Критерии оценивания и решения заданий заключительного этапа по направлению «Лингвистика: теория языка»

Задания по направлению состояли только из инвариантной части. Для того, чтобы претендовать на статусы медалиста, дипломанта I, II, III степени, участникам необходимо набрать наибольшее число баллов за все задания.

Номер задания	Максимальный балл	Учёт в рейтинге по направлению
1. Canon problem	40	✓
2. Don't go problem	60	✓

Task 1

Part 1 (max. 15 points)

> Prove that, after some time, the number of groups singing the anthem in unison will become fixed.

When two singers are adjacent and the singer behind has a faster pace, that faster singer will eventually catch up to the slower singer in front. Once they meet, the faster singer must adopt the slower singer's pace, and from then on, they sing together as one group. Crucially:

1. **No group ever splits once formed.** Because a faster singer adopts a slower pace, a group can only stay the same or merge with another group; it cannot break apart.
2. **The number of convicts is finite.** Therefore, only a finite number of merges can occur — there simply aren't enough singers for infinitely many pairwise catch-ups to happen one after another.
3. **No two paces are equal, and none is 0 or 1.** These conditions ensure that every catch-up, if it happens, occurs at a definite (finite) time.

As a result, there comes a moment after which no further catch-ups are possible. From that point on, the number of unison groups is *fixed*.

Important Clarification

A key detail is that a faster singer catches up *only* to the slower singer directly in front of them. Although it may seem obvious that faster singers will continue catching slower ones, a precise

formulation must specify that they catch the *nearest* slower singer ahead. Once merged, they no longer move faster, so they cannot "jump" to catch someone else further ahead at a later stage.

Criteria

- **15 points** were awarded for a correct, accurate proof of why the final number of groups becomes fixed.
- Up to **7.5 points** could be deducted for formulations that were incomplete or missed the crucial detail that a singer only merges with the directly preceding singer (or group) if the pace behind is faster.
- Any reasonable proof (for example, through induction) that stated these ideas rigorously — finite merges, no splitting, and finite time catch-ups — received full points.

Part 2 (max. 25 points).

Calculate the expected number (expected value** of the number) of such groups

We will focus on one detailed proof below, though all rigorously argued solutions rest on the same core ideas and were equally accepted.

Label the singers from left to right as 1,2,…,n. The leftmost singer (person 1) is the one who started singing last, and the rightmost singer (person n) is the one who started singing first. Let the pace of the i-th singer (from the left) be v_i. Because all v_i are chosen randomly and distinctly from (0, 1), we can think of $(v_1,\ldots,v_n)$ as a random permutation of n different numbers in (0,1).

Let's look from **right to left** (i. e. from first to last):

1. Start with the rightmost singer (person n). They form a group by themself initially.
2. Move one step to the left (person $n-1$), compare pace v_{n-1} to the pace of the group on the right.
    - If $v_{n-1}>v_n$, then person $(n-1)$ eventually *catches up* to the rightmost person's group (since $(n-1)$ sings faster and will meet them in the text). After they meet, they stay together.
    - If $v_{n-1}<v_n$, then person $(n-1)$ never gets caught (because the one on the right is slower and can't "reach back" through the text). Hence $(n-1)$ continues alone in the long run, forming a *separate* final group.

3. Then consider person (n−2), and so on, step by step to the left until you reach the first singer.

In this procedure, whenever you find a singer whose pace is **smaller** than every group's pace to the right, that singer **remains alone** and forms a *new* final group. If instead the singer has a pace larger than or equal to an existing group on the right, they will merge with the first such slower group.

Hence, the final number of groups is exactly the number of times (from right to left) that we encounter a pace *strictly smaller* than *all* paces we have seen so far to the right.

In a random permutation of n distinct values ($v_1,\ldots,v_n$), each position k (when read from right to left) has a $\frac{1}{k}$ probability of containing the new smallest value among the first k values considered because each arrangement of the first k elements is equally likely. By summing these probabilities across all k from 1 to n, we get:

$$E(record\ lows) = \sum_{k=1}^{n} \frac{1}{k} = 1 + \frac{1}{2} + \frac{1}{3} + \ldots + \frac{1}{n}$$

This sum is the n-th harmonic number, denoted H_n.

Criteria

1. Identifying the Final Number of Groups as Record Lows (**10 Points**)

- Clearly explains that the final number of unison groups is exactly the count of paces that are strictly smaller than all paces to their right (i.e., “record-low” paces when read from right to left).

- Correctly shows why faster singers merge with the first slower group to their right, ensuring that each “new” slower pace remains a separate group.

- Up to **5 points** deducted if the connection between merging mechanics and “record lows” is not made or is only vaguely stated.

2. Derivation of the Harmonic Sum for the Expected Value (**15 Points**)

- Clearly demonstrates that each position in a random permutation has a $\frac{1}{k}$ chance of being the new minimum among the first k values (when looking from right to left, or an equivalent argument).

- Sums up these probabilities to obtain $\sum_{k=1}^{n} \frac{1}{k}$, the n-th harmonic number.
- Most Critical Step: Explaining *why* the probability is $\frac{1}{k}$ and explaining why the probabilities should be summed.
- Points Deducted if:
    - The harmonic sum appears without justification.
- Up to **5 points** deducted if the explanation is confusing or incomplete, making the logic hard to verify.

Task 2

Part 1

From Table 1, note the inventory of the derivational stems in the three languages:

- Archi: *primary* (unmarked), *imperfective*, *perfective*
- Mehweb: *perfective* and *imperfective*
- Avar: *primary* (unmarked) and *habitual*

Table 2 provides all available forms of positive and negative imperatives. We see that:

- In Archi, the positive imperative is derived from the unmarked stem, while the negative imperative is derived from the imperfective stem.
- In Mehweb, the positive imperative is derived both from the perfective and the imperfective stem, while the negative imperative is only derived from the imperfective stem.
- In Avar, the positive imperative is derived from the unmarked stem, and the negative imperative is derived from the habitual stem.

Positive commands in all languages are formed from primary stems regardless of their aspectual status. In contrast, negative commands are only formed from the imperfective stem. Here, we rely on the idea that habitual is a specific type of imperfective meaning; in some languages a general imperfective form may historically develop in a habitual one. We thus establish the following constraints:

1. Positive imperatives tend to be formed from primary stems.
2. Negative imperatives (prohibitives) tend to be formed from imperfective stems.

In a larger pool of data, this statement may not hold — in Lak, negative imperatives are formed from all three verbal stems, perfective, imperfective and iterative — but this certainly holds as a very strong tendency.

It is important to emphasize that the constraints on positive and negative commands are independent and should not be described using the same terms:

- In Mehweb, positive imperatives derive from both aspectually marked stems, suggesting that aspect alone does not constrain the formation of positive imperatives.

- In Archi, only the unmarked stem can form the positive imperative, supporting the idea that positive commands are most directly tied to morphological status (i.e. primary vs. derived), rather than aspect.

On the other hand, it is not the case that negative imperatives always derive from derived stems:

- In Mehweb, both stems are primary, but only the imperfective stem forms the negative imperative.

- In Archi, although both the perfective and imperfective stems are derived, only the imperfective one can form the prohibitive.

Thus, while primary stems tend to be unmarked or perfective, and derived stems often carry imperfective meaning, this is a tendency, not a rule.

Part 2

There is no clear parallel in Russian for the first generalization (about positive imperatives and primary stems), since in Russian, aspect is a derivational category, and the concept of "primary stem" is not clearly morphologically defined.

However, negative commands in Russian are by far more frequent in the corpus when formed from imperfective verbs.

- The Russian National Corpus shows that imperfective verbs appear about six times more often than perfective verbs in negative imperative constructions.
- Conversely, in positive imperatives, perfective verbs are slightly more frequent (by around 10%).

In addition, negative imperatives formed from perfective verbs often acquire extra semantic nuances, such as apprehensive meaning (e.g., Не упади! 'Don't fall!'), which further supports the idea that perfective forms are marked in the context of prohibitions. This pattern is consistent with the tendency observed in the Daghestanian data.

Part 3

In typology and in linguistics in general, motivations are a dangerous path to follow. Different frameworks would probably suggest different motivations. We are open to consider different ideas.

1. Positive imperatives tend to be formed from primary stems.

Positive commands are highly frequent in discourse. Cross-linguistically, they tend to be formally minimal, often using bare stems with little or no additional morphology. This may explain why East Caucasian languages prefer primary (unmarked) stems for positive imperatives — these stems provide the least marked, most economical morphological base.

2. Negative imperatives (prohibitives) tend to be formed from imperfective stems.

One possible motivation is this: the connection between negative imperative and imperfectivity may reflect the real life fact that a *prohibition to do something* tends to have a larger time span than *inducement to do something* which may - or may not - be limited to the specific speech act situation.

It is common to have a prohibition on engagement in a repetitive situation (*И не звони мне больше!*) or to convey universal principles of avoidance (*С любимыми не расставайтесь!*). This connection is so strong that even with prohibitions that apply to one specific situation the imperfective imperative may substitute the expected perfective one (*Не пей вина, Гертруда!*, where the negative command applies to one specific goblet - the fact played upon later in the lines *Не пей вина, Гертруда! Пьянство не красит дам*, with the first line being a direct quote which is then necessarily reanalyzed as habitual in the context that follows).

In contrast, the command to do something is equally possible as an inducement to do something here and now, in this specific situational context (*Поговори хоть ты со мной, Гитара семиструнная!*), more generally (*Ты, говорит, ходи, говорит, Ко мне, говорит, почаще, — Ты, говорит, носи, говорит, Пряники послаще*).

Criteria

<u>Part 1 (max. 20 points)</u>

- +10 points – The participant correctly notes that positive imperatives are formed from primary stems.
    - –5 points – Deducted if the participant incorrectly formulates this generalization in terms of aspectual status.
- +10 points – The participant correctly observes that negative imperatives (prohibitives) are derived from imperfective stems.
    - –5 points – Deducted if the participant incorrectly explains prohibitives in terms of morphological (derivational) status of the stem.

- +5 points – Awarded if the participant discusses the idea that the habitual aspect is a subtype or semantic variant of the imperfective.

Note: Formulating both generalizations correctly and without the penalized misconceptions is sufficient to receive the full 20 points.

Part 2 (max. 20 points)

- +20 points – Awarded for any accurate and relevant comparison between the East Caucasian data and another language the participant knows well.

For Russian specifically:

- +10 points – The participant correctly notes that negative imperatives are typically formed from imperfective verbs.

- +10 points – The participant adds that negative imperatives formed from perfective verbs are possible, but tend to carry specialized meanings, such as apprehension or warning.

Part 3 (max. 20 points)

- +5 points – Given for a plausible and coherent motivation for the formation of positive imperatives.

- +15 points – Given for a well-reasoned motivation for the tendency to use imperfective stems in prohibitives.

General Deductions

- Up to –10 points – May be deducted for the incorrect use of linguistic terminology, unjustified claims, or factually inaccurate statements.