25 to a token, then that token must give a weight of 0.50 to the verb). However, a token in the lowest category does not double this attention weight; rather, the attention between the two are equal.
- Next, we calculate the attention weight for the remaining non-diagonal cells. We have already calculated the attention weights for all edges involving the verb, so the remaining non-diagonal cells represent the edges between two tokens that are not the verb. Each of these cells is assigned the lowest attention weight previously used (i.e., x in our algebraic analysis).
- Finally, we complete the attention weight for the remaining diagonal cells. Since the attention weights in each row must add up to 1, we fill the remaining diagonal cells with the corresponding values.

Worked example: *The cat meowed.*

We start with the empty attention matrix:

	the	*cat*	*meow*	*ed*
the	?	?	?	?
cat	?	?	?	?
meow	?	?	?	?
ed	?	?	?	?



(N) A Token of Your Attention (2/2) [Solution]

Since there is no object or oblique here, the hierarchy is ELSE $<$ SUBJ $<$ INFL $<$ VERB. Let these have values x, $2x$, $3x$, and $4x$ respectively. Since the row sum must be 1, we get $x + 2x + 3x + 4x = 1$, so $10x = 1$ and therefore $x = .10$.

Doing this, we first fill in the verb row:

	the	*cat*	*meow*	*ed*
the	?	?	?	?
cat	?	?	?	?
meow	.10	.20	.40	.30
ed	?	?	?	?

Next, each token pays twice as much attention to the verb as the verb pays to it, except for the lowest category, where the attention is equal. Doing this, we get:

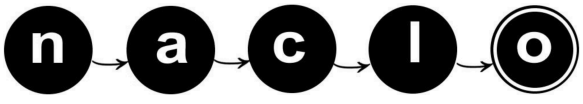
	the	*cat*	*meow*	*ed*
the	?	?	(.10)	?
cat	?	?	.40	?
meow	.10	.20	.40	.30
ed	?	?	.60	?

Next, we assign the lowest value, namely $x = .10$, to the remaining non-diagonal cells. Doing this, we get:

	the	*cat*	*meow*	*ed*
the	?	.10	.10	.10
cat	.10	?	.40	.10
meow	.10	.20	.40	.30
ed	.10	.10	.60	?

Finally, we fill the remaining diagonal cells so that each row sums to 1. Doing this, we get:

	the	*cat*	*meow*	*ed*
the	.70	.10	.10	.10
cat	.10	.40	.40	.10
meow	.10	.20	.40	.30
ed	.10	.10	.60	.20



(O) Sum Times in Na (1/1) [Solution]

O1.

(1) $30 + 30 = 60$
(2) $6 \times 6 = 36$
(3) $27 \times 2 = 54$
(4) $37 + 53 = 90$
(5) $22 \times 3 = 66$
(6) $46 + 47 = 93$

O2. ko-jo-bi-jɔkɛ bi-jɔ muta — 83

O3.

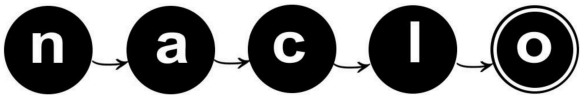
- 44 — **jɔkɛ-jo bi-jɔ sɔ**
- 117 — **ko-muta-bi-jɔkɛ bi-jɔ mitikijo**

O4. Digits:

2	3	4	6	7
jo	**muta**	**sɔ**	**maka**	**mitikijo**

Tens: $20 =$ **jɔkɛ**, $30\alpha\,[+20] =$ **ko-**α[**-bi-jɔkɛ**], $\alpha + \beta = \boxed{\alpha}$ **bi-jɔ** $\boxed{\beta}$ ($20 \le \alpha$, $1 \le \beta \le 9$).

ⓘ 40 is formed (perhaps surprisingly) as **jɔkɛ-jo** ($\leftarrow 20 \times 2$).



(P) Wear There's a Will (1/1) [Solution]

P1.

1. *The fiancée will collect my wine.*
2. *My religion student will criticize cotton.* (or *fabric*, *coat-to-be*, etc.)
3. *The priest will wear the raw oil.*

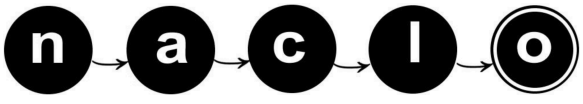
P2.

4. **uima ɔʁsussɑq katissavaa**
5. **palasiga qalissiassamik katɛʁsissɑɑq**
6. **uissɑʁa kunngissamik isɔʁsissɑɑq**

P3. Throughout this solution, a noun with *the* or *my* is called definite, and a noun with *a* is called indefinite.

1. Word order: [SUBJ] [(OBJ)] [VERB].
2. Noun structure:
   - **-ssɑq** = "future" (e.g. **palasi-ssɑq** = "one who will become a priest in the future", i.e. *religion student*)
   - **-mik** = indefinite
3. Possession ("*my* ...") = $\begin{cases} \textbf{-ma} & \text{on the subject, but only if there is a definite object;} \\ \textbf{-ga} & \text{otherwise. (-ga} \to \textbf{-ʁa} \text{ if the noun ends in q)} \end{cases}$.
4. Verb structure: [ROOT]–[SUFFIX], where [SUFFIX] = $\begin{cases} \textbf{-ssavaa} & \text{if there is a definite object;} \\ \textbf{-sissɑɑq} & \text{if there is an indefinite object;} \\ \textbf{-ssɑɑq} & \text{if there is no object.} \end{cases}$
5. Sound changes:
   - All* suffixes remove an immediately preceding consonant, if it exists.
     - *This does not apply to **-sissɑɑq**.
     - There are other possible explanations of this phenomenon, although they may be more complex.
   - Before **ʁ** and **q**, we have **a** → **ɑ**, **i** → **ɛ**, and **u** → **ɔ**.
     - In fact, the vowels **ɑ**, **ɛ**, **ɔ** never appear before other consonants.

Additional notes (not relevant to the problem): in reality, **-ssɑɑq** is the basic future ending for a verb with no definite object. The ending **-sissɑɑq** can be analyzed as **-si-ssɑɑq**, where **-si** allows the verb to be used with an indefinite object; this is what linguists call the *antipassive* (but knowing this is not necessary for solving the problem). This marker **-si** is the only one in the problem that does not remove a preceding consonant.



(Q) Sea Saw (1/2) [Solution]

Q1.

1. *he saw them*
2. *they saw them*
3. *the whale saw me; the whale saw you*
4. *the shark saw her*

Q2.

5. **ningingarringka**
6. **ngimwirringka mwangwiyiwanga**
7. **nanakwirringka apwirtha**
8. **ningkwirringkatjingwa**

Q3.

Subjects and objects, excluding pronouns, follow the verb. The verb **-rringka** means *saw*.

All nouns and pronouns belong to a hierarchy:

$$\textit{I/me}, \textit{you} > \textit{they/them} > \textit{she/her}, \textit{he/him} > \textit{shark} > \textit{whale}$$

The *shark* and *whale* nouns in this problem are representative of larger noun classes. Each noun belongs to a noun class that is mostly unpredictable given its meaning.

The subject and object are expressed using two prefixes on the verb; the first one represents whichever one comes earlier in the hierarchy, and the second one represents whichever one comes later. If the subject and object are on the same tier of the hierarchy, the subject is represented first.

	1st Prefix		**2nd Prefix**	
	Subject	Object	Subject	Object
I/me	**ningi-**	**ngi-**		
you	**ningkwi-**	**ngi-**		
they/them	**narri-**	**narra-**	**pwi-**	**arra-**
she/her	**yingi-**	**yinga-**	**nga-**	**nga-**
he/him	**na-**	**nana-**	**ni-**	**ni-**
shark	(**nimwa-**)	(**nimwa-**)	**mwi-**	**mwa-**
whale	(**niwa-**)	(**niwa-**)	**kwi-**	∅-

The prefixes used when the subject performs an action on itself are identical to those used in the first position for subjects. In those cases, the verb also takes the suffix **-tjingwa**.

When the combination of two prefixes causes two vowels to come into contact, the first vowel is deleted. For example, **ningi-arra-** $\rightarrow$ **ningarra-**.

(Q) Sea Saw (2/2) [Solution]

*Note: In reality, the vowel changes between prefixes are quite complex. Many of the prefixes are often analysed as lacking a final vowel, and the vowels that appear between prefixes are inserted to make the words easier to pronounce. This inserted vowel tends to be **i** after subject prefixes and **a** after object prefixes, making it easier to distinguish forms like **narrirra-** and **narrarra-**, which would otherwise be identical.*

These prefixes combine to form the following:

	me/you	*them*	*her*	*him*	*shark*	*whale*	*self*
I	**yirri-***	**ningarra-**	**ninginga-**	**ningini-**	**ningimwa-**	**ningi-**	**ningi-**
you	**yi-***	**ningkwarra-**	**ningkwinga-**	**ningkwinini-***	**ningkwimwa-**	**ningkwi-**	**ningkwi-**
they	**ngipwi-**	**narrirra-***	**narringa-**	**narrini-**	**narrimwa-**	**narri-**	**narri-**
she	**ngingi-***	**narranga-**	**naninga-***	**yingini-**	**yingimwa-**	**yingi-**	**yingi-**
he	**ngini-**	**narrani-**	**nanga-**	**nani-**	**nimwa-***	**ni-***	**ni-***
shark	**ngimwi-**	**narramwi-**	**yingamwi-**	**nanamwi-**	**nimwa-***	**nimwa-***	**nimwa-***
whale	**ngikwi-**	**narrakwi-**	**yingakwi-**	**nanakwi-**	**niwa-***	**niwa-***	**niwa-***

*Irregular forms.

Note that the regular forms follow two different consistent, concatenative patterns above and below the thick dividing line. Many equivalent explanations can produce these same regular combined prefixes.