Garo to English School Dictionary and the Graphical law

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Abstract

We study a Garo to English School Dictionary. We draw the natural logarithm of the number of entries, normalised, starting with a letter vs the natural logarithm of the rank of the letter, normalised. We conclude that the Dictionary can be characterised by BP(4,$\beta H = 0.02$) i.e. a magnetisation curve for the Bethe-Peierls approximation of the Ising model with four nearest neighbours with $\beta H = 0.02$. β is $\frac{1}{k_B T}$ where, T is temperature, H is external magnetic field and k_B is the Boltzmann constant.

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I. INTRODUCTION

Garo people comes from Garo Hills of Meghalaya, India. The people are referred to as Garos, their language is known as Garo. "Bachi?" meaning where, "cha.a ringa?" meaning to eat and drink, "da.al nama?" meaning "are you fine today?", are the commonest way of conversations among them. A common man smiles as he talks. They laugh profusely. There are twelve clans. Am.beng, A.we, etc; four surnames; plenty of middle names, each referring to one ancestral place in the Garo Hills. Each clan has their respective places. A.we comes from Rishibelpara. The dialects vary as one goes from one region to another. The Rishibelpara dialect is the "official" version. In this language, "Balgito" means a lily, "Miktoksi" means a white flowering small tree, "boka" means white, "salanti" means everyday, "salaram" means the east, "janera" means a mirror, "grit" means a sugarcane, "matcha" means a tiger, "matchu" means a bull.

In this article, we try to do a thorough study of magnetic field pattern behind a dictionary of the Garo language,[1]. We have started considering magnetic field pattern in [2], in the languages we converse with. We have studied there, a set of natural languages, [2] and have found existence of a magnetisation curve under each language. We have termed this phenomenon as graphical law. Then, we moved on to investigate into, [3], dictionaries of five disciplines of knowledge and found existence of a curve magnetisation under each discipline. This was followed by finding of the graphical law behind the bengali language,[4] and the basque language[5]. This was pursued by finding of the graphical law behind the Romanian language, [6], five more disciplines of knowledge, [7], Onsager core of Abor-Miri, Mising languages,[8], Onsager Core of Romanised Bengali language,[9], the graphical law behind the Little Oxford English Dictionary, [10], the Oxford Dictionary of Social Work and Social Care, [11] and the Visayan-English Dictionary, [12], respectively.

In our first paper, [2], we have studied the Garo to English School Dicionary,[1]. There we took resort to average counting i.e. finding an average number of words par page and multiplying by the number of pages corresponding to a letter we obtained the number of words starting with a letter. We deduced that the dictionary,[1], is characterised by BP(4,βH=0.01). Here, in this paper we leave behind the approximate method. We count thoroughly, one by one each word. Moreover, we augment the analysis. But the conclusion is very close to that of [2]. We conclude here, that the dictionary can be characterised by

BP(4,βH=0.02). It is desirable that this analysis is to be followed for other Garo language dictionaries to find out whether the same conclusion one reaches to for all of those.

The planning of the paper is as follows. We give an introduction to the standard curves of magnetisation of Ising model in the section II. In the section III, we describe analysis of the entries of the Garo language, [1]. Sections IV, V are Acknowledgement and Bibliography respectively.

II. MAGNETISATION

A. Bragg-Williams approximation

Let us consider a coin. Let us toss it many times. Probability of getting head or, tale is half i.e. we will get head and tale equal number of times. If we attach value one to head, minus one to tale, the average value we obtain, after many tossing is zero. Instead let us consider a one-sided loaded coin, say on the head side. The probability of getting head is more than one half, getting tale is less than one-half. Average value, in this case, after many tossing we obtain is non-zero, the precise number depends on the loading. The loaded coin is like ferromagnet, the unloaded coin is like paramagnet, at zero external magnetic field. Average value we obtain is like magnetisation, loading is like coupling among the spins of the ferromagnetic units. Outcome of single coin toss is random, but average value we get after long sequence of tossing is fixed. This is long-range order. But if we take a small sequence of tossing, say, three consecutive tossing, the average value we obtain is not fixed, can be anything. There is no short-range order.

Let us consider a row of spins, one can imagine them as spears which can be vertically up or, down. Assume there is a long-range order with probability to get a spin up is two third. That would mean when we consider a long sequence of spins, two third of those are with spin up. Moreover, assign with each up spin a value one and a down spin a value minus one. Then total spin we obtain is one third. This value is referred to as the value of long-range order parameter. Now consider a short-range order existing which is identical with the long-range order. That would mean if we pick up any three consecutive spins, two will be up, one down. Bragg-Williams approximation means short-range order is identical with long-range order, applied to a lattice of spins, in general. Row of spins is a lattice of one dimension.

Now let us imagine an arbitrary lattice, with each up spin assigned a value one and a down spin a value minus one, with an unspecified long-range order parameter defined as above by $L = \frac{1}{N}\Sigma_i\sigma_i$, where σ_i is i-th spin, N being total number of spins. L can vary from minus one to one. $N = N_+ + N_-$, where N_+ is the number of up spins, N_- is the number of down spins. $L = \frac{1}{N}(N_+ - N_-)$. As a result, $N_+ = \frac{N}{2}(1+L)$ and $N_- = \frac{N}{2}(1-L)$. Magnetisation or, net magnetic moment , M is $\mu\Sigma_i\sigma_i$ or, $\mu(N_+ - N_-)$ or, μNL, $M_{max} = \mu N$. $\frac{M}{M_{max}} = L$. $\frac{M}{M_{max}}$ is referred to as reduced magnetisation. Moreover, the Ising Hamiltonian,[13], for the lattice of spins, setting μ to one, is $-\epsilon\Sigma_{n.n}\sigma_i\sigma_j - H\Sigma_i\sigma_i$, where n.n refers to nearest neighbour pairs. The difference $\triangle E$ of energy if we flip an up spin to down spin is, [14], $2\epsilon\gamma\bar{\sigma} + 2H$, where γ is the number of nearest neighbours of a spin. According to Boltzmann principle, $\frac{N_-}{N_+}$ equals $exp(-\frac{\triangle E}{k_B T})$, [15]. In the Bragg-Williams approximation,[16], $\bar{\sigma} = L$, considered in the thermal average sense. Consequently,

$$ln\frac{1+L}{1-L} = 2\frac{\gamma\epsilon L + H}{k_B T} = 2\frac{L + \frac{H}{\gamma\epsilon}}{\frac{T}{\gamma\epsilon/k_B}} = 2\frac{L+c}{\frac{T}{T_c}} \quad (1)$$

where, $c = \frac{H}{\gamma\epsilon}$, $T_c = \gamma\epsilon/k_B$, [17]. $\frac{T}{T_c}$ is referred to as reduced temperature.
Plot of L vs $\frac{T}{T_c}$ or, reduced magentisation vs. reduced temperature is used as reference curve. In the presence of magnetic field, $c \neq 0$, the curve bulges outward. Bragg-Williams is a Mean Field approximation. This approximation holds when number of neighbours interacting with a site is very large, reducing the importance of local fluctuation or, local order, making the long-range order or, average degree of freedom as the only degree of freedom of the lattice. To have a feeling how this approximation leads to matching between experimental and Ising model prediction one can refer to FIG.12.12 of [14]. W. L. Bragg was a professor of Hans Bethe. Rudlof Peierls was a friend of Hans Bethe. At the suggestion of W. L. Bragg, Rudlof Peierls following Hans Bethe improved the approximation scheme, applying quasi-chemical method.

B. Bethe-peierls approximation in presence of four nearest neighbours, in absence of external magnetic field

In the approximation scheme which is improvement over the Bragg-Williams, [13],[14],[15],[16],[17], due to Bethe-Peierls, [18], reduced magnetisation varies with reduced temperature, for γ

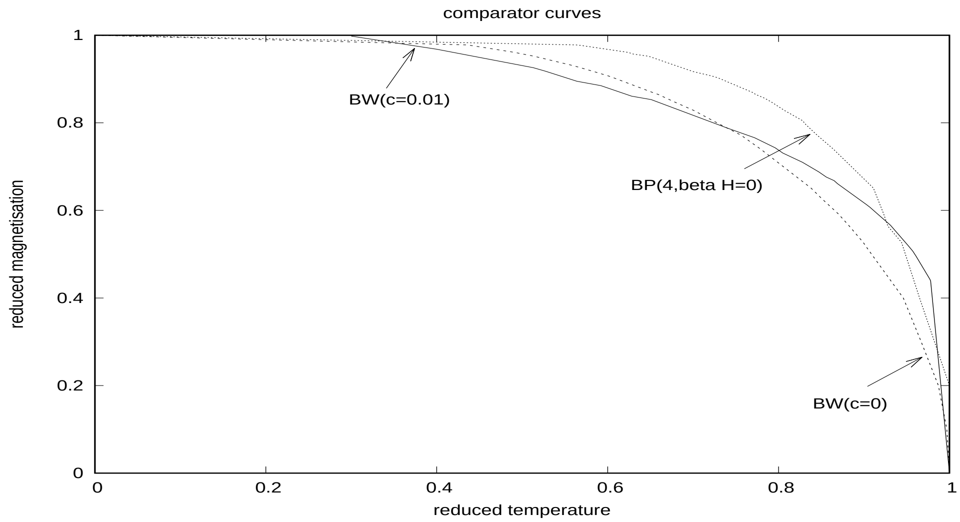

FIG. 1. Reduced magnetisation vs reduced temperature curves for Bragg-Williams approximation, in absence(dark) of and presence(inner in the top) of magnetic field, $c = \frac{H}{\gamma\epsilon} = 0.01$, and Bethe-Peierls approximation in absence of magnetic field, for four nearest neighbours (outer in the top).

neighbours, in absence of external magnetic field, as

$$\frac{ln\frac{\gamma}{\gamma-2}}{ln\frac{factor-1}{factor^{\frac{\gamma-1}{\gamma}}-factor^{\frac{1}{\gamma}}}} = \frac{T}{T_c}; factor = \frac{\frac{M}{M_{max}}+1}{1-\frac{M}{M_{max}}}. \tag{2}$$

$ln\frac{\gamma}{\gamma-2}$ for four nearest neighbours i.e. for $\gamma = 4$ is 0.693. For a snapshot of different kind of magnetisation curves for magnetic materials the reader is urged to give a google search "reduced magnetisation vs reduced temperature curve". In the following, we describe datas generated from the equation(1) and the equation(2) in the table, I, and curves of magnetisation plotted on the basis of those datas. BW stands for reduced temperature in Bragg-Williams approximation, calculated from the equation(1). BP(4) represents reduced temperature in the Bethe-Peierls approximation, for four nearest neighbours, computed from the equation(2). The data set is used to plot fig.1. Empty spaces in the table, I, mean corresponding point pairs were not used for plotting a line.

BW	BW(c=0.01)	BP(4,βH = 0)	reduced magnetisation
0	0	0	1
0.435	0.439	0.563	0.978
0.439	0.443	0.568	0.977
0.491	0.495	0.624	0.961
0.501	0.507	0.630	0.957
0.514	0.519	0.648	0.952
0.559	0.566	0.654	0.931
0.566	0.573	0.7	0.927
0.584	0.590	0.7	0.917
0.601	0.607	0.722	0.907
0.607	0.613	0.729	0.903
0.653	0.661	0.770	0.869
0.659	0.668	0.773	0.865
0.669	0.676	0.784	0.856
0.679	0.688	0.792	0.847
0.701	0.710	0.807	0.828
0.723	0.731	0.828	0.805
0.732	0.743	0.832	0.796
0.756	0.766	0.845	0.772
0.779	0.788	0.864	0.740
0.838	0.853	0.911	0.651
0.850	0.861	0.911	0.628
0.870	0.885	0.923	0.592
0.883	0.895	0.928	0.564
0.899	0.918		0.527
0.904	0.926	0.941	0.513
0.946	0.968	0.965	0.400
0.967	0.998	0.965	0.300
0.987		1	0.200
0.997		1	0.100
1	1	1	0

TABLE I. Reduced magnetisation vs reduced temperature datas for Bragg-Williams approximation, in absence of and in presence of magnetic field, $c = \frac{H}{\gamma\epsilon} = 0.01$, and Bethe-Peierls approximation in absence of magnetic field, for four nearest neighbours .

C. Bethe-peierls approximation in presence of four nearest neighbours, in presence of external magnetic field

In the Bethe-Peierls approximation scheme , [18], reduced magnetisation varies with reduced temperature, for γ neighbours, in presence of external magnetic field, as

$$\frac{ln\frac{\gamma}{\gamma-2}}{ln\frac{factor-1}{e^{\frac{2\beta H}{\gamma}}factor^{\frac{\gamma-1}{\gamma}}-e^{-\frac{2\beta H}{\gamma}}factor^{\frac{1}{\gamma}}}} = \frac{T}{T_c}; factor = \frac{\frac{M}{M_{max}}+1}{1-\frac{M}{M_{max}}}. \tag{3}$$

Derivation of this formula ala [18] is given in the appendix of [7].

$ln\frac{\gamma}{\gamma-2}$ for four nearest neighbours i.e. for $\gamma = 4$ is 0.693. For four neighbours,

$$\frac{0.693}{ln\frac{factor-1}{e^{\frac{2\beta H}{\gamma}}factor^{\frac{\gamma-1}{\gamma}}-e^{-\frac{2\beta H}{\gamma}}factor^{\frac{1}{\gamma}}}} = \frac{T}{T_c}; factor = \frac{\frac{M}{M_{max}}+1}{1-\frac{M}{M_{max}}}. \tag{4}$$

In the following, we describe datas in the table, II, generated from the equation(4) and curves of magnetisation plotted on the basis of those datas. BP(m=0.03) stands for reduced temperature in Bethe-Peierls approximation, for four nearest neighbours, in presence of a variable external magnetic field, H, such that $\beta H = 0.06$. calculated from the equation(4). BP(m=0.025) stands for reduced temperature in Bethe-Peierls approximation, for four nearest neighbours, in presence of a variable external magnetic field, H, such that $\beta H = 0.05$. calculated from the equation(4). BP(m=0.02) stands for reduced temperature in Bethe-Peierls approximation, for four nearest neighbours, in presence of a variable external magnetic field, H, such that $\beta H = 0.04$. calculated from the equation(4). BP(m=0.01) stands for reduced temperature in Bethe-Peierls approximation, for four nearest neighbours, in presence of a variable external magnetic field, H, such that $\beta H = 0.02$. calculated from the equation(4). BP(m=0.005) stands for reduced temperature in Bethe-Peierls approximation, for four nearest neighbours, in presence of a variable external magnetic field, H, such that $\beta H = 0.01$. calculated from the equation(4). The data set is used to plot fig.2. Empty spaces in the table, II, mean corresponding point pairs were not used for plotting a line.

BP(m=0.03)	BP(m=0.025)	BP(m=0.02)	BP(m=0.01)	BP(m=0.005)	reduced magnetisation
0	0	0	0	0	1
0.583	0.580	0.577	0.572	0.569	0.978
0.587	0.584	0.581	0.575	0.572	0.977
0.647	0.643	0.639	0.632	0.628	0.961
0.657	0.653	0.649	0.641	0.637	0.957
0.671	0.667		0.654	0.650	0.952
	0.716			0.696	0.931
0.723	0.718	0.713	0.702	0.697	0.927
0.743	0.737	0.731	0.720	0.714	0.917
0.762	0.756	0.749	0.737	0.731	0.907
0.770	0.764	0.757	0.745	0.738	0.903
0.816	0.808	0.800	0.785	0.778	0.869
0.821	0.813	0.805	0.789	0.782	0.865
0.832	0.823	0.815	0.799	0.791	0.856
0.841	0.833	0.824	0.807	0.799	0.847
0.863	0.853	0.844	0.826	0.817	0.828
0.887	0.876	0.866	0.846	0.836	0.805
0.895	0.884	0.873	0.852	0.842	0.796
0.916	0.904	0.892	0.869	0.858	0.772
0.940	0.926	0.914	0.888	0.876	0.740
	0.929			0.877	0.735
	0.936			0.883	0.730
	0.944			0.889	0.720
	0.945				0.710
	0.955			0.897	0.700
	0.963			0.903	0.690
	0.973			0.910	0.680
				0.909	0.670
	0.993			0.925	0.650
		0.976	0.942		0.651
	1.00				0.640
		0.983	0.946	0.928	0.628
		1.00	0.963	0.943	0.592
			0.972	0.951	0.564
			0.990	0.967	0.527
				0.964	0.513
			1.00		0.500
				1.00	0.400
					0.300
					0.200
					0.100
					0

TABLE II. Bethe-Peierls approx. in presence of little external magnetic fields

D. Onsager solution

At a temperature T, below a certain temperature called phase transition temperature, T_c, for the two dimensional Ising model in absence of external magnetic field i.e. for H equal to zero, the exact, unapproximated, Onsager solution gives reduced magnetisation as a function of reduced temperature as, [19], [20], [21], [18],

$$\frac{M}{M_{max}} = [1 - (sinh\frac{0.8813736}{\frac{T}{T_c}})^{-4}]^{1/8}.$$

Graphically, the Onsager solution appears as in fig.3.

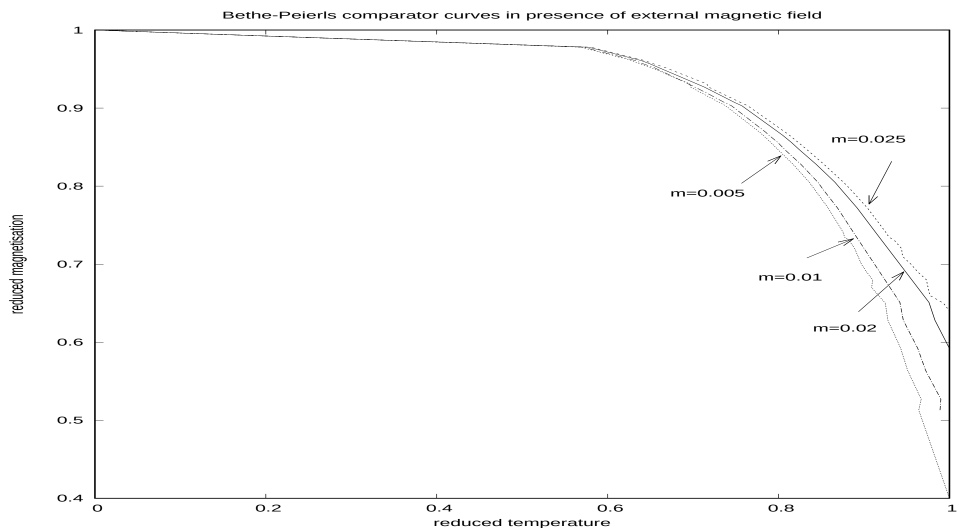

FIG. 2. Reduced magnetisation vs reduced temperature curves for Bethe-Peierls approximation in presence of little external magnetic fields, for four nearest neighbours, with $\beta H = 2m$.

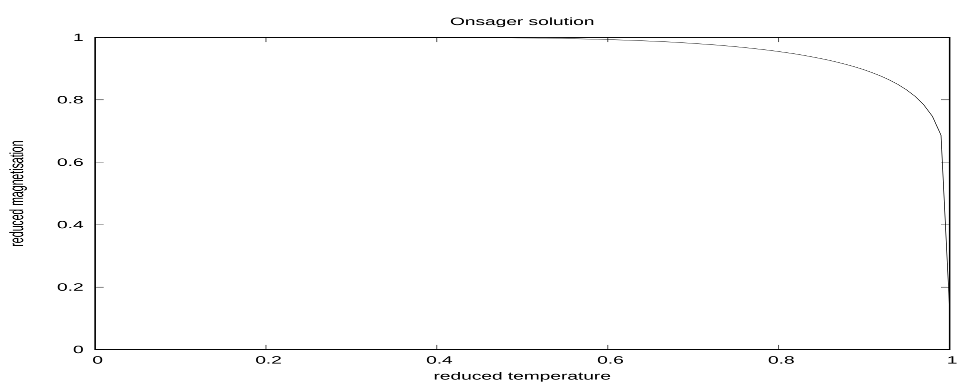

FIG. 3. Reduced magnetisation vs reduced temperature curves for exact solution of two dimensional Ising model, due to Onsager, in absence of external magnetic field

letter	A	B	C	D	E	F	G	H	I	J	K	L	M
number	1208	1456	725	683	105	0	1220	80	110	697	798	52	1261
splitting	1192+16	1435+21	695+30	653+30	105+0	0	1205+15	80+0	108+2	682+15	774+24	51+1	1234+27
letter	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
number	562	266	618	0	1414	1374	528	128	0	428	0	0	0
splitting	530+32	265+1	611+7	0	1372+42	1340+34	520+8	116+12	0	422+6	0	0	0

TABLE III. Entries of the Garo to English Dictionary: the first row represents letters of the english alphabet in the serial order, the second row is the respective number of entries, the third row describes the splitting of entries.

III. METHOD OF STUDY AND RESULTS

The Garo language written in English alphabet is composed of twenty letters. We count all the entries in the dictionary, [1], one by one from the beginning to the end, starting with different letters. This has been done in two steps for the dictionary. First, we have counted all entries initiating with A form the section for the letter A. The number is one thousand one hundred ninety two. Second, we have enlisted all entries initiating with A form the sections for the letters B, D,..,Z. Then we have removed from the list entries already appearing in the section belonging to A. Then we have counted the number of the entries in that list. The number is sixteen. As a result total number of words beginning with A is one thousand two hundred and eight. This exercise was then followed for B,C,..Z. The result is the following table, III. Highest number of entries, one thousand four hundred fifty six, starts with the letter B followed by words numbering one thousand four hundred fourteen beginning with R, one thousand three hundred seventy four with the letter S etc. To visualise we plot the number of entries against the respective letters in the figure fig.4. For the purpose of exploring graphical law, we assort the letters according to the number of words, in the descending order, denoted by f and the respective rank, [22], denoted by k. k is a positive integer starting from one. Moreover, we attach a limiting rank, k_{lim}, and a limiting number of words. The limiting rank is maximum rank plus one, here it is twenty one and the limiting number of words is one. As a result both $\frac{lnf}{lnf_{max}}$ and $\frac{lnk}{lnk_{lim}}$ varies from zero to one. Then we tabulate in the adjoining table, IV, and plot $\frac{lnf}{lnf_{max}}$ against $\frac{lnk}{lnk_{lim}}$ in the figure fig.5.

We then ignore the letter with the highest number of words, tabulate in the adjoining table, IV, and redo the plot, normalising the lnfs with next-to-maximum $lnf_{nextmax}$, and

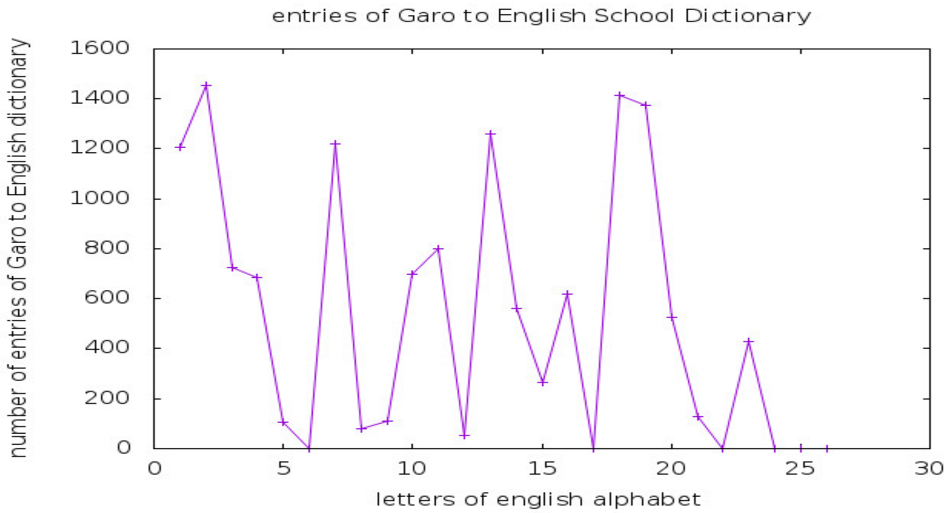

FIG. 4. Vertical axis is number of entries of the Garo to English school Dictionary,[1]. Horizontal axis is the letters of the English alphabet. Letters are represented by the sequence number in the alphabet.

starting from $k = 2$ in the figure fig.6. Normalising the lnfs with next-to-next-to-maximum $lnf_{nextnextmax}$, we tabulate in the adjoining table, IV, and starting from $k = 3$ we draw in the figure fig.7. Normalising the lnfs with next-to-next-to-next-to-maximum $lnf_{nextnextnextmax}$ we record in the adjoining table, IV, and plot starting from $k = 4$ in the figure fig.8. Normalising the lnfs with 4n-maximum lnf_{4n-max} we record in the adjoining table, IV, and plot starting from $k = 5$ in the figure fig.9. Normalising the lnfs with 5n-maximum lnf_{5n-max} we record in the adjoining table, IV, and plot starting from $k = 6$ in the figure fig.10, with 6n-maximum lnf_{6n-max} we record in the adjoining table, IV, and plot starting from $k = 7$ in the figure fig.11.

k	lnk	lnk/lnk_{lim}	f	lnf	lnf/lnf_{max}	lnf/lnf_{nmax}	lnf/lnf_{nnmax}	lnf/lnf_{nnnmax}	lnf/$lnf_{nnnnmax}$	lnf/$lnf_{nnnnnmax}$	lnf/$lnf_{nnnnnnmax}$
1	0	0	1456	7.283	1	Blank	Blank	Blank	Blank	Blank	Blank
2	0.69	0.228	1414	7.254	0.996	1	Blank	Blank	Blank	Blank	Blank
3	1.10	0.361	1374	7.225	0.992	0.996	1	Blank	Blank	Blank	Blank
4	1.39	0.455	1261	7.140	0.980	0.984	0.988	1	Blank	Blank	Blank
5	1.61	0.528	1220	7.107	0.976	0.980	0.984	0.995	1	Blank	Blank
6	1.79	0.589	1208	7.097	0.974	0.978	0.982	0.994	0.999	1	Blank
7	1.95	0.639	798	6.682	0.917	0.921	0.925	0.936	0.940	0.942	1
8	2.08	0.683	725	6.586	0.904	0.908	0.912	0.922	0.922	0.928	0.986
9	2.20	0.722	697	6.547	0.899	0.903	0.906	0.917	0.921	0.923	0.980
10	2.30	0.756	683	6.526	0.896	0.900	0.903	0.914	0.918	0.920	0.977
11	2.40	0.788	618	6.426	0.882	0.886	0.889	0.900	0.904	0.905	0.962
12	2.48	0.816	562	6.332	0.869	0.873	0.876	0.887	0.891	0.892	0.948
13	2.56	0.842	528	6.269	0.861	0.864	0.868	0.878	0.882	0.883	0.938
14	2.64	0.867	428	6.059	0.832	0.835	0.839	0.849	0.853	0.854	0.907
15	2.71	0.889	266	5.583	0.767	0.770	0.773	0.782	0.786	0.787	0.836
16	2.77	0.911	128	4.852	0.666	0.669	0.672	0.680	0.683	0.684	0.726
17	2.83	0.930	110	4.700	0.645	0.648	0.651	0.658	0.661	0.662	0.703
18	2.89	0.949	105	4.654	0.639	0.642	0.644	0.652	0.655	0.656	0.696
19	2.94	0.967	80	4.382	0.602	0.604	0.607	0.614	0.617	0.617	0.656
20	3.00	0.984	52	3.951	0.542	0.545	0.547	0.553	0.556	0.557	0.591
21	3.05	1	1	0	0	0	0	0	0	0	0

TABLE IV. Entries of the Garo to English Dictionary: ranking, natural logarithm, normalisations

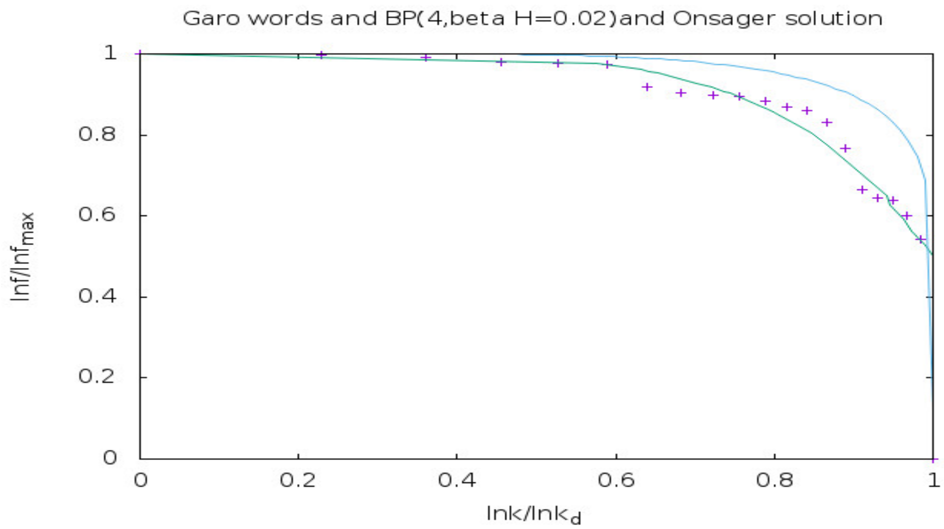

FIG. 5. Vertical axis is $\frac{lnf}{lnf_{max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Garo language with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.01$ or, $\beta H = 0.02$. The uppermost curve is the Onsager solution.

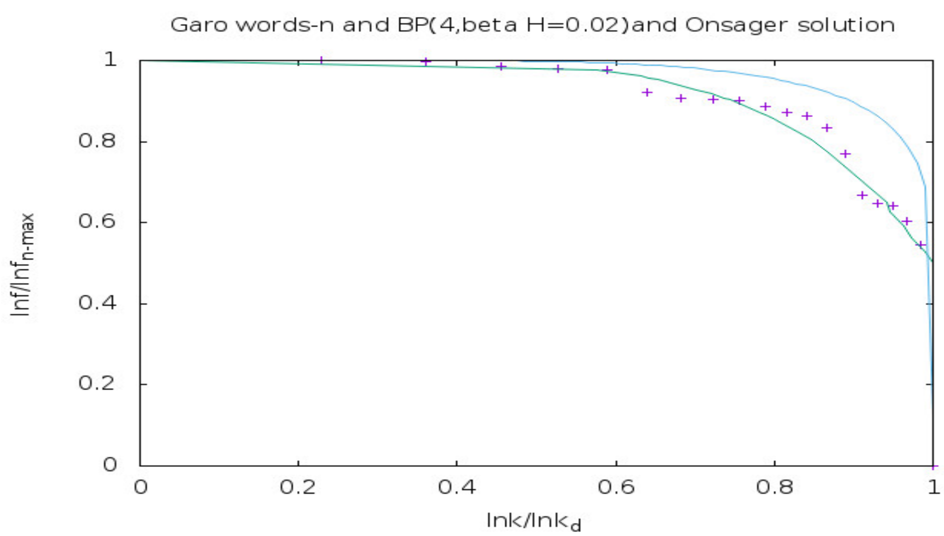

FIG. 6. Vertical axis is $\frac{lnf}{lnf_{next-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Garo language with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.01$ or, $\beta H = 0.02$. The uppermost curve is the Onsager solution.

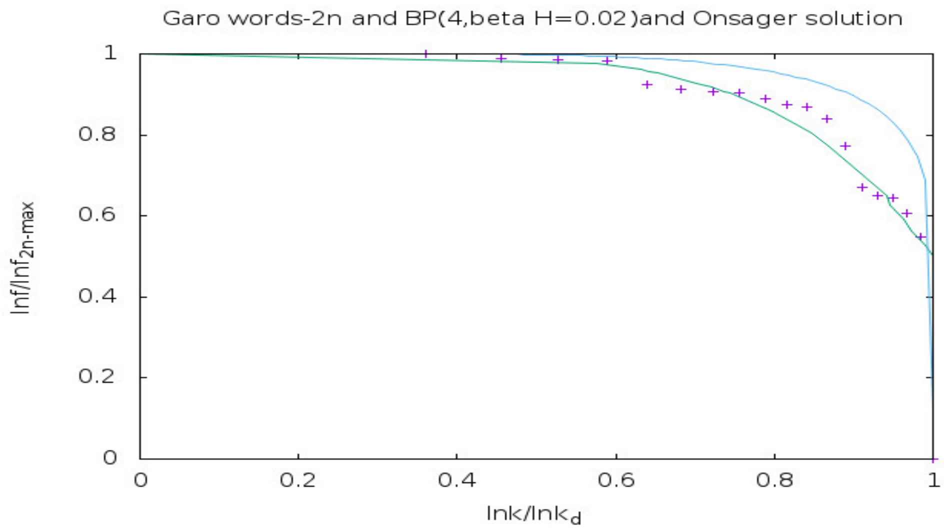

FIG. 7. Vertical axis is $\frac{lnf}{lnf_{nn-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Garo language with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.01$ or, $\beta H = 0.02$. The uppermost curve is the Onsager solution.

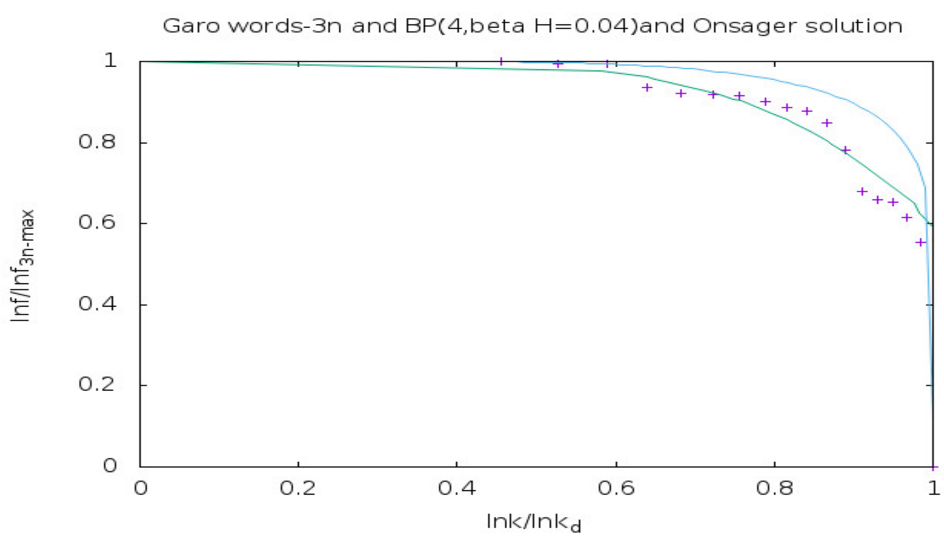

FIG. 8. Vertical axis is $\frac{lnf}{lnf_{nnn-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Garo language with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.02$ or, $\beta H = 0.04$. The uppermost curve is the Onsager solution.

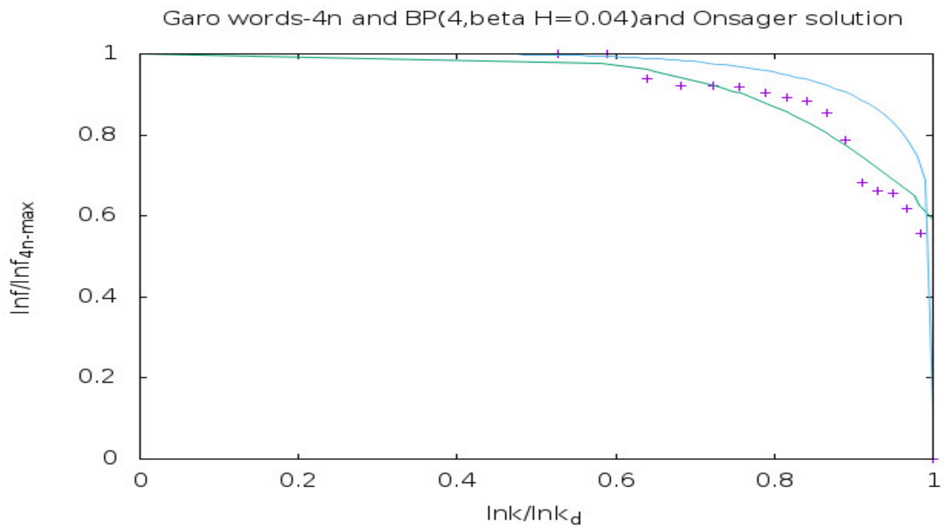

FIG. 9. Vertical axis is $\frac{lnf}{lnf_{nnnn-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Garo language with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.02$ or, $\beta H = 0.04$. The uppermost curve is the Onsager solution.

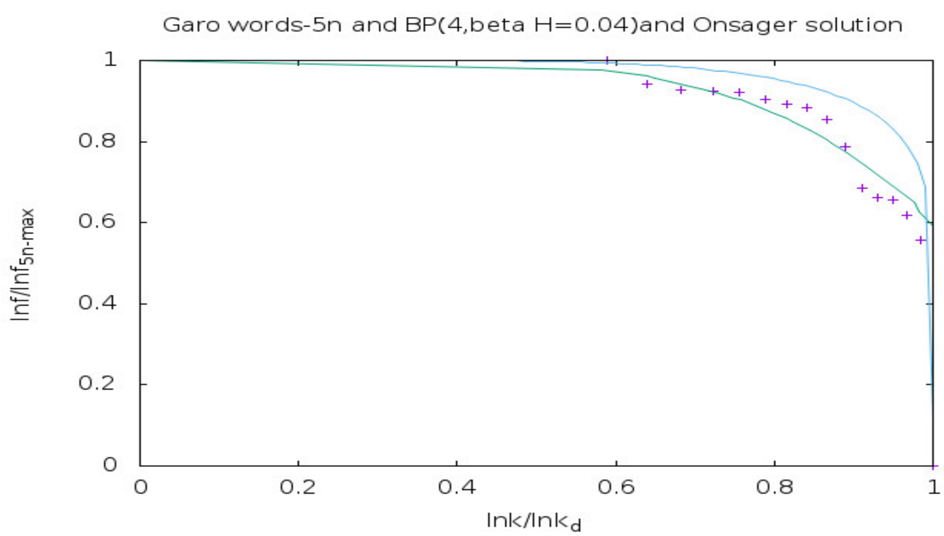

FIG. 10. Vertical axis is $\frac{lnf}{lnf_{nnnnn-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Garo language with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.02$ or, $\beta H = 0.04$. The uppermost curve is the Onsager solution.

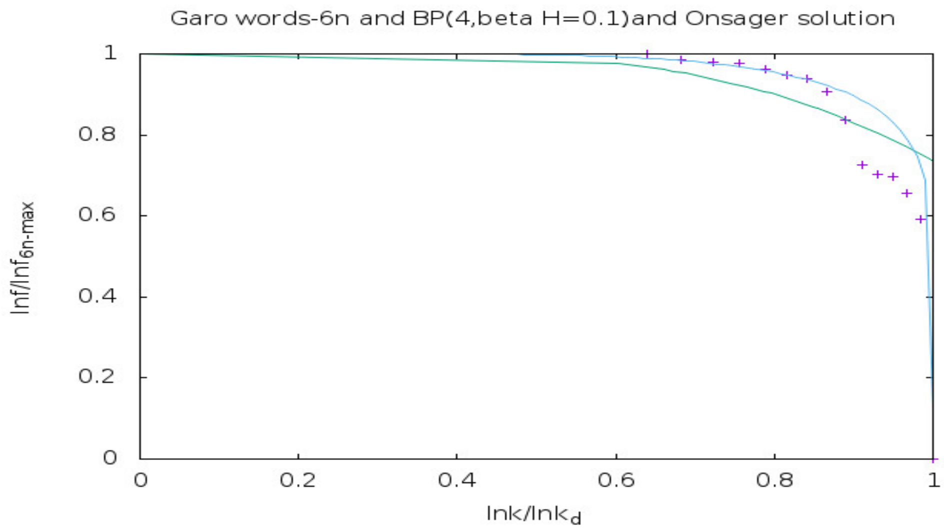

FIG. 11. Vertical axis is $\frac{lnf}{lnf_{nnnnnn-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the english language with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.05$ or, $\beta H = 0.1$. The uppermost curve is the Onsager solution. The points of the Garo language do not go over to Onsager's solution.

1. *conclusion*

From the figures (fig.5-fig.11), we observe that behind the entries of the dictionary, [1], there is a magnetisation curve, BP(4,$\beta H = 0.02$), in the Bethe-Peierls approximation with four nearest neighbours, in presence of liitle magnetic field, $\beta H = 0.02$.
Moreover, the associated correspondance with the Ising model is,

$$\frac{lnf}{lnf_{maximum}} \longleftrightarrow \frac{M}{M_{max}},$$

and

$$lnk \longleftrightarrow T.$$

k corresponds to temperature in an exponential scale, [23]. As temperature decreases, i.e. lnk decreases, f increases. The letters which are recording higher entries compared to those which have lesser entries are at lower temperature. As the Garo language expands, the letters which get enriched more and more, fall at lower and lower temperatures. This is a manifestation of cooling effect as was first observed in [24] in another way.

IV. ACKNOWLEDGEMENT

We have used gnuplot for drawing the figures. At the end, google-wise discussion with Dr. Debrabata Tripathi of the Department of Biotechnology and Bioinformatics of nehu has proved to be beneficial.

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Words starting with
A from other letters' sections.

a·kol kotsa, ~~A·chik A·song~~, ~~aganmitapa~~, attepong, aganbat·bela.
~~a·a·tangni mikchatang baksade ka·dimeataniko man·a~~, atte bisil,
am·bol bojasa, atte botsa, aganchaka, amchakja, atamchibara,
aganboching, atte pota, akpreta, a·jak ra·a, atchiram, an·chengrara,
~~adasa~~, Angasa, ~~adatang~~, a·songtang, ~~ian toktok~~, a·bri totsa,
A·watheng.

16

Words starting with
B from other letters' sections

budu dingsa, Bia mancha, ba mikka simdipa, bikpitgipa,
bimang daka, Bidana ~~at~~ okkrigipa, ~~Bipantus~~ ~~baning uena~~,
be·enni nangrimgrikaniko dakmanjok, ~~bigil dormik sika~~, ~~balpanga~~,
Bilsini, bebera·a, buga ba pusil ra·a, ~~Balyagni rama~~, bolrara,
Basen Rane, banggal mori, brungsam, bon·nasia, ~~Bisong~~,
basing te·sa, ba·ra tomsa, bol tong·sa, Bajar-ona,
Be·en wal·kusi nanga kri nanggrung saka. Baluani rama

21

Words starting with
C from other letters' sections

~~cha·chipa~~, chichotsa, ~~cha·chita~~, chimongdama, chadoa,
cha·e ra·angbo, cha·gopa, cheksiko mochichia, chongipa ukil,
~~chonnika~~, cha·gaga, cha dakatpa, chinamgija grasa,
chisam a·natika, cha·u mikgitoka, chining-Buga, chiganggarina gato,
chapchiding choa, chamitang minga an·senga, chigaginchitang,
chikoo nikdika, chatchi-ba·be, chabeka, cha·belbela, cha·bejok,
~~cha·boka~~, chami anggik bolagipi, cha·botbola, chanchiechipa napanga,
chitprako, ~~cha·prata~~, cha·ram, ~~cha·amram~~, ~~chirama~~,
cha·narara, ~~chua upta~~, cha·rima, chisam, ~~cha·asia~~.
~~cha·sinapa~~, chasongska, cha·taia, ~~chiktita~~, ~~chatinga~~,
cha·tok, ~~cha·toma~~, ~~cha·tota~~,

30

Words starting with D from other letters' sections,

danchipa, do·ga chotsa, ~~dakch·ta~~, ~~dok~~ do kgrika, dak guala, ~~datkapa~~, do· obilchakata, ~~dak majoa~~, dakmikkang, danmitapa, dal rimit, ~~do·nok~~, dakjaodi, duk ba suk, ~~duk ong·a~~, dao, dualma roa, dram salskika, dosko dakan dosni jrimako chanchichengaung a·ja, dongarijajok, de·nita, duk a·sil dongoba an·tangni mikchatang baksadi ka·dimcataniko man·a, ~~dakbewal~~, dakboching, dakchaa, dongchaa, dongchaka, dakchaka, dakchenga, dakchina, ~~dongram~~, dakram, ~~daro~~, do·orang, ~~daksamsoa~~, dundamdik pakna sigin, dak sika, ~~dakrasia~~, dongsinapa, ~~daksoa~~, daksuto, dokfaia, daktaitaia, doktimita, doktimango, dongtima,

30

Words starting with E from other letters' sections

No word # 0

Words starting with G from other letters' sections

~~gadoa~~, ~~gadoa~~, gal·dak, gitokma·sia, guuri gita, gitchakmrangmrang, ~~galwoka~~, ~~Gro~~ Gro pe·a, gipata, gano am·pak salja, goldo graang, ~~gro~~, gro a·sil nanga, gongginako doka, Ga·jemjeme re·a, go·olo jota rangsi sika, Gro·rin·a, gamchatgipa ro·ong, ~~gitok sita~~, ga·skata, gansua, gita changa gita,

15

Words starting with H from other letters' sections

No word # 0

Words starting with I from other letters' sections

Ia mancha, ~~Isotobira~~, ian toktak, ~~indakgipa~~,

2

3

Words starting with J from other letters' sections

jakchokga, ~~jachang~~, jal gogripa, jakni maja, jal·ik gita, Jakpa panjinia, ~~jakpang~~, jata pongso, ja·pa ki·tik cham·a, joka, jinmani me·ram ba moram, ~~jetor~~, jean ba·ra kancha, janggi birang, jako ra·a, ~~jakrara~~, ja·rika, ~~Ja·ga~~, jikesa, jorasa, ~~jaksamsa~~,

#15

Words starting with K from other letters' sections

Kaduta, ka·sire chalaibo, kolgapa, ~~kragija~~, kamja, kim ongja, ku·sik ong·a, karap soka, kasiko do·me pota, kamalba ramja anggalba goa, kosapak-kosapin-Aati-Beati-Dingepa-BA·BRA, kari jakpa ra·a, katta bimikgri, katboka, kodal botsa, ~~ka·sachaka~~, kopiwena, ka·rakgipa, katchi-Rangsi, ~~katsika~~, ku·chi rera-rera dakgipa, kolchangbonga, knaasa, kimitdam, katlimanga, ~~knatima~~, kitkit, ka·toma,

#24

Words starting with L from other letters' sections,

Lekao cha·skapa,

#1

Words starting with M from other letters' sections

mikchita, majalni satsa, ~~morurua~~, matchu atsa, ~~migit alaar~~, Mikkangparo, ~~mikgitchingchi~~ ria, man·pila, Matcha pil·a, mitsipong, mangma wagam pongsa, ~~muagamatchi~~ mikka ililani, muagamchi tinga, Mina alaa ra·nachala su·a, ~~mikrang tiria~~, mikka aro chini mite, me·a aro me·chik, ~~mikboka~~, masa ra·a, ~~man·chaka~~, me·chik chatchi, me·asa chatchi, ~~mikchapa~~, mitsipu, ~~mandi ra·a~~, milaram, mande ram ram, ~~Mraggo~~, menggorang, mandirara, man·rika, man·rikrika, Mandesa, ~~mandaska~~,

Words starting with M from other letters' sections (4)

Me.mang so dika, ~~Mande so.ot~~ ~~Mande so.ot~~a, man.atang, merong tomsa, ~~Maljuri~~, migil olasa, ~~mewagamchi tinga~~, #27

Words starting with N from other letters' sections

namchipja, namchong, ~~n~~ namchongmota, name paribo, name dakbo, Na.chi sammitua, nikguala, nambatkata, noko dongkama, ~~nakata~~, nang.koa, ~~Na.tok maria~~, nal.gimin moida, namasachim, ~~nang.pa~~, nikpila, ~~nampita~~, nito dak nang suanggipa me.chik, Na.anba, Na.tok bagasa ba choksa, Nitoa bam.dikdik, namjabea, ninaching, ~~nem.boka~~, nambreja, ~~nichaka~~, ~~me.chik~~ ~~chatchi~~, nang.konitate cha.na anga cha.matja, ~~nikchanga~~, Na.a mai chatchi? ~~me.asa chatchi~~, ~~nikchinga~~, ~~napanga~~, nok prakaha, ~~nok sam~~, ~~nang.takram~~, nim ram ram, ~~niriika~~, ~~nangrima~~, nachil ramso, ~~nik anga~~, ~~nikasia~~, ~~nisoa~~, ~~Na.song~~, Na.song, nik retor, Noksuda, nok te.sa, namjatek, ~~nitima~~, Nam toka, nang.ana, #32

Words starting with O from other letters' sections

~~an.gitika~~, ~~on.chepa~~, ~~onirika~~, on.rotrota, ~~orani~~, #1

Words starting with P from other letters' sections

patal salekika, pring an.tam, palonggi, pakkra cha.a, pangchaka, pagipako ra.a, ~~Paringsa~~, pasraksuak, #7

Words starting with R from other letters' sections

re.bachipja, rama chitsa, rodama, ~~ra.dama~~, Rampa, re.dumla, rama ga.songa, rirokgipa ginde, ronggra ginde, re.gitika, ring chuka, rang.san, re.angkal, ringkande re.babo, ran.kapa, ~~re.ongkata~~, Words starting with R from other letters' sections

rim·kingkinga, ran·kruka, ~~rim·krupa~~, ~~re·mikkang~~, Re·angpaa,
Re·angpa, ~~re·bapila~~, ruapang, Ranini a·song,
Rurube – kimase – Marenu – Marebak – kosapak – kosapin – Aäli – Beäli –
Dingipa – BA·BRA, re·angnabe, ~~re·beka~~, ripruap, ~~Re·angbo~~,
re·angbojak, ringchaka, ~~ra·chakja~~, ra·chapa, ~~re·chapa~~,
Riga chikchika, re·angchekcheka, ran·chita, re·angachim, ra·chimanga,
~~re·panga~~, rapraka, ~~re·pruta~~, Re·rakja, ~~re·rika~~, ~~rorika~~,
Re – burikrika, re·rima, rama samsa, rama samtang tangchin,
rama sam, ~~re·samsoa~~, re·angsan, re·sinapa, ram·sisia, ripengska,
~~rim·skapa~~, ran·skapa, ~~re·soa~~, re·tanggitika, ~~rim·tipa~~, re·angtok,
re·toma, rong·te tatsa,

~~# 27~~

42

Words starting with S from other letters' sections

songchipak, slang da·aria, su·budam, ~~saleka~~, salgitchinga,
sigitika, ~~sagitika~~, Sepanggrika, ~~seguala~~, ~~seng·krip~~, starang gäa,
~~singi majoa~~, sanika, ~~saloka~~, ~~suk ang·a~~, salpika, slai pangsa,
sko tingting saa, ~~so·ata~~, ~~sraka~~, sichina denila, ~~susabada~~,
~~sikbelbela~~, sada bil·a, ~~sibaka~~, schima khasiana, sokbreja,
sing·chaa, sal chaka, ~~sithaka~~, ~~sing·chaka~~, sokchakja,
sal changa, ~~sicheta~~, siachibaria, sikchepe, sokchiminga,
~~su penga~~, ~~salputa~~, Sangma Racha, Sengrakja, sal rakchanga,
Sikramram, seritchong, singrok-roka, ~~sambasia~~, ~~sikepa~~,
sokbarasia, ~~sitiki~~, ~~sengsoa~~, Sing·taja, ~~sikatang~~,
Soktelna rango, ~~salteta~~, sotipa, su·tota tatsa,
sambasia wa·dang ara, Siti

34

Words starting with T from other letters' sections

tang.doa, tugitchinga, ~~tangpila~~, Te.gite.ma.chong, Taria ~~a~~ dosea, ~~tipchanga~~, tama tong.sa, ~~twima~~, ~~Tipe rita~~, ta.bolchu tang.sa, ta.a totsa, te.brong mina baksotjok

8

Words starting with ~~a~~ u from other letters' sections

uaba nampaa, uipilgija peka, ~~Uanba~~, ~~uasan~~, uisuta, Ua re.btaia, untalan, uakatti makanga, uni ja.man.n, ua somolon, Ua nokan, Uanon, Ua me.a bi.~~sa~~ katsrukangaba, Ua una kadingsteka,

12

Words starting with W from other letters' sections

walchipa, wa.a chongsa, wagam chongsa, wa.ding dingsa, wa.al spoani, waknok, wa.pong gititdapa, ~~wa.al chaka~~, watchanga, walchanga, walang-salang, ~~wat singa~~, ~~wasisia~~, ~~wat sare~~.

6.