

Dictionary of Culinary Terms by Philippe Pilibossian and the Graphical law

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Abstract

We study the Dictionary of Culinary Terms by Philippe Pilibossian. 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 $BP(4, \beta H = 0)$, i.e. the Bethe-Peierls curve in the presence of four nearest neighbours and no external magnetic field, H , with $\beta H = 0$. β is $\frac{1}{k_B T}$ where, T is temperature and k_B is the tiny Boltzmann constant.

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I. INTRODUCTION

”Taste of the pudding is in eating”.. proverb.

From the beginning of the civilisations, with the invention of fire, started the inventions of culinary items and diffusion of those to each nook and corner of this magnificent world. Those inventions are part of the human cultures, recorded in languages in human memories. Whether there is any imprint of magnetic field like in other human endeavors, we look forward to the Dictionary of Culinary Terms by Philippe Pilibossian, [1]. We count all entries one by one and probe for the magnetic field pattern. 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 the 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], the Visayan-English Dictionary, [12], Garo to English School Dictionary, [13], Mursi-English-Amharic Dictionary, [14] and Names of Minor Planets, [15], A Dictionary of Tibetan and English, [16], Khasi English Dictionary, [17], Turkmen-English Dictionary, [18], Websters Universal Spanish-English Dictionary, [19], A Dictionary of Modern Italian, [20], Langenscheidt’s German-English Dictionary, [21], Essential Dutch dictionary by G. Quist and D. Strik, [22], Swahili-English dictionary by C. W. Rechenbach, [23], Larousse Dictionnaire De Poche for the French, [24], the Onsager’s solution behind the Arabic, [25], the graphical law behind Langenscheidt Taschenwörterbuch Deutsch-Englisch / Englisch-Deutsch, Völlige Neubearbeitung, [26], the graphical law behind the NTC’s Hebrew and English Dictionary by Arie Comey and Naomi Tsur, [27], the graphical law behind the Oxford Dictionary Of Media and Communication, [28], the graphical law behind the Oxford Dictionary Of Mathematics, Penguin Dictionary Of Mathematics, [29], the Onsager’s solution behind the Arabic Second part, [30], the graphical law behind the Penguin Dictionary Of

Sociology, [31], behind the Concise Oxford Dictionary Of Politics, [32], a Dictionary Of Critical Theory by Ian Buchanan, [33], the Penguin Dictionary Of Economics, [34], the Concise Gojri-English Dictionary by Dr. Rafeeq Anjum, [35], A Dictionary of the Kachin Language by Rev.O.Hanson, [36], A Dictionary Of World History by Edmund Wright, [37], Ekagi-Dutch-English-Indonesian Dictionary by J. Steltenpool, [38], A Dictionary of Plant Sciences by Michael Allaby, [39], respectively. The graphical law was pursued more in Along the side of the Onsager's solution, the Ekagi language ,[40], Along the side of the Onsager's solution, the Ekagi language-Part Three, [41], Oxford Dictionary of Biology by Robert S. Hine and the Graphical law, [42], A Dictionary of the Mikir Language by G. D. Walker and the Graphical law, [43], A Dictionary of Zoology by Michael Allaby and the Graphical Law, [44], Dictionary of all Scriptures and Myths by G. A. Gaskell and the Graphical Law, [45], respectively.

We describe how the graphical law is hidden within A Dictionary of Culinary Terms by Philippe Pilibossian, [1], 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 the analysis of A Dictionary of Culinary Terms by Philippe Pilibossian, [1]. The section IV is Acknowledgment. The last section is Bibliography.

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 $L = \frac{1}{N}\sum_i \sigma_i$, 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 $\mu\sum_i \sigma_i$ 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,[46], for the lattice of spins, setting μ to one, is $-\epsilon\sum_{n,n}\sigma_i\sigma_j - H\sum_i \sigma_i$, where n.n refers to nearest neighbour pairs. The difference ΔE of energy if we flip an up spin to down spin is, [47], $2\epsilon\gamma\bar{\sigma} + 2H$, where γ is the number of nearest neighbours of a spin. According to Boltzmann principle, $\frac{N_-}{N_+}$ equals $exp(-\frac{\Delta E}{k_B T})$, [48]. In the Bragg-Williams approximation,[49], $\bar{\sigma} = L$, 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, $c = \frac{H}{\gamma\epsilon}$, $T_c = \gamma\epsilon/k_B$, [50]. $\frac{T}{T_c}$ is referred to as reduced temperature.

Plot of L vs $\frac{T}{T_c}$ or, reduced magnetisation 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 [47]. 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, [46],[47],[48],[49],[50], due to Bethe-Peierls, [51], reduced magnetisation varies with reduced temperature, for γ neighbours, in absence of external magnetic field, as

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

$\ln \frac{\gamma}{\gamma-2}$ 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($4, \beta H = 0$)	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 the presence of external magnetic field, $c = \frac{H}{\gamma\epsilon} = 0.01$, and Bethe-Peierls approximation in absence of magnetic field, for four nearest neighbours .

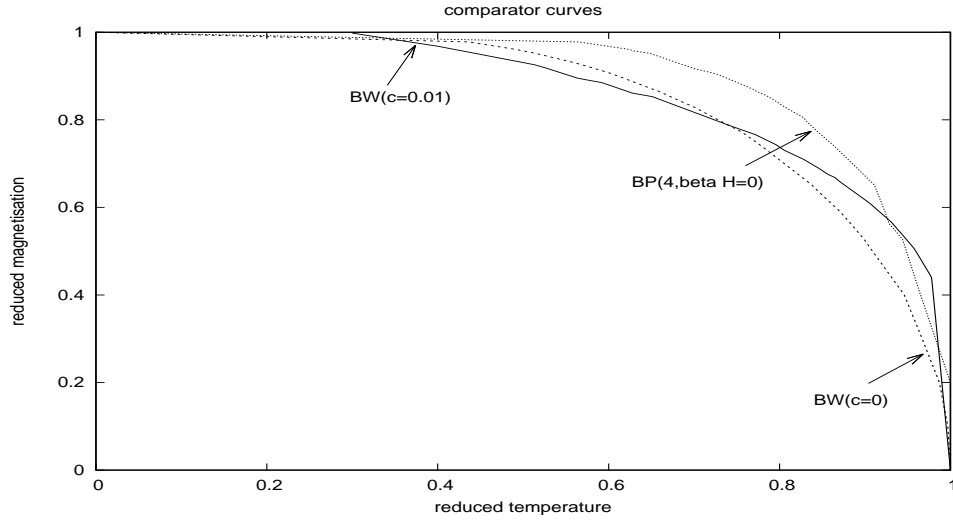


FIG. 1. Reduced magnetisation vs reduced temperature curves for Bragg-Williams approximation, in absence(dark) of and presence(inner in the top) of magnetic field, $c = \frac{H}{\gamma\epsilon} = 0.01$, and Bethe-Peierls approximation in absence of magnetic field, for four nearest neighbours (outer in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

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	Y	Z
139	132	278	56	113	125	127	50	18	23	4	62	168	39	51	259	4	94	149	85	4	61	2	3

TABLE II. Dictionary of Culinary Terms entries

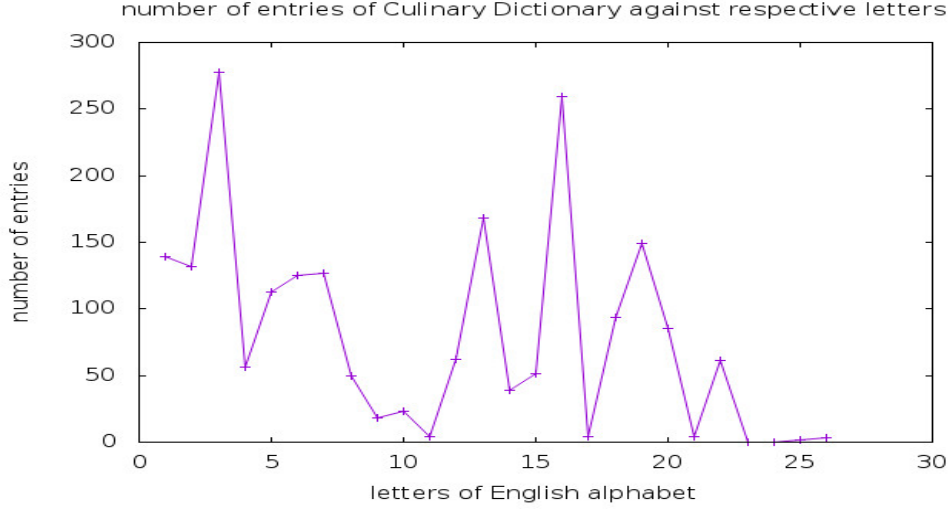


FIG. 2. The vertical axis is number of entries in the Dictionary of Culinary Terms by Philippe Pilibossian,[1]. The horizontal axis is the letters of the English alphabet. Letters are represented by the sequence number in the alphabet.

III. ANALYSIS OF DICTIONARY OF CULINARY TERMS

In the Dictionary of Culinary Terms by Philippe Pilibossian, [1], we have counted the entries, one by one from the beginning to the end, starting with different letters. The result is the table, II. Highest number of entries, two hundred seventy eight, starts with the letter C followed by entries numbering two hundred fifty nine beginning with P, one hundred sixty eight with the letter M. To visualise we plot the number of entries against respective letters in the dictionary sequence,[1] in the figure fig.2.

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, [52], denoted by k . k is a positive integer starting from one. Moreover, we attach a limiting rank, k_{lim} , or, k_d and a limiting number of words. The limiting rank is maximum rank plus one, here it is twenty three and the limiting number of words is one. As a result both $\frac{\ln f}{\ln f_{max}}$ and $\frac{\ln k}{\ln k_{lim}}$ varies from zero to one. Then we tabulate in the adjoining table, III, and plot $\frac{\ln f}{\ln f_{max}}$ against $\frac{\ln k}{\ln k_{lim}}$ in the

k	lnk	lnk/ lnk_{lim}	f	lnf	lnf/ lnf_{max}	lnf/ lnf_{n-max}	lnf/ lnf_{2n-max}	lnf/ lnf_{3n-max}	lnf/ lnf_{4n-max}
1	0	0	278	5.628	1	Blank	Blank	Blank	Blank
2	0.69	0.220	259	5.557	0.987	1	Blank	Blank	Blank
3	1.10	0.350	168	5.124	0.910	0.922	1	Blank	Blank
4	1.39	0.443	149	5.004	0.889	0.900	0.977	1	Blank
5	1.61	0.513	139	4.934	0.877	0.888	0.963	0.986	1
6	1.79	0.570	132	4.883	0.868	0.879	0.953	0.976	0.990
7	1.95	0.621	127	4.844	0.861	0.872	0.945	0.968	0.982
8	2.08	0.662	125	4.828	0.858	0.869	0.942	0.965	0.979
9	2.20	0.701	113	4.727	0.840	0.851	0.923	0.945	0.958
10	2.30	0.732	94	4.543	0.807	0.818	0.887	0.908	0.921
11	2.40	0.764	85	4.443	0.789	0.800	0.867	0.888	0.900
12	2.48	0.790	62	4.127	0.733	0.743	0.805	0.825	0.836
13	2.56	0.815	61	4.111	0.730	0.740	0.802	0.822	0.833
14	2.64	0.841	56	4.025	0.715	0.724	0.786	0.804	0.816
15	2.71	0.863	51	3.932	0.699	0.708	0.767	0.786	0.797
16	2.77	0.882	50	3.912	0.695	0.704	0.763	0.782	0.793
17	2.83	0.901	39	3.664	0.651	0.659	0.715	0.732	0.743
18	2.89	0.920	23	3.135	0.557	0.564	0.612	0.626	0.635
19	2.94	0.936	18	2.890	0.514	0.520	0.564	0.578	0.586
20	3.00	0.955	4	1.386	0.246	0.249	0.270	0.277	0.281
21	3.04	0.968	3	1.099	0.195	0.198	0.214	0.220	0.223
22	3.09	0.984	2	0.693	0.123	0.125	0.135	0.138	0.140
23	3.14	1	1	0	0	0	0	0	0

TABLE III. Entries of the Dictionary of Culinary Terms : ranking, natural logarithm, normalisations

figure fig.3. We then ignore the letter with the highest of words, tabulate in the adjoining table, III, and redo the plot, normalising the $lnfs$ with next-to-maximum $lnf_{nextmax}$, and starting from $k = 2$ in the figure fig.4. This programme we repeat up to $k = 5$ getting figures up to the figure fig.7.

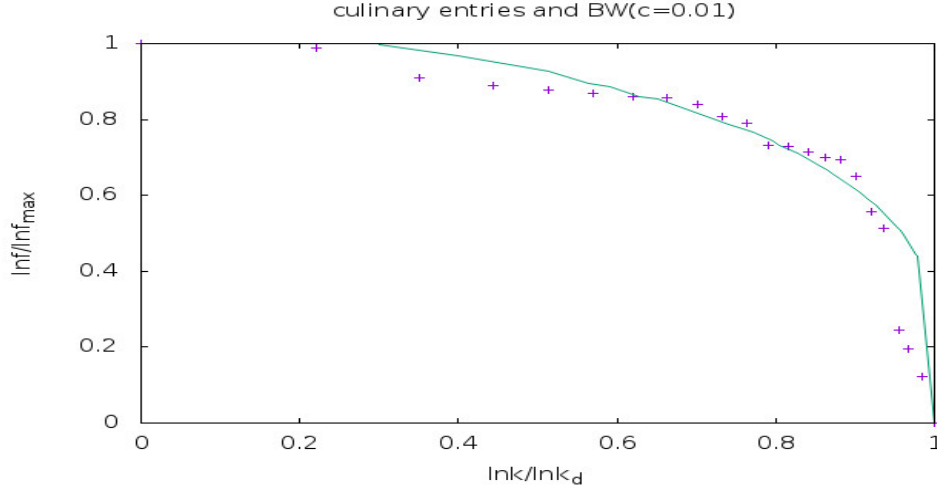


FIG. 3. The vertical axis is $\frac{\ln f}{\ln f_{max}}$ and the horizontal axis is $\frac{\ln k}{\ln k_{lim}}$. The + points represent the entries of the Dictionary of Culinary Terms with the fit curve being the Bragg-Williams curve in the presence of external magnetic field, BW($c=0.01$).

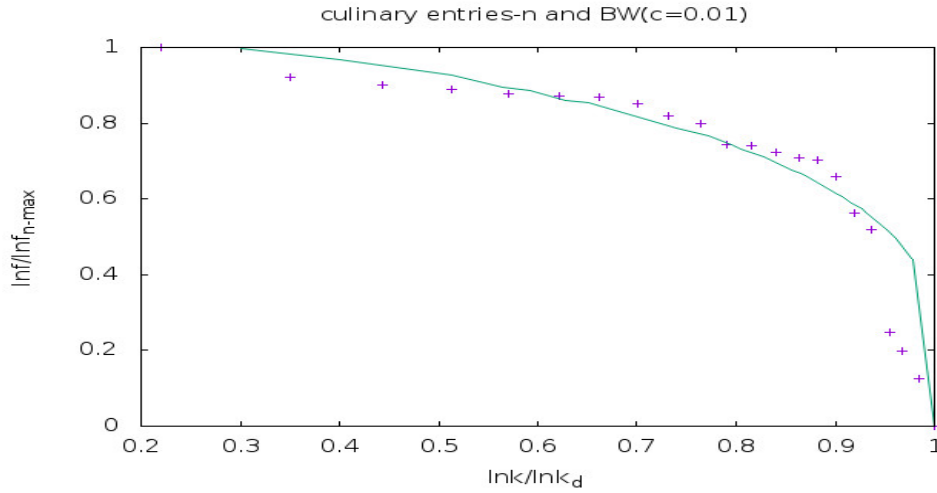


FIG. 4. The vertical axis is $\frac{\ln f}{\ln f_{n-max}}$ and the horizontal axis is $\frac{\ln k}{\ln k_{lim}}$. The + points represent the entries of the Dictionary of Culinary Terms with the fit curve being the the Bragg-Williams curve in the presence of external magnetic field, BW($c=0.01$).

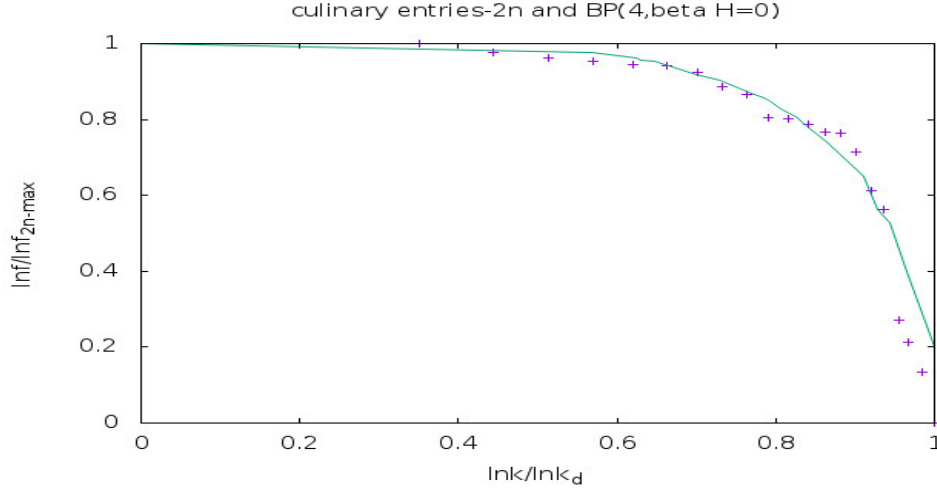


FIG. 5. The vertical axis is $\frac{\ln f}{\ln f_{2n-max}}$ and the horizontal axis is $\frac{\ln k}{\ln k_{lim}}$. The + points represent the entries of the Dictionary of Culinary Terms with the fit curve being the Bethe-Peierls curve in the presence of four nearest neighbours and no external magnetic field, $m = 0$ or, $\beta H = 0$.

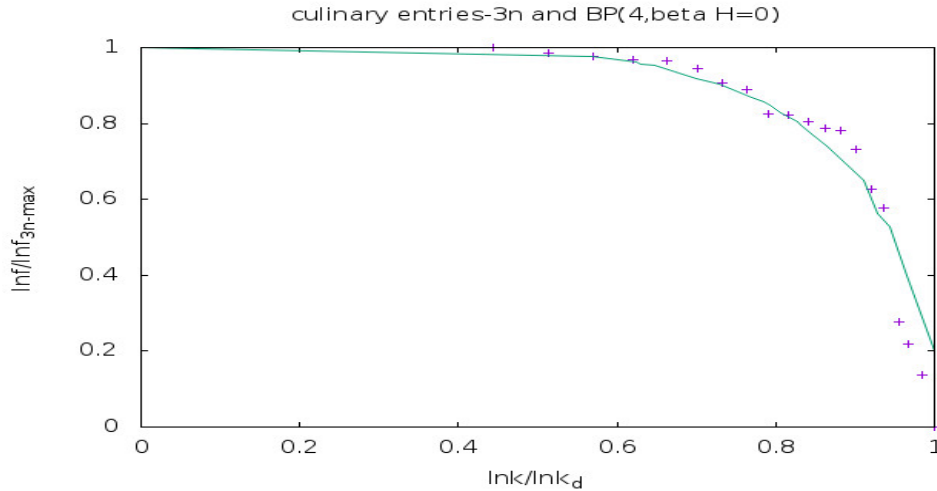


FIG. 6. Vertical axis is $\frac{\ln f}{\ln f_{3n-max}}$ and horizontal axis is $\frac{\ln k}{\ln k_{lim}}$. The + points represent the words of the entries of the Dictionary of Culinary Terms with the fit curve being the Bethe-Peierls curve in the presence of four nearest neighbours and no external magnetic field, $m = 0$ or, $\beta H = 0$.

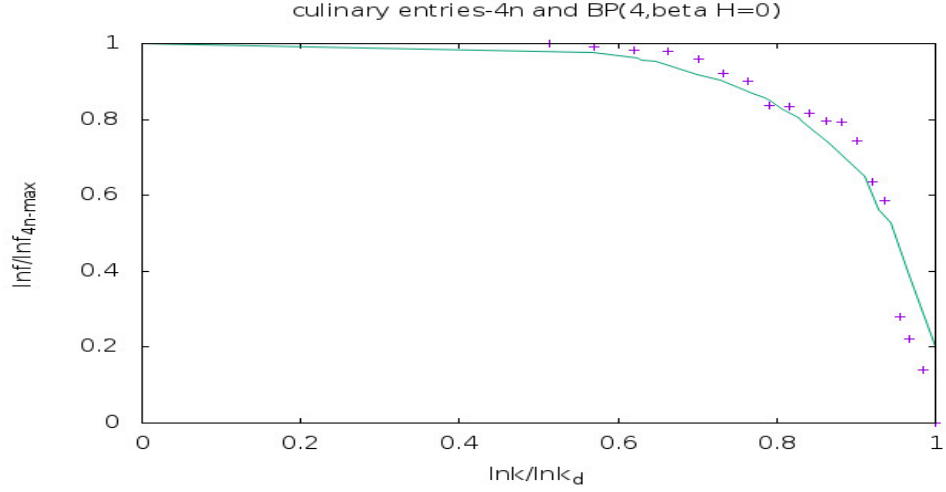


FIG. 7. Vertical axis is $\frac{\ln f}{\ln f_{4n-max}}$ and horizontal axis is $\frac{\ln k}{\ln k_{lim}}$. The + points represent the words of the entries of the Dictionary of Culinary Terms with the fit curve being Bethe-Peierls curve in the presence of four nearest neighbours and no external magnetic field, $m = 0$ or, $\beta H = 0$.

A. conclusion

From the figures (fig.3-fig.7), we observe that there is a curve of magnetisation, behind the entries of the Dictionary of Culinary Terms by Philippe Pilibossian,[1]. This is the magnetisation curve in the Bethe-Peierls approximation in the presence of four nearest neighbours and no external magnetic field, $m = 0$ or, $\beta H = 0$.

Moreover, the associated correspondance is,

$$\frac{\ln f}{\ln f_{2n-max}} \longleftrightarrow \frac{M}{M_{max}},$$
$$\ln k \longleftrightarrow T.$$

k corresponds to temperature in an exponential scale, [53]. As temperature decreases, i.e. $\ln k$ decreases, f increases. The letters which are recording higher entries compared to those which have lesser entries are at lower temperature. As the subject of Culinary art expands, the letters like ...,M, P, C which get enriched more and more, fall at lower and lower temperatures. This is a manifestation of cooling effect, as was first observed in [54], in another way.

IV. ACKNOWLEDGMENT

We have used gnuplot for plotting the figures in this paper.

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