Visayan-English Dictionary and the Graphical law

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Abstract

We study the Visayan-English Dictionary(Kapulúñgan Binisayá-Iningĺs). 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

"........

Imagine all the people sharing all the world,..

........"

..............John W. Lennon, Imagine Lyrics.

In the pacific, spreads about 11 degree north, the Phillippines islands. Three prominent islands are Luzon in north, Visayas in the center and Mindanao in the south. The language is Visayan in the Visayas island. Influence of Spanish is widespread. We navigate through the Visayan-English Dictionary(Kapulún̄gan Binisayá-Iningĺs), [1], by Rev. J. Kaufmann, word by word. We get surprised, and startled as we go along from the beginning to towards the end. Native spaekers of Hiligaynon in Visyas island, refer to Visayan language as Bisaya or, Binisayo. One cousin sister of the author was of the name 'tultul'. The word 'túltul' in Visayan means compact mass(of sugar, salt etc.). One cousin sister is 'bulbul'. The word 'búlbul' in Visayan means fine hair. One cousin brother is 'tintin'. The word 'tíntin' in Visayan means to hop about on one foot. One friend of the author from the school days is 'pinu', 'pinu saha'. They were originally from Sylhet of Bangladesh. In Visayan 'pinóy' means Filipino, 'sáhà' means seedling(of bananas etc), 'sílot' means punishment. Surprisingly, 'Shukla' means silk.

In this article, we try to find magnetic field pattern behind the Visayan language. 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], and the Oxford Dictionary of Social Work and Social Care, [11], respectively.

We describe how a graphical law is hidden within the Dictionary of Visayan llanguage in this article. 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 Visayan 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,[12], 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, [13], $2\epsilon\gamma\bar{\sigma} + 2H$, where γ is the number of nearest neighbours of a spin. According to Boltzmann principle, $\frac{N_-}{N_+}$ equals $exp(-\frac{\triangle E}{k_B T})$, [14]. In the Bragg-Williams approximation,[15], $\bar{\sigma} = L$, 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, $c = \frac{H}{\gamma\epsilon}$, $T_c = \gamma\epsilon/k_B$, [16]. $\frac{T}{T_c}$ 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 [13]. 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, [12],[13],[14],[15],[16], due to Bethe-Peierls, [17], reduced magnetisation varies with reduced temperature, for γ neighbours, in absence of external magnetic field, as

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

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 .

$ln\frac{\gamma}{\gamma-2}$ 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.

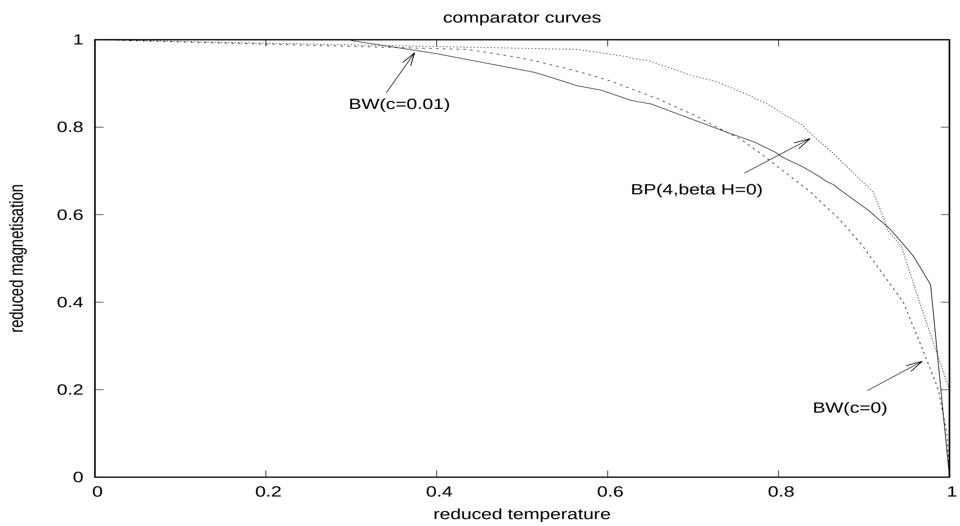

FIG. 1. Reduced magnetisation vs reduced temperature curves for Bragg-Williams approximation, in absence(dark) of and presence(inner in the top) of magnetic field, $c = \frac{H}{\gamma\epsilon} = 0.01$, and Bethe-Peierls approximation in absence of magnetic field, for four nearest neighbours (outer in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

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

In the Bethe-Peierls approximation scheme , [17], reduced magnetisation varies with reduced temperature, for γ neighbours, in presence of external magnetic field, as

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

Derivation of this formula ala [17] 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,

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

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, [18], [19], [20], [17],

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

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

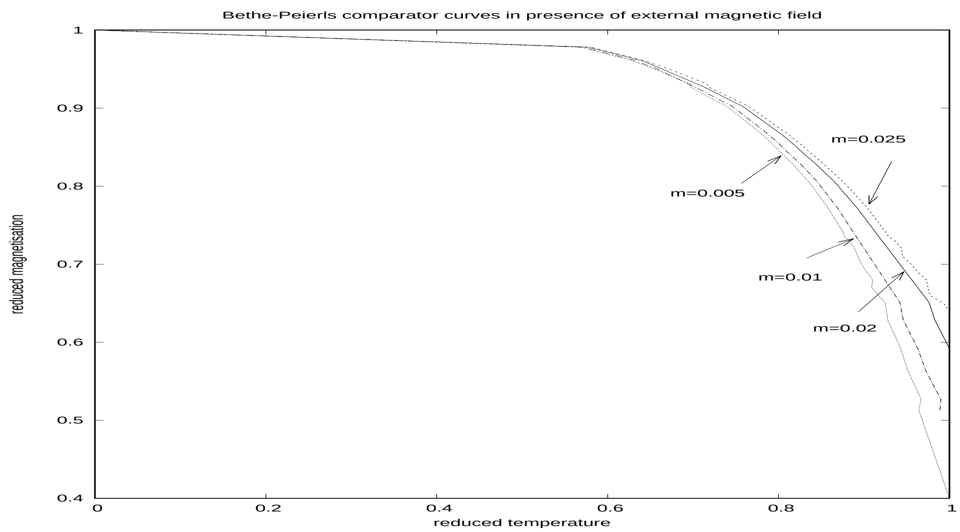

FIG. 2. Reduced magnetisation vs reduced temperature curves for Bethe-Peierls approximation in presence of little external magnetic fields, for four nearest neighbours, with $\beta H = 2m$.

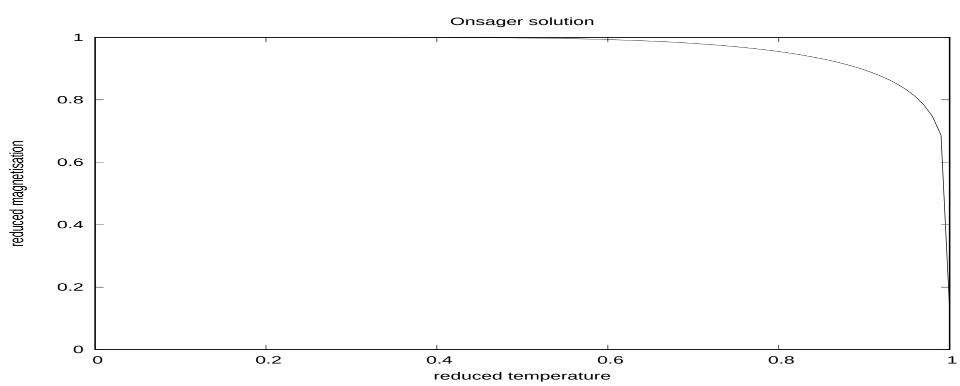

FIG. 3. Reduced magnetisation vs reduced temperature curves for exact solution of two dimensional Ising model, due to Onsager, in absence of external magnetic field

A	B	D	E	F	G	H	I	K	L	M	N	O	P	R	S	T	U	W	Y
1204	2028	1009	146	51	599	1547	496	3036	1695	1900	213	249	4017	280	1895	2234	477	127	120

TABLE III. Visayan-English Dictionary entries

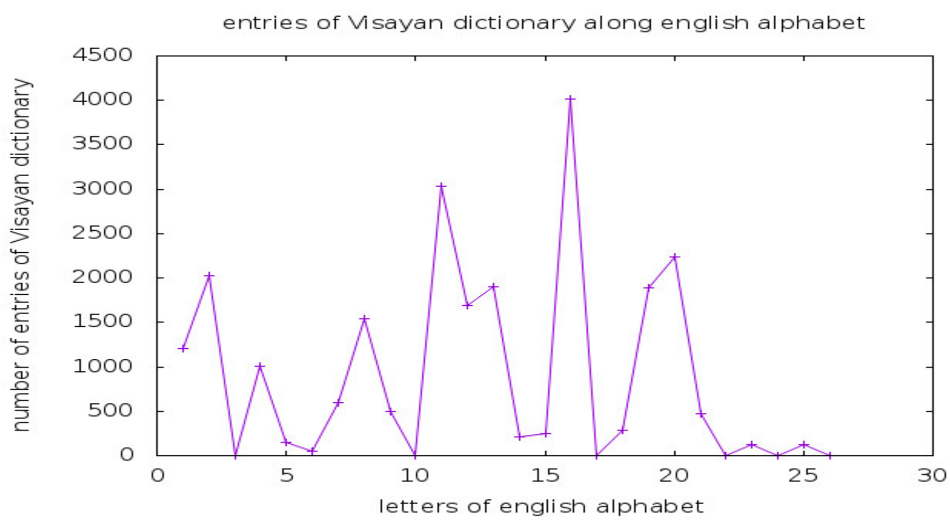

FIG. 4. Vertical axis is number of entries of the Visayan-English Dictionary,[1]. Horizontal axis is the letters of the English alphabet. Letters are represented by the sequence number in the alphabet.

III. METHOD OF STUDY AND RESULTS

A. entries of the Visayan-English Dictionary

The Visayan 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. The result is the following table, V. Highest number of entries, four thousand seventeen, starts with the letter P followed by words numbering three thousand thirty six beginning with K, two thousand two hundred thirty four with the letter T 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, [21], 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

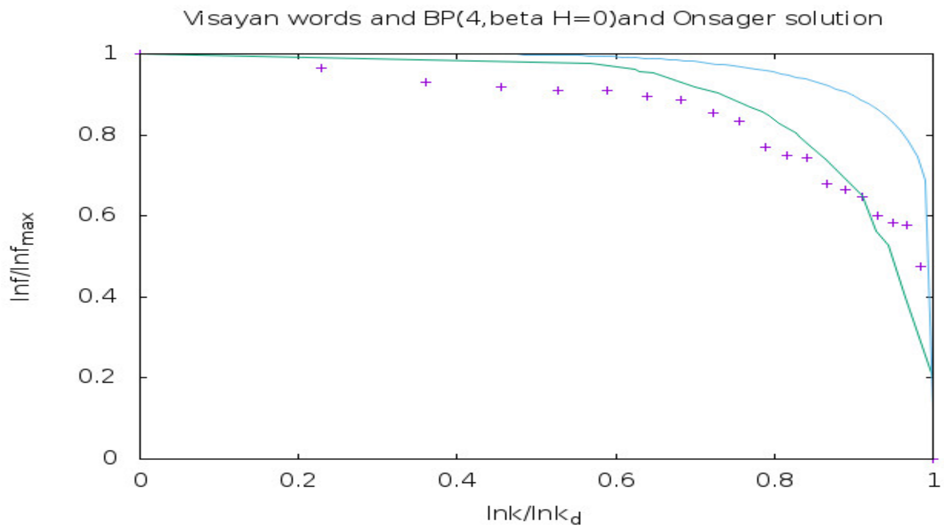

FIG. 5. Vertical axis is $\frac{lnf}{lnf_{max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Visayan language with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and in absence of external magnetic field. The uppermost curve is the Onsager solution.

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 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. For the purpose of exploring Onsager core, we normalise the lnfs with 10n-maximum $lnf_{10n-max}$ we record in the adjoining table, IV, and plot starting from $k = 11$ in the figure fig.12.

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/$lnf_{nnnnnnmax}$	lnf/lnf_{10nmax}
1	0	0	4017	8.298	1	Blank	Blank	Blank	Blank	Blank	Blank	Blank
2	0.69	0.228	3036	8.018	0.966	1	Blank	Blank	Blank	Blank	Blank	Blank
3	1.10	0.361	2234	7.712	0.929	0.962	1	Blank	Blank	Blank	Blank	Blank
4	1.39	0.455	2028	7.615	0.918	0.950	0.987	1	Blank	Blank	Blank	Blank
5	1.61	0.528	1900	7.550	0.910	0.942	0.979	0.991	1	Blank	Blank	Blank
6	1.79	0.589	1895	7.547	0.909	0.941	0.979	0.991	0.9996	1	Blank	Blank
7	1.95	0.639	1695	7.435	0.896	0.927	0.964	0.976	0.985	0.985	1	Blank
8	2.08	0.683	1547	7.344	0.985	0.916	0.952	0.964	0.973	0.973	0.988	Blank
9	2.20	0.722	1204	7.093	0.855	0.885	0.920	0.931	0.939	0.940	0.954	Blank
10	2.30	0.756	1009	6.917	0.834	0.863	0.897	0.908	0.916	0.917	0.930	Blank
11	2.40	0.788	599	6.395	0.771	0.798	0.829	0.840	0.847	0.847	0.860	1
12	2.48	0.816	496	6.207	0.748	0.774	0.805	0.815	0.822	0.822	0.835	0.971
13	2.56	0.842	477	6.168	0.743	0.769	0.800	0.810	0.817	0.817	0.830	0.965
14	2.64	0.867	280	5.635	0.679	0.703	0.731	0.740	0.746	0.747	0.758	0.881
15	2.71	0.889	249	5.517	0.665	0.688	0.715	0.724	0.731	0.731	0.742	0.863
16	2.77	0.911	213	5.361	0.646	0.669	0.695	0.704	0.710	0.710	0.721	0.838
17	2.83	0.930	146	4.984	0.601	0.622	0.646	0.654	0.660	0.660	0.670	0.779
18	2.89	0.949	127	4.844	0.584	0.604	0.628	0.636	0.642	0.642	0.652	0.757
19	2.94	0.967	120	4.787	0.577	0.597	0.621	0.629	0.634	0.634	0.644	0.749
20	3.00	0.984	51	3.932	0.474	0.490	0.510	0.516	0.521	0.521	0.529	0.615
21	3.05	1	1	0	0	0	0	0	0	0	0	0

TABLE IV. entries of the Visayan-English Dictionary: ranking, natural logarithm, normalisations

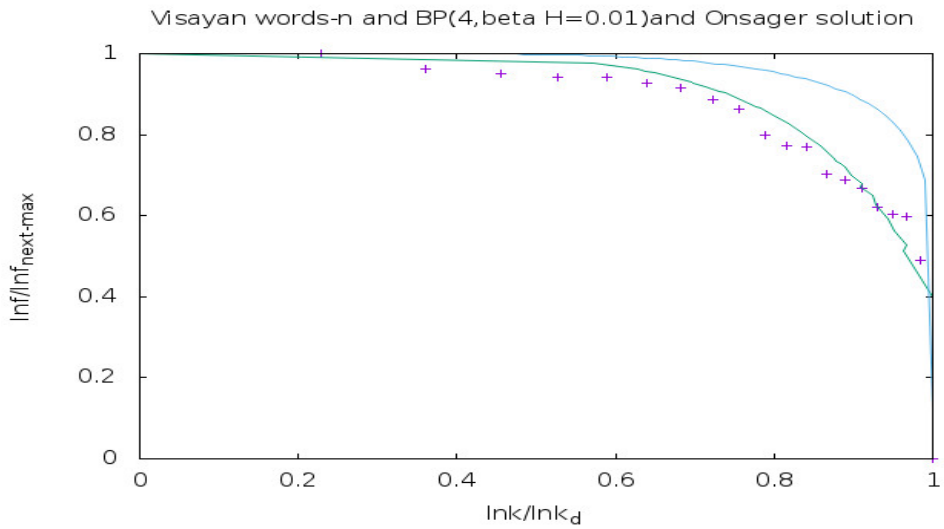

FIG. 6. Vertical axis is $\frac{lnf}{lnf_{next-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Visayan language with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.005$ or, $\beta H = 0.01$. The uppermost curve is the Onsager solution.

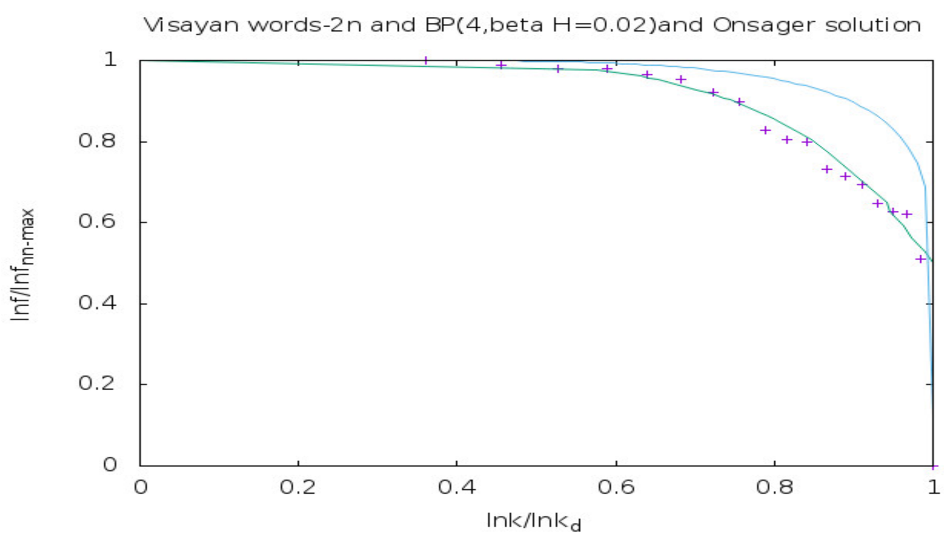

FIG. 7. Vertical axis is $\frac{lnf}{lnf_{nn-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Visayan language with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.01$ or, $\beta H = 0.02$.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

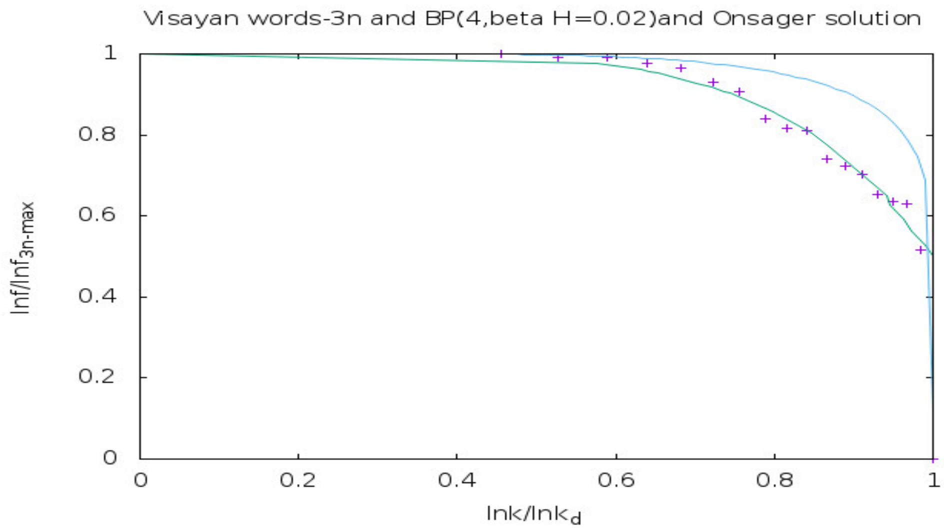

FIG. 8. Vertical axis is $\frac{lnf}{lnf_{nnn-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Visayan language with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.01$ or, $\beta H = 0.02$. The uppermost curve is the Onsager solution.

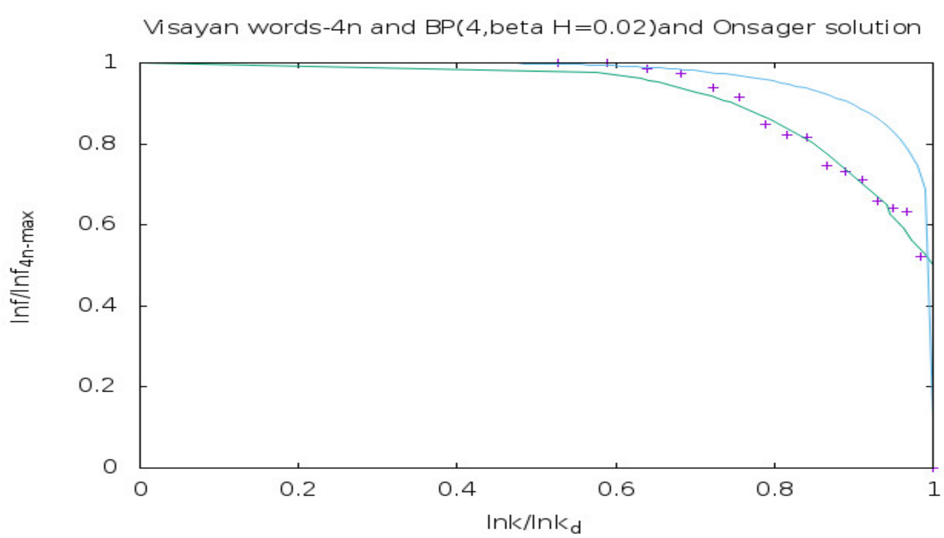

FIG. 9. Vertical axis is $\frac{lnf}{lnf_{nnnn-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Visayan language with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.01$ or, $\beta H = 0.02$. The uppermost curve is the Onsager solution.

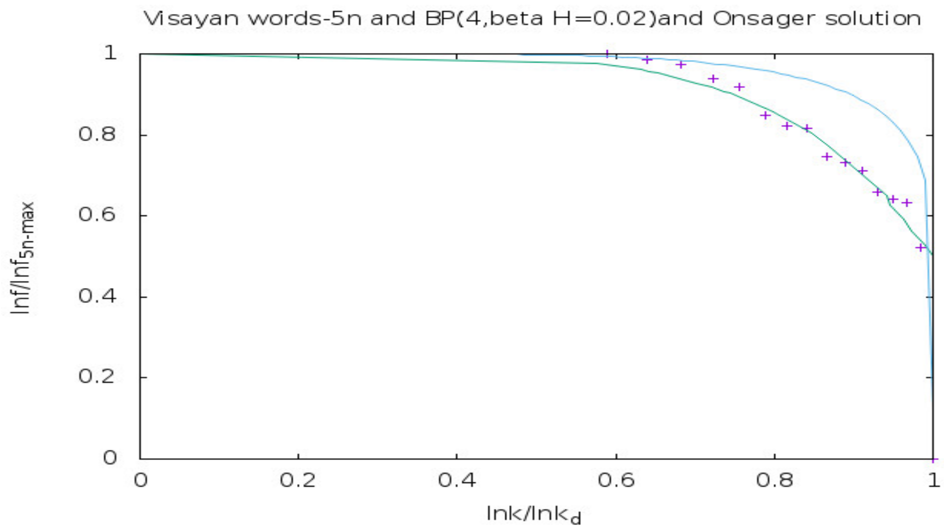

FIG. 10. Vertical axis is $\frac{lnf}{lnf_{nnnnn-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Visayan language with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.01$ or, $\beta H = 0.02$. The uppermost curve is the Onsager solution.

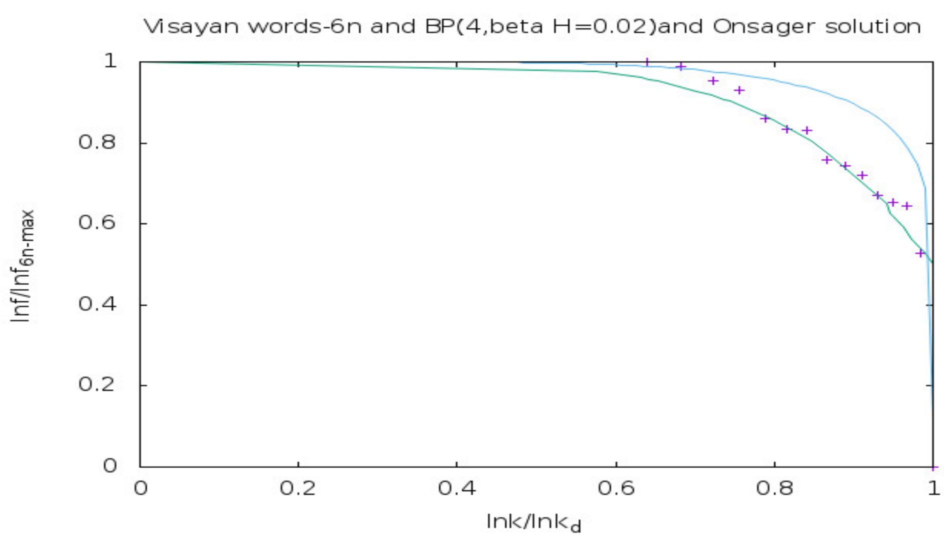

FIG. 11. Vertical axis is $\frac{lnf}{lnf_{nnnnnn-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the english language with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.01$ or, $\beta H = 0.02$. The uppermost curve is the Onsager solution.

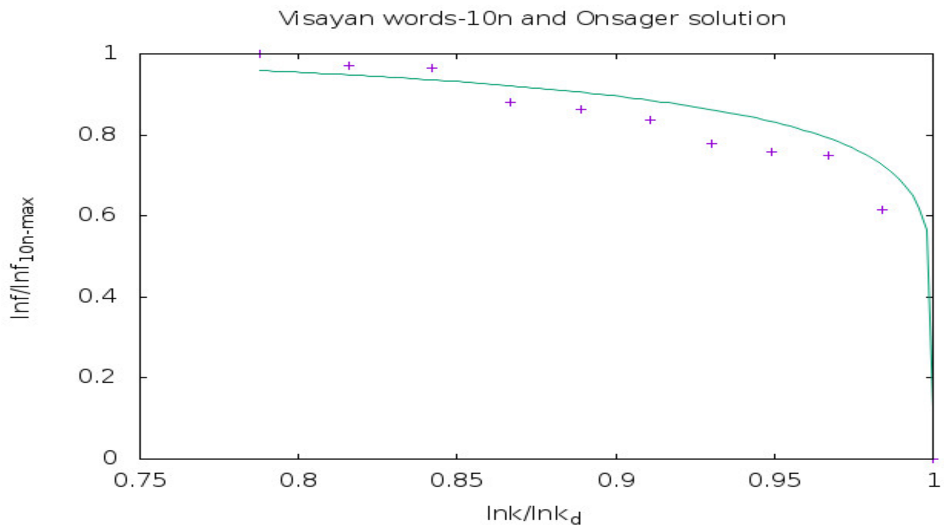

FIG. 12. Vertical axis is $\frac{lnf}{lnf_{10n-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the english language. The reference curve is the Onsager solution. The entries of the Visayan-English Dictionary are not going over to the Onsager solution.

1. conclusion

From the figures (fig.5-fig.12), 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,

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

and

$$lnk \longleftrightarrow T.$$

k corresponds to temperature in an exponential scale, [22]. 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 Visayan 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 [23] in another way.

A	B	D	G	H	I	K	L	M	N	O	P	R	S	T	U	W	Y
1204	2028	1009	599	1547	642=496+146	3036	1695	1900	213	249	4068=4017+51	280	1895	2234	477	127	120

TABLE V. Visayan Dictionary entries in the reduced scheme

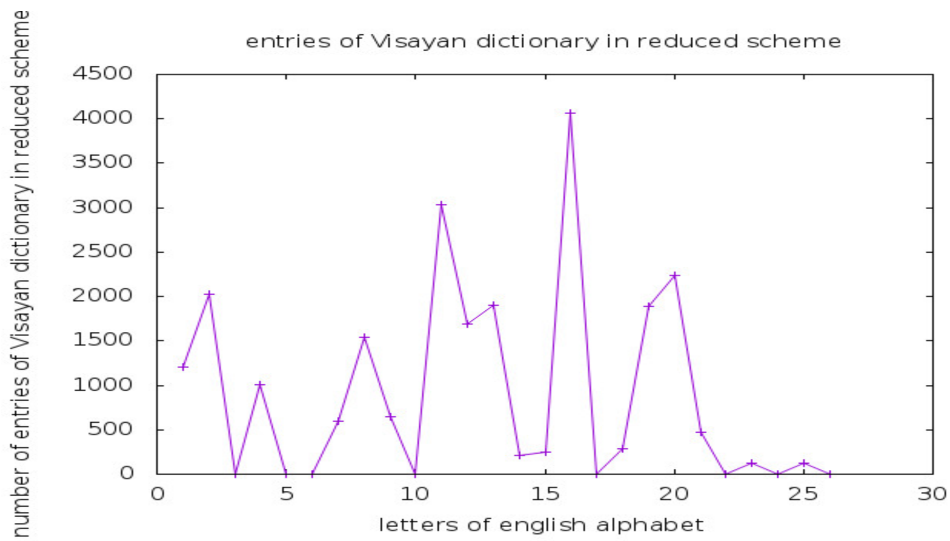

FIG. 13. Vertical axis is number of entries of the Visayan-English Dictionary, [1], in the reduced scheme. Horizontal axis is the letters of the English alphabet. Letters are represented by the sequence number in the alphabet.

B. entries of the Visayan-English Dictionary in the reduced scheme

Combining the letter F into P and the letter E into I, [1], we get the following enumeration, V, from the dictionary, [1]. Highest number of entries, four thousand sixty eight, starts with the letter P followed by words numbering three thousand thirty six beginning with K, two thousand two hundred thirty four with the letter T etc. To visualise we plot the number of reduced entries against the respective letters in the figure fig.13. 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, [21], 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 nineteen 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, VI, and plot $\frac{lnf}{lnf_{max}}$ against $\frac{lnk}{lnk_{lim}}$ in the figure fig.14.

We then ignore the letter with the highest number of words, tabulate in the adjoining table,

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_{10nmax}
1	0	0	4068	8.311	1	Blank	Blank	Blank	Blank	Blank	Blank
2	0.69	0.235	3036	8.018	0.965	1	Blank	Blank	Blank	Blank	Blank
3	1.10	0.373	2234	7.712	0.928	0.962	1	Blank	Blank	Blank	Blank
4	1.39	0.471	2028	7.615	0.916	0.950	0.987	1	Blank	Blank	Blank
5	1.61	0.547	1900	7.550	0.908	0.942	0.979	0.991	1	Blank	Blank
6	1.79	0.609	1895	7.547	0.908	0.941	0.979	0.991	0.9996	1	Blank
7	1.95	0.661	1695	7.435	0.895	0.927	0.964	0.976	0.985	0.985	Blank
8	2.08	0.706	1547	7.344	0.884	0.916	0.952	0.964	0.973	0.973	Blank
9	2.20	0.746	1204	7.093	0.853	0.885	0.920	0.931	0.939	0.940	Blank
10	2.30	0.782	1009	6.917	0.832	0.863	0.897	0.908	0.916	0.917	Blank
11	2.40	0.815	642	6.465	0.778	0.806	0.838	0.849	0.856	0.857	1
12	2.48	0.844	599	6.395	0.769	0.798	0.829	0.840	0.847	0.847	0.989
13	2.56	0.871	477	6.168	0.742	0.769	0.800	0.810	0.817	0.817	0.954
14	2.64	0.896	280	5.635	0.678	0.703	0.731	0.740	0.746	0.747	0.872
15	2.71	0.920	249	5.517	0.664	0.688	0.715	0.724	0.731	0.731	0.853
16	2.77	0.942	213	5.361	0.645	0.669	0.695	0.704	0.710	0.710	0.829
17	2.83	0.962	127	4.844	0.583	0.604	0.628	0.636	0.642	0.642	0.749
18	2.89	0.982	120	4.787	0.576	0.597	0.621	0.629	0.634	0.634	0.740
19	2.94	1	1	0	0	0	0	0	0	0	0

TABLE VI. entries of the Visayan-English Dictionary in the reduced scheme:ranking, natural logarithm, normalisations

VI, and redo the plot, normalising the lnfs with next-to-maximum $lnf_{nextmax}$, and starting from $k = 2$ plot in the figure fig.15. Normalising the lnfs with next-to-next-to-maximum $lnf_{nextnextmax}$, we tabulate in the adjoining table, VI, and starting from $k = 3$ we draw in the figure fig.16. Normalising the lnfs with next-to-next-to-next-to-maximum $lnf_{nextnextnextmax}$ we record in the adjoining table, VI, and plot starting from $k = 4$ in the figure fig.17. Normalising the lnfs with 4n-maximum lnf_{4n-max} we record in the adjoining table, VI, and plot starting from $k = 5$ in the figure fig.18. Normalising the lnfs with 5n-maximum lnf_{5n-max} we record in the adjoining table, VI, and plot starting from $k = 6$ in the figure fig.19. For the purpose of exploring Onsager core, we normalise the lnfs with 10n-maximum $lnf_{10n-max}$ we record in the adjoining table, VI, and plot starting from $k = 11$ in the figure fig.20.

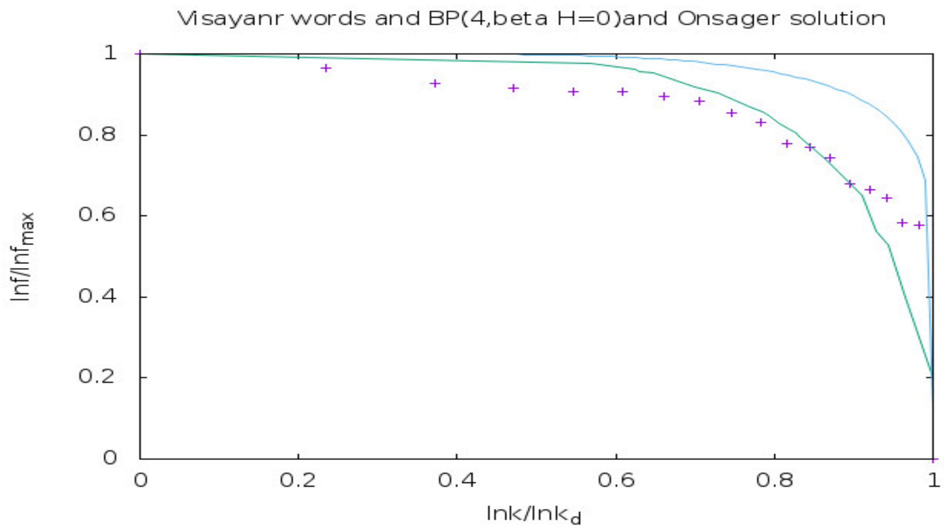

FIG. 14. Vertical axis is $\frac{lnf}{lnf_{max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Visayan-English Dictionary in the reduced scheme with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and in absence of external magnetic field. The uppermost curve is the Onsager solution.

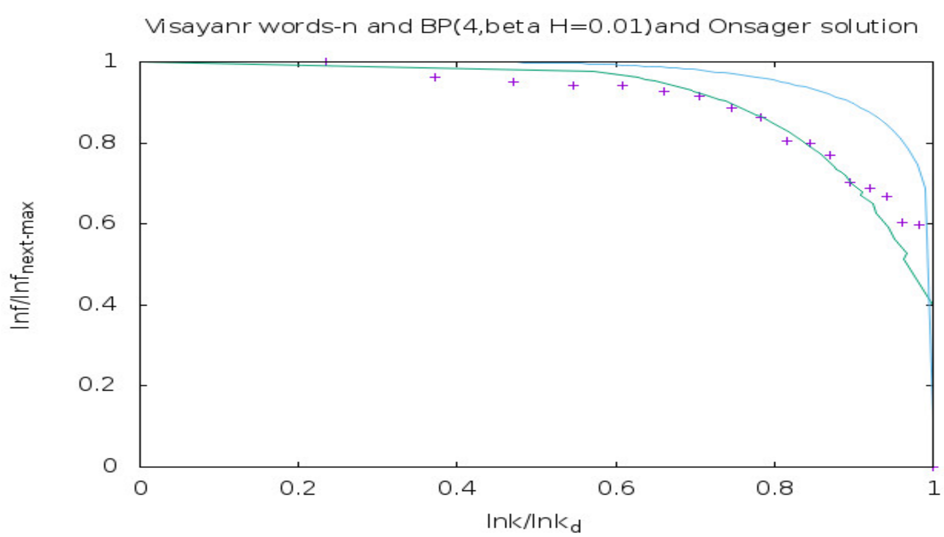

FIG. 15. Vertical axis is $\frac{lnf}{lnf_{next-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Visayan-English Dictionary in the reduced scheme with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.005$ or, $\beta H = 0.01$. The uppermost curve is the Onsager solution.

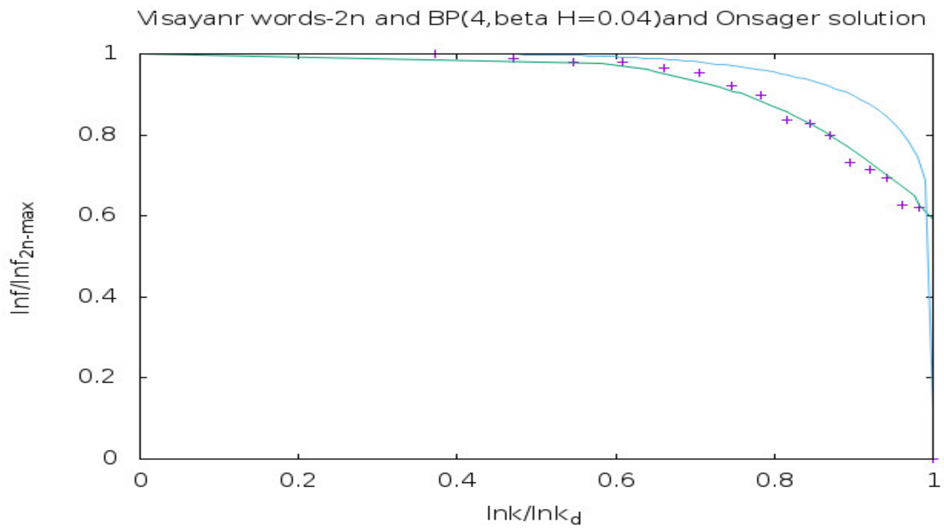

FIG. 16. Vertical axis is $\frac{lnf}{lnf_{nn-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Visayan-English Dictionary in the reduced scheme with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.02$ or, $\beta H = 0.04$. The uppermost curve is the Onsager solution.

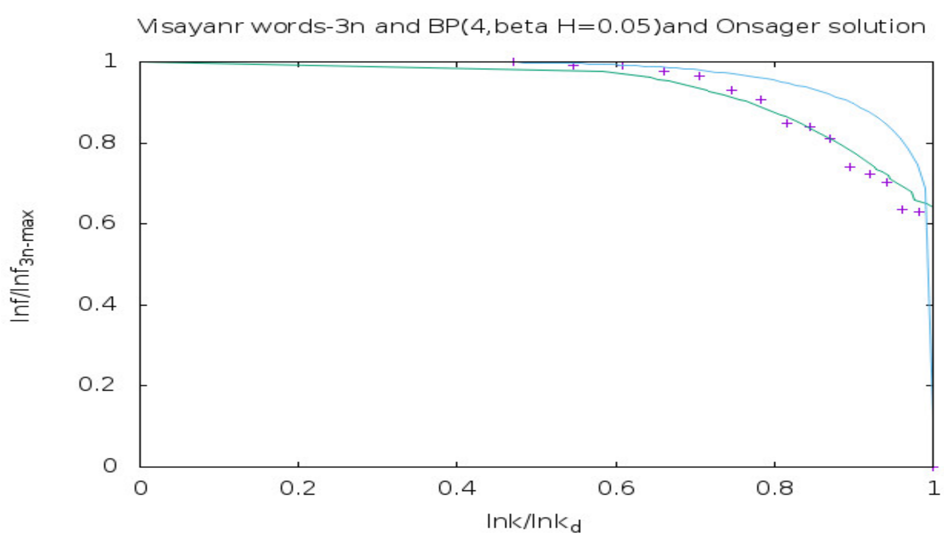

FIG. 17. Vertical axis is $\frac{lnf}{lnf_{nnn-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Visayan-English Dictionary in the reduced scheme with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.025$ or, $\beta H = 0.05$. The uppermost curve is the Onsager solution.

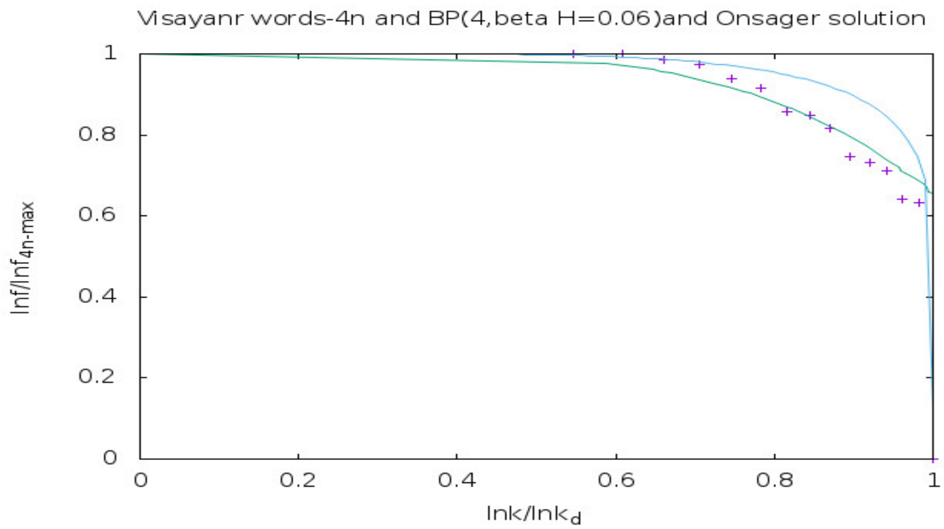

FIG. 18. Vertical axis is $\frac{lnf}{lnf_{nnnn-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Visayan-English Dictionary in the reduced scheme with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.03$ or, $\beta H = 0.06$. The uppermost curve is the Onsager solution.

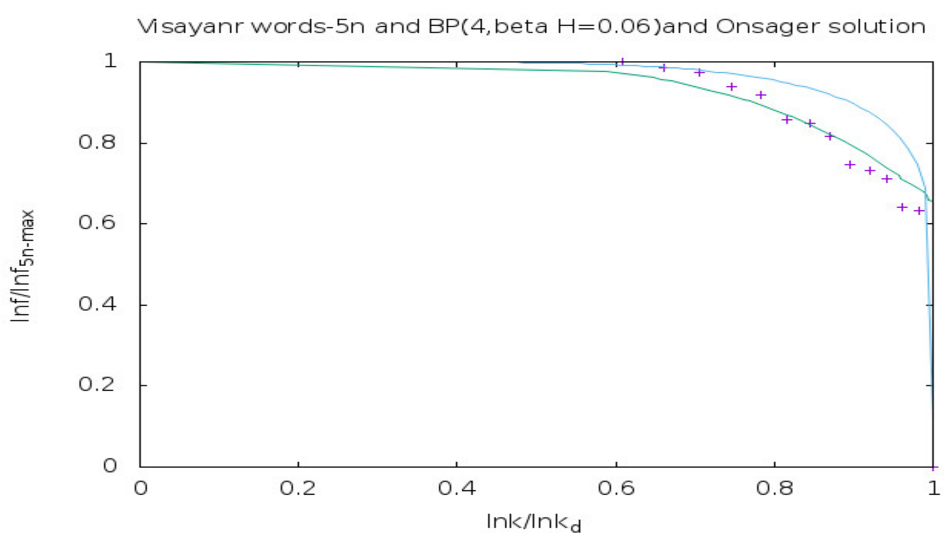

FIG. 19. Vertical axis is $\frac{lnf}{lnf_{nnnnn-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Visayan-English Dictionary in the reduced scheme with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.03$ or, $\beta H = 0.06$. The uppermost curve is the Onsager solution.

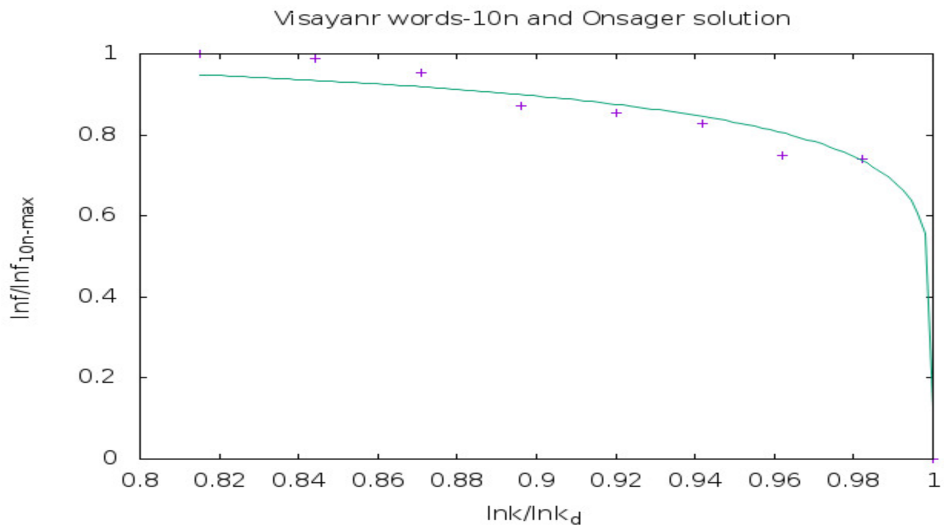

FIG. 20. Vertical axis is $\frac{lnf}{lnf_{10n-max}}$ and horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Visayan-English Dictionary in the reduced scheme. The uppermost curve is the Onsager solution. The entries of the Visayan-English Dictionary in the reduced scheme are not going over to the Onsager solution.

1. conclusion

From the figures (fig.14-fig.20), we observe that behind the entries of the Vsayan- English Dictionary, [1], in the reduced scheme, there is a magnetisation curve, BP(4,$\beta H = 0.04$), in the Bethe-Peierls approximation with four nearest neighbours, in presence of liitle magnetic field, $\beta H = 0.04$.

Moreover, the associated correspondance with the Ising model is,

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

and

$$lnk \longleftrightarrow T.$$

k corresponds to temperature in an exponential scale, [22]. 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 English 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 [23] 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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