en(A)

Twenty-second International Linguistics Olympiad

Taipei (Taiwan), July 20–27, 2025

Individual Contest Problems

Rules for writing out the solutions

Do not copy the problems. Write down your solution to each problem on a separate sheet or sheets. On each sheet indicate the number of the problem, the number of your seat and your surname. If you do not do this, your work may be mislaid or misattributed.

Unless stated differently, you should describe any patterns or rules that you identified in the data. Otherwise your solution will not be awarded full marks.

Problem 1 (20 points). Here are some numbers in Dzongkha and their numerical values:

1 — **ci** 3 — **sum** 8 — **ge** 12 — **cuɲi** 17 — **cupdyn** 19 — **cygu**

For higher numbers, Dzongkha uses two different systems (referred to here as A and B). Below are some numbers written in both systems, as well as their numerical values:

System A	System B	Value
ke ci da ɲi	**tsaɲi**	22
ke ci da ŋa	**tsaŋa**	25
ke pɟe-da ɲi	**sumcu**	30
ke ci da cyʑi	**soʑi**	34
ke ɲi da dyn	**ʑedyn**	47

System A	System B	Value
ke ko-da sum	**ŋaŋa**	55
ke sum da cuɖu	**døndu**	76
ke ʑi	**gepcu**	80
ke ʑi da gu	**ɟagu**	89
ke ceŋa	**sumɟa**	300

Finally, some equalities are given with left-hand side written in system A and right-hand side written in system B. Some numbers are missing.

	System A		System B
(1)	**cusum + ke pɟe-da ʑi**	=	**ɟasum**
(2)	**ɲiɕu ɲi**	=	**ɲiɕu × ʑipcu**
(3)	**ɲiɕu ci da ke sum da gu**	=	**(ŋapcu × gu) + cygu**
(4)	**ɲiɕu pɟe-da ɲi + ke pɟe-da ɖu**	=	**ŋapɟa + ɲiɟa cutãm**
(5)	**(ɲi × ko) + pɟe**	=	**ɲi**
(6)	**(ɲiɕu ko-da sum × pɟe) + ke pɟe-da sum**	=	**ɖukɟa**
(7)	**ɲiɕu ci da ke cuɖu da cuɖu**	=	**(ɟaʑi × ʑi) + ʑipɟa**
(8)	**ɲi × ɲiɕu ci da ke cutãm da gu**	=	**(____X × ɲiɕu) + copge**
(9)	____Y **+ ke ci da ʑi**	=	**ɟaɖu**
(10)	____Z **+ ke ko-da ɖu**	=	**dynɟa + sumɟa**

(a) Fill in the blanks X–Z with Dzongkha numbers.

(b) Write with digits the equalities (1–10).

(c) Write in Dzongkha in both systems: 75; 570.

⚠ The Dzongkha language belongs to the Sino-Tibetan family. It is spoken by approx. 171,000 people in Bhutan.

The words are given in a simplified transcription. **ɖ**, **ɟ**, **ɲ**, **ŋ**, **ɕ** and **ʑ** are consonants. **ã**, **ø** and **y** are vowels. *—Vlad A. Neacşu*

Problem 2 (20 points). Here are some phrases in Gaahmg and their English translations in arbitrary order:

1. **ā fəndág**	A. *my aunts*
2. **á máámààd**	B. *his horn*
3. **á tááðà**	C. *your*$_{\text{sg}}$ *anchor*
4. **áðág ūyùg**	D. *my grandmother*
5. **āg pɛ̀bàrɛ̄ɛ̄g**	E. *our ribs*
6. **āg máàm**	F. *his hammer*
7. **ɖɔ̄ɔ̄r íinī**	G. *my grindstones*
8. **ɛ̄ îl**	H. *their grandmothers*
9. **ɛ̄ pɛ̄bārɛ̄ɛ̄g**	I. *your*$_{\text{pl}}$ *grandfathers*
10. **ɛ̄g ìlɔ̄ə̄g**	J. *my cheeks*
11. **ɛ̄g tááðàd**	K. *your*$_{\text{sg}}$ *horns*
12. **gùùr əyàn**	L. *their horns*
13. **gùùrìig ánàg**	M. *your*$_{\text{sg}}$ *uncle*
14. **ɔ́ ābɛ́ɛ́**	N. *our grindstone*
15. **ɔ̄ bɔ̄ɔ̄ràà**	O. *your*$_{\text{pl}}$ *elbows*
16. **ɔ̄ ílàəg**	P. *his ribs*
17. **ɔ̄g tùndùlīīg**	Q. *your*$_{\text{sg}}$ *shoulder*
18. **ɔ̄g məəðáəd**	R. *his anchors*
19. **ʈɛ́ɛ̀l úùn**	S. *our aunt*
20. **ʈɛ́ɛ́lààg ínìgī**	T. *your*$_{\text{pl}}$ *dogs*

(a) Determine the correct correspondences.

(b) Based on the above data, you might think that the phrases **ɛ̄ tááðà** and **ɛ̄ məəð** would be incorrect, but in fact, they are correct. Translate the phrases and explain why they are unexpected.

(c) Translate to English:

21. **āg bɔ̀ɔ̀rāāg**
22. **ɖɔ̄ɔ̄rɛ́ɛ̄g əyàg**
23. **ɛ̄ bɔ̄ɔ̄rààg**
24. **ɔ̄ túndúlìig**
25. **ɔ́ máàm**

(d) Translate to Gaahmg:

26. *my grindstone*
27. *their cheeks*
28. *your*$_{\text{pl}}$ *anchor*
29. *our uncle*
30. *your*$_{\text{sg}}$ *dogs*

⚠ The Gaahmg language belongs to the Eastern Sudanic family. It is spoken by approx. 100,000 people in the southeastern part of Sudan. **a** ≈ *a* in *father*, **ə** = *a* in *about*, **ɛ** = *e* in *bed*, **i** = *ee* in *see*, **ɔ** ≈ *o* in *lord*, **u** ≈ *oo* in *pool*. Signs above a vowel indicate tone: ˊ = high, ¯ = mid, ˋ = low, ˆ = falling. Double vowels are pronounced long. Other letters denote consonants.

In this problem, *horn* refers to the horn on the heads of some animals. —*David Hultman*

Problem 3 (20 points). Here are some sentences in Kuria and their English translations:

1. **aaha** — *He has given (something).*
2. **aaβină** — *He has sung (something).*
3. **asáámba** — *He burns (something).*
4. **nnaasyá** — *Indeed, I have ground (something).*
5. **mbaaβúna** — *Indeed, they have broken (something).*
6. **toraroma** — *We are about to bite (something).*
7. **ndasukură** — *I am about to rub (something).*
8. **toosaambá** — *We have burned (something).*
9. **ndasiitaáka** — *I am about to accuse (someone).*
10. **naaturuúŋána** — *I have welcomed (someone).*
11. **βahóótóótéra** — *They reassure (someone).*
12. **tookoondókóra** — *We have uncovered (something).*
13. **ndaroma itʃíímbéɣo** — *I am about to bite the seeds.*
14. **naarya eɣétóókɛ** — *I have eaten the banana.*
15. **naaryá éɣétóókɛ** — *Indeed, he has eaten the banana.*
16. **toraβiima áβáánto** — *We are about to measure the people.*
17. **ndarya iritáárákímúra** — *I am about to eat the secretary bird.*
18. **torakoondokórá áɣátʃúβa** — *We are about to uncover the bottle.*
19. **ntúrúúŋáná írítáárákímúra** — *I welcome the secretary bird.*

(a) In (20) is a Kuria sentence with tone marking removed, and with its translation. Mark the correct tones.

20. **aheetoka** — *He remembers (something).*

(b) Translate to English:

21. **βaasukurá**
22. **toosya itʃíímbéɣo**
23. **ndóma**
24. **naaβína**

(c) Translate to Kuria:

25. *We are about to eat the seeds.*
26. *I sing (something).*
27. *Indeed, we have measured the secretary bird.*
28. *We are about to burn (something).*
29. *He has remembered (something).*

⚠ The Kuria language belongs to the Eastern Bantu group of the Atlantic-Congo family. It is spoken by approx. 500,000 people in Migori County in southwest Kenya and in the Mara Region in northwest Tanzania.

Signs above a vowel indicate tone: ˊ = high, ˇ = rising. All other vowels have low tone. Two consecutive vowels are treated as separate, rather than as one long vowel, for the purpose of tone assignment. **β** is like *v* in *vine*, but pronounced with the lips held together. **ɣ** is like *ch* in *Bach*, but pronounced with vibration of the vocal folds. **ŋ** = *ng* in *sing*. **ʧ** = *ch* in *church*. **y** = *y* in *yacht*. **ɛ** and **ɔ** are vowels.

A secretary bird is a bird found in sub-Saharan Africa. —*Eimear McKnight*

Problem 4 (20 points). Here are some phrases in Kewa and their English translations:

1.	**repena-ini**	*coals of a fire*	8.	**ki-komaa**	*whole arm*
2.	**mena-iri**	*tough grass*	9.	**repena-agaa**	*headlights*
3.	**ora adaa poripu**	*tempest*	10.	**orada dia**	*it is not true*
4.	**mena-irikai**	*animals*	11.	**yagaa-iri**	*beard, whiskers (of an animal)*
5.	**naakina ini-agaa**	*boy's face*	12.	**repena ene**	*swelling on a tree*
6.	**adaa ki**	*middle finger*	13.	**adaa-agaa**	*mother tongue, Kewa language*
7.	**yaa-apaa**	*bird's egg*	14.	**balina aga**	*maize*

(a) Match the Kewa words and phrases below (15–39) with their translations (A–Y).

15.	**ada-mena**	20.	**ini apaa**	25.	**mena-ki**	30.	**ora-agaa**	35.	**repena-uni**
16.	**adaa naaki**	21.	**ki-ene**	26.	**mena-yagaa**	31.	**poripu-agaa**	36.	**suku**
17.	**aga-ini**	22.	**komaa**	27.	**nina irikai**	32.	**poripu**	37.	**uni nala**
18.	**agaa nala**	23.	**mena uni**	28.	**nogona ki**	33.	**repena suku**	38.	**yaa-ada**
19.	**balina agaa**	24.	**mena-ada**	29.	**ora pamoagae**	34.	**repena-boke**	39.	**yaa-agaa**

A. *pig thigh*
B. *bird's beak*
C. *my dog*
D. *domesticated pig*
E. *hole in a tree*
F. *wind*
G. *pig sty*
H. *upper arm*
I. *pig bone*
J. *sticks*
K. *truth*
L. *toothache*
M. *bright flames*
N. *big boy*
O. *eyeball*
P. *very old woman*
Q. *pig's jawbone*
R. *bird's nest*
S. *bone ache*
T. *pandanus nut*
U. *gossip*
V. *girl's hand*
W. *English language*
X. *shiny thing*
Y. *joint of the arm*

(b) Translate to English, giving multiple translations only where necessary:

40. **repena**
41. **agaa**
42. **iri**
43. **yagaa**
44. **nida dia**
45. **yaa-iri**
46. **nogo-naaki**

(c) Translate to Kewa:

47. *white man*
48. *bone*
49. *seed of a tree*
50. *hole*
51. *very big*
52. *pandanus*
53. *old woman's eye*

One has the same form as one of (1–39).

⚠ No additional explanation besides the answers is required, nor will be marked.

The Kewa language belongs to the Engan branch of the Trans-New Guinea family. It is spoken by approx. 100,000 people in the Southern Highlands province of Papua New Guinea. Kewa has tones, but these are not usually written down. The difference between separating words by a hyphen or a space is not relevant to the solution of the problem.

Pandanus is a genus of trees that includes species whose nuts can be harvested once a year. The pandanus nut and its harvest are very important to Kewa people. Maize is not a native crop of New Guinea.

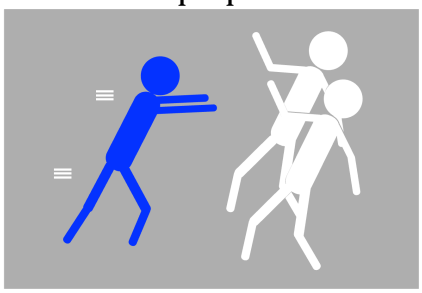
English is an official language of Papua New Guinea, introduced under Australian rule.

—Samuel Ahmed

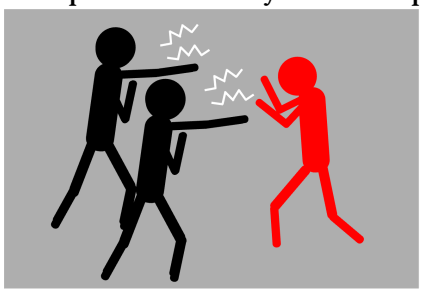
Problem 5 (20 points). In one psycholinguistics study, native speakers of Kaqchikel undertook a task in which they repeatedly had to judge whether a sentence they heard accurately described a picture they saw. While participants were listening to the sentences, their brain activity was recorded using functional Magnetic Resonance Imaging (fMRI). The researchers were interested in measuring activity in two brain regions: the frontal cortex and the auditory cortex. Higher activity in the frontal cortex can signal that the sentence is more difficult to process. Higher activity in the auditory cortex can signal that the sound is surprising or unexpected.

Below are some pictures similar to the ones participants saw paired with Kaqchikel sentences that accurately describe the pictures. Some parts of the sentences have been replaced with gaps.

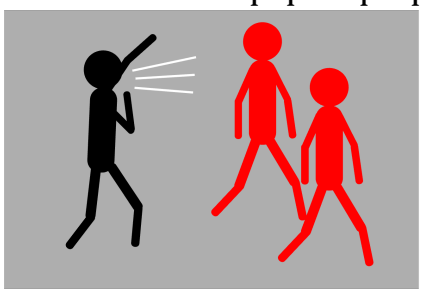
1. **Xerunïm ri taq säq ri xar**



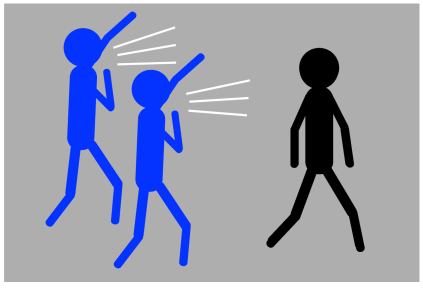
2. **Ri taq** _[A]_ **xkich'äy** _[B]_ **käq**



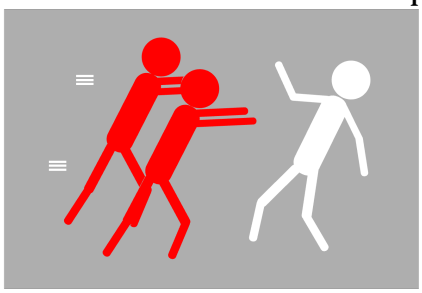
3. _____[C]_____ **ri q'ëq ri taq käq**



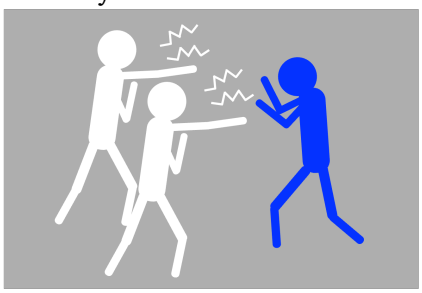
4. **Ri q'ëq xkoyoj** _____[D]_____



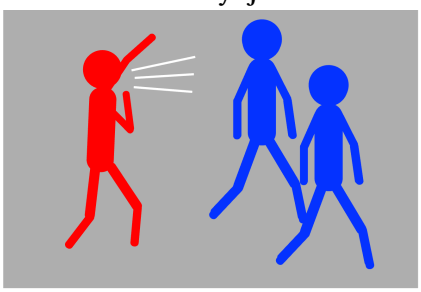
5. _____[E]_____ **ri säq**



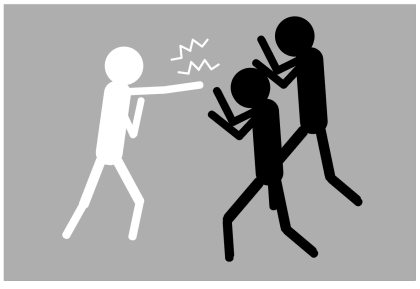
6. **Xkich'äy** _____[F]_____



7. ____[G]____ **xeroyoj** ____[H]____



8. _____[I]_____



Below is a table containing the brain activity pattern one would expect for the sentence–picture pairs above, based on the results of the original study.

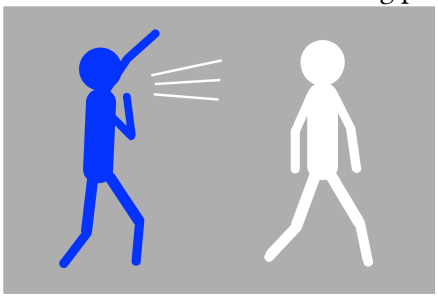
Sentence number	Frontal Cortex (activity)	Auditory Cortex (activity)
1	lower	higher
2	lower	lower
3	higher	higher
4	higher	lower
5	higher	higher
6	lower	higher
7	higher	lower
8	lower	lower

(a) Fill in the blanks A–I.

(b) Draw all the possible pictures that the following sentences could describe, or write equivalent verbal descriptions:

9. **Ri taq säq xkinïm ri q'ëq**
10. **Xekich'äy ri taq xar ri taq käq**

(c) Write all the possible Kaqchikel sentences that could describe the following picture:



(d) What activity levels in the frontal and auditory cortices do you predict for the following sentences? If there is an activity level you cannot predict, explain why not.

11. **Xeruq'etey ri käq ri taq q'ëq**
12. **Xerachik'aj ri taq säq ri xar**
13. **Ri taq q'ëq xekitz'ët ri taq säq**

⚠ The Kaqchikel language belongs to the Quichean-Mamean branch of the Mayan family. It is spoken by approx. 500,000 people in central Guatemala. **ch'**, **k'**, **q'** and **tz'** are consonants. **ä**, **ë** and **ï** are vowels. *—Dan-Mircea Mirea*

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Good luck!

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Answer sheet: **Problem 2**

(a)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

(b)

- **ɛ̄ tááðà** — _____
- **ɛ̄ məə̄ð** — _____

(c)

21. **āg bɔ̀ɔ̀rāāg** — _____
22. **ɖɔ̄ɔ̄rɛ́ɛ̄g āyàg** — _____
23. **ɛ̄ bɔ̄ɔ̄rààg** — _____
24. **ɔ̄ túndúlìig** — _____
25. **ɔ́ máàm** — _____

(d)

26. *my grindstone* — _____
27. *their cheeks* — _____
28. *your*$_{\text{pl}}$ *anchor* — _____
29. *our uncle* — _____
30. *your*$_{\text{sg}}$ *dogs* — _____

en(A)

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Answer sheet: **Problem 4**

⚠ No additional explanation besides the answers is required, nor will be marked.

(a)

15	16	17	18	19
20	21	22	23	24
25	26	27	28	29
30	31	32	33	34
35	36	37	38	39

(b)

40. **repena** — _____
41. **agaa** — _____
42. **iri** — _____
43. **yagaa** — _____
44. **nida dia** — _____
45. **yaa-iri** — _____
46. **nogo-naaki** — _____

(c)

47. *white man* — _____
48. *bone* — _____
49. *seed of a tree* — _____
50. *hole* — _____
51. *very big* — _____
52. *pandanus* — _____
53. *old woman's eye* — _____