INFORMATIQUE

A COMPARATIVE COMPUTER ANALYSIS
OF INUIT SONGS

by

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In Musil's novel "The Man without Qualities", Ulrich demands count Leinsdorf the creation of a General Secretariat for Precision and Soul. In Wittgenstein's and Freud's Vienna, the synthesis of both - precision and soul - remained an utopia which the following generations tried to achieve on earth. In this effort participated also informatics and musicology...

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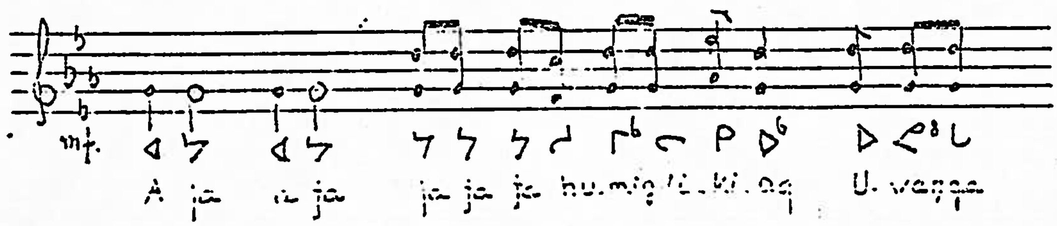
1. We are presenting this paper to justify the usefulness of computation in comparative musicological analysis. However, we would like first to explain and, if possible, to clarify some assumptions, which, in our view, warrant the effectiveness of the procedures employed.

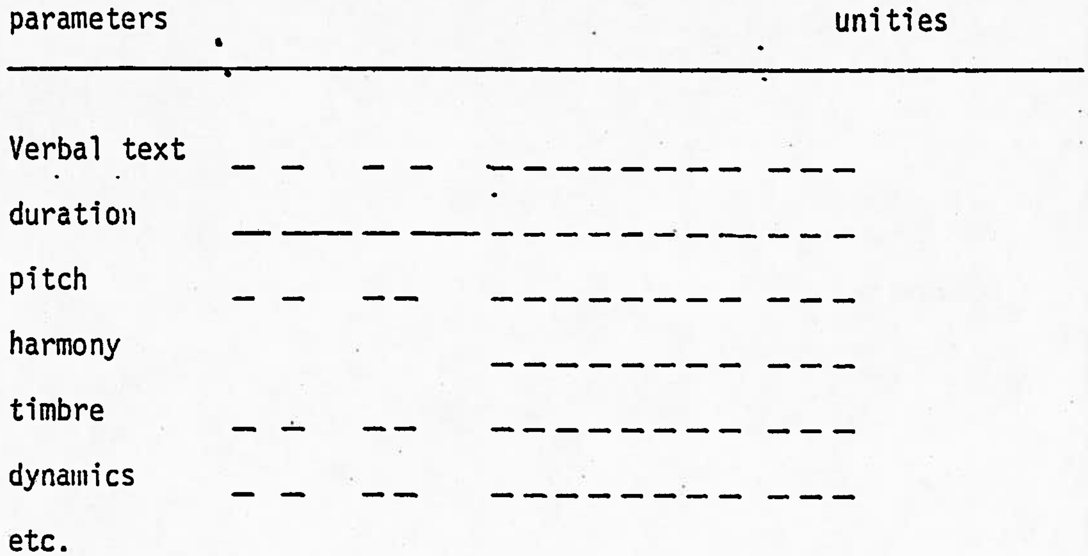
   1.1 In order to have a musical analysis implemented by a digital computer, music has to be considered as a system which consists of discrete units of pitch, duration, dynamics, etc... These units are defined by their distinctive traits, the code of which can be expressed in quantitative statements. According to the mathematical theory of communication, even if the signal transmitted in actual musical performance is continuous, its message is formed out by a successive selection of discrete symbols (C.E. Shannon and W. Weaver 1964: 8 and 12).

   Units expressed in symbolic music notation can have different dimensions, according to the level of analysis chosen, and to the kind of music studied. Function and organisation of units is certainly different in "Exotica" by Mauricio Kagel than in an Inuit "ajajai" song. Thus, in certain kinds of contemporary music, the many-layered sequences of units of various lengths in the various parameters are not synchronised in regard to the moment of articulation. However, in an Inuit personal song, the different units of the various parameters are synchronised by virtue of the temporally unifying segmentation of the verbal text into syllables.

   For example:



The synchronic organisation of unities in this example can be represented graphically as follows:



In this analysis, we privilege the parameters of pitch and duration. It seems to us that in the context of the Eskimo culture, these two parameters carry relatively more information than the other ones of a more redundant nature.

1.2 We describe the samples under consideration as a system of probabilities: the Inuit composer is considered to be a selector of sounds from the sound thesaurus of his culture, which is in turn a selection of the universal thesaurus of the circa 350,000 sounds perceivable by the human ear. This selection of sounds occurs with a certain degree of probability which can be expressed in terms of statistic percentages. A statistic percentage implies that the samples under consideration are ergodic: a finite sample under analysis has the same statistical structure as the infinite sequence of songs from which the sample is taken (J.E. Cohen 1962: 155-156). To assure the rightness of the ergodic assumption, the samples under consideration should be representative of homogeneous corpora (s.p. 4).

We use the concept of probability in the statistic sense: statistic probability is the counting of the number of occurrences of a quantitatively determined physical trait whicn belongs to a physical system (R. Carnap - W. Stegmüller 1959: 5-6). The number of occurrences is always expressed in a quantitative statement. The number of occurrences is an empiric concept: it is based on a certain amount of possible observations which are used to verify the statements concerning probability.

1.3 A computational analysis refers to music as a syntactic system. Quantitative elements refer not only to the elements of the system but also to the relationships among them, i.e. to the specific ways they are connected. This means that the immediate goal of computational analysis is to show how the system functions internally rather than to show what the system communicates (semantics) or how the message is used (pragmatics) (Ch. Morris 1938: 6). It is our assumption that no matter what the main goals of musical analysis are, a precise determination of the syntax of the musical system in question is necessary, for its specific organisation is the source of the possible significance attached to it and of the possible usage that it tolerates.

Being the determination of a syntactic system induced from the number of occurences of specific arrangements of elements, the computational analysis of syntactic arrangements also becomes useful for stylistical purposes. Indeed, stylistic statements as well can be induced from the frequency of occurrence of certain distinctive traits of the musical discourse.

Musical discourse
↓
recurrence of < traits or elements > → Syntax → Statistics → Stylistics

Although, one must admit, the pragmatic of our own discourse, based upon the syntactyco-analytical, already plays a role in determining what the object of the analysis is , its status, and what qualities it reveals.

2. At this stage, should we be accused of positivism and reductionism, we may bring to mind some metaphysical "rapprochements" of the musical to the numeric:

Philolaos from Croton:

"It would not be possible to have an object of knowledge, if everything was limitless. Indeed, everything which can be known, has a number. For it is not possible to seize with the thought or to know anything without a number" (H. Diels 1957: 77. Our translation)

Leibniz:

Music is "exercitium arithmeticae occultum nescientis se numerari animi" (G.W. Leibniz: Leibnitii Epistolae, Collectio Kortholti, ep. 154)

Rameau:

"Music is a science which must have definite rules; these must be drawn from an evident principle and this principle can hardly be known without the aid of mathematics"(Ph. Rameau 1722: Preface. Our translation)

M. Serres:

"Along with mathematics came the other Greek miracle: Music" (1)

For the purpose of this study, we have chosen two samples of 35 songs each, representing two Inuit settlements from the West coast of the Hudson Bay: Rankin Inlet and Eskimo Point. (2)

We have imposed upon the selection of the samples the following constraints:

2.1 The selected samples should belong to the same culture. Cultural subgroup differences represented by corresponding subsets of songs, are not taken into account. This means that the results of our analysis will specify quantifiable traits of the two corpora in relation to each other. The pertinence level will be the social groups from which the samples are taken.

Because music is sensitive to its social context, we have decided to start our research using exclusively songs recorded in the field by a member of the team. By using first hand data, we believe to insure the authenticity and the homogeneity of the samples.

2.2 The set of songs chosen for analysis should be representative of only one genre. In this case, we have selected the genre of the "ajajait"or personal songs used mainly for drumdancing.

Under these two constraints, the expected output should indicate stylistic traits specific to the regional and subgroup traditions.

We are aware that the number of songs is too small for a computer analysis to be really advantageous. However, this study was conceived as a pilot project to test the viability of a comparative computer analysis of Inuit songs. Consequently, we have chosen to start our work on a reduced sample.

3. One of the most serious problems which should be solved before beginning with the computer analysis is induced by the musical transcription: it conditions the output of the analytical procedure. In the process of translating oral data into graphic representation, tape recording into musical notation, misinterpretations may occur, which could mislead the entire process of analysis, and, consequently,infirm its results.

In order to prevent such distortions, we have taken the following precautions:

- assuming that experience in the field may refine the aural perception of a music that lies beyond our realm of cultural competence, the transcriptions were done by the same person which recorded the songs in the field. This precaution has the advantage of eliminating the diversity of perception by different transcribers, thus reducing the number of subjective decisions.

- most of the transcriptions were done in the field itself.

- all transcriptions were verified before their encoding.

- only such songs were considered in the sample, the intonation of which did not exceed the average limits of aural perception at the service of musical transcription.

- identical sound phenomena which were perceived identically were transcribed with identical signs.

Faced with the difficulty of determining the emicity of sound phenomena, we have decided in favour of an etic transcription, which indicates pitch, duration and phrase markers.

We did not try to determine emic equivalences already at the stage of the musical transcription, since the determination of emic equivalences is an analytical process which exceeds far the competence of the process of transcription into musical notation. However, it should be underlined that the transcription into conventional music notation represents already a strong abstraction from the subtle intonational "deviations" which characterize the Inuit performance of the"ajajait". The fluctuation of intonation (as seen from a Western perceptive behaviour) could be considered as systemic in Inuit music; systemic at least in the pitchband which surrounds the tonal center, and is approximatively delimited by an upper second major (G-A) and a lower second major (G-F).

Although these intonational fluctuations are most characteristic of Inuit singing, it was impossible to rationalize them into a system which could be accounted for by computational analysis. Theory is not a substitute for reality!

4. Before initiating our research, we agreed, at least in the preliminary stages of the research, that informaticians would abstain from asking questions about the aesthetic laws which may involve the composition and the performance of"ajajait". On the other hand, the musicological partner agreed to ask only questions which were formulable in quantitative terms. This agreement was obviously a condition sine qua non for starting a fruitful dialogue with the computer. The deliberate narrowing of the use of reason to the limits of computable experience was intended to give more leeway for the fancies of hermeneutic creativity...

Accordingly, our preliminary analytical goals are modest: we will begin with an inventory of the unities of the system; at a further stage, these unities will be used as elements for syntactic determinations.

Thus the analytical procedure includes:

- A computation of notes
    - the number of notes in each sample
    - the total time values of the notes in the samples
    - the total duration of each note
    - the frequency of each note
    - the notae finales
    - the total amount of different tones used (the "scale" of the sample)

- A computation of intervals

    - which intervals appear in the samples
    - the frequency of each interval (in percentage)
    - the frequency of note i being followed by note j
    - the frequency of note j being preceded by note i

- A listing of melodic patterns

- A computation of rhythmic values

    - table of rhythmic values occurring in a sample
    - rhythmic patterns of two consecutive time values

One of the interests of this preliminary analysis is to test its heuristic power. As we will show later (s.p. 20), it is (to a certain extent) possible to draw synthetic conclusions from simple computational procedures.

However, before presenting the conclusions, let us first explain the computer procedures involved in this study.

One of our first problems was finding an encoding for the representation of music in computer-readable form: this is a necessary consideration in a project of this sort, and it will always be until (there exists) systems able to efficiently process the usual musical notation, or (even better) directly the music itself. In this project, we use two representations of the musical notations:

a) The "external" representation, used in order to keypunch the music on cards. Main concerns when designing this representation are aspects of human engineering, i.e. convenience for the encoder and keypuncher.

b) The "internal" representation is the representation used in the computer data base, and must be designed with consideration to easy programming and efficient processing.

Concerning external representation, a review of the literature in the area revealed two major candidates:

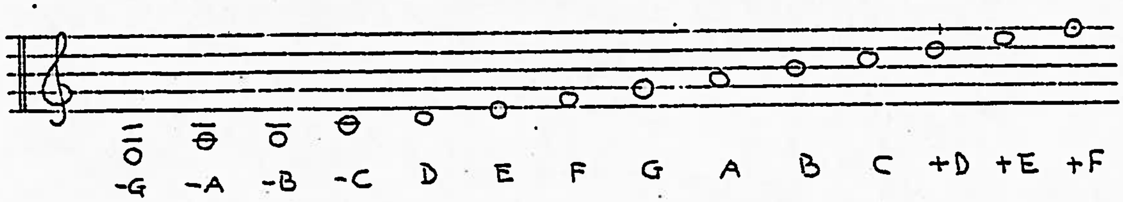
a) DARMS (DARMS 1977)

b) Wenker (J. Wenker 1970)

DARMS had the two advantages of being well-documented and well-established. However several reasons convinced us against it. First of all, many of the features of that representation were not needed by us, but still would have had to be used if we were to keep faithful to it. Consider for example key signature, clef and tempo indications: DARMS requests that they be given, which of course is unnecessary for our songs. On the other hand, Inuit music contains features that are foreign to Western music, and for which no representation exists in DARMS. Examples are the many different types of portamento, special ornamentation, etc.

Similar observations are valid for Wenker's representation. This one, however, having been devised for ethnomusicological purpose, was much closer to our needs.

Therefore, we decided to design our own external representation, thought in terms of the specific corpus of music in which we were interested, and in terms of the character set of the computer we had available (an IBM 360/65), following, but not constraining ourselves to, the ideas of Wenker.

Our representation is able to encode all the elements of the songs that were thought to be of interest, including ornamentation. A complete description of the notation will be published in the near future (P.J. Hickey, L. Logrippo, R. Pelinski, and E.C. Strong 1979). Notes are represented by the letters from A to G, as customary in the English tradition, and as in Wenker's representation. Middle C and notes below it are identified by a preceding -, while the note above the octave of middle C are identified by a preceding +. Graphically:

This range of three octaves can obviously be further extended by adding pluses and minuses, but such an extension is not necessary for the sets of songs we have taken into consideration. We also have symbols for sharps, flats, and for the representation of some pitch fluctuations (i.e. higher or lower than standard pitch). However, at this stage of our work, we have decided to ignore these subtle fluctuations, and to normalize the pitches to a tempered scale of twelve equal semitones. So in the attached tables the reader will find reference to notes such as "A sharp", which of course is to be considered equivalent to "B flat" (it should be noted that the data base contains instead an exact transcription of the pitches shown in the musical notation).

As concerns rhythm, we again followed Wenker's ideas. The semibreve is represented by a 1, and all its fractions are represented by the denominator of the fraction. So "4A" represents a quarter A, "16G" a G twice as fast, etc.

The songs were encoded by using this notation, and then keypunched. We prepared a set of programs to read the cards, perform as many legality checks as possible (in order to detect encoding or keypunching mistakes resulting in such things as uncompleted ties, etc.), and transform the encoding to the "internal" representation. Again, we refer the reader to the mentioned forthcoming paper that will explain the details of this representation. Here we only mention the fact that each note is represented by a record consisting of a number of fields, containing information such as: pitch of the note; its rhythmic value; whether it is a grace note, it contains portamentos, or is tied to the next note; etc.

All the analyses performed so far take into consideration only the information contained in the first two fields; however, in view of future work, we have created a data base containing a complete representation of all the elements of the melody. All this extra information has the unfortunate effect of complicating programming, but will become useful should we ever decide to study topics such as the use of grace notes, etc. It should be stressed that the decision on how much information to include in the data base is one of the most important decisions in a project of this sort. If too much information is included, encoding, keypunching and programming will be unnecessarily complicated by the presence of data that will never be used. If too little, much work may be necessary in order to add the omitted information at a later stage. It is unfortunate that this crucial decision must be taken at the very initial stages of the project, where some of the research objectives may still not be completely clear.

A fact that has to be taken into consideration when designing an encoding system for ethnomusicological notation is that this notation cannot be as standardized as the one used for Western classical music. Also, sets of songs of different origin may require somewhat different notations. For example, at the time we started this research, only the Rankin Inlet corpus was available, thus we tailored our representation according to what was needed there. When we started to work on the Eskimo Point corpus, we realized that it contained some new notation, needed to represent things such as "Sprechstimme", new types of ornamentation typical to the Eskimo Point style, etc. An external and internal representation had to be invented for this new notation. Furthermore, since we wanted to be able to use any of the previously written programs on any of the songs, we were forced to modify accordingly all the existing files and programs.. We hope that less of this work will be needed as we take into consideration more and more songs, thereby making our representation increasingly more complete.

An obvious lesson to be drawn from this experience is therefore that an important characteristic of encodings to be used in this sort of research is that they be easily extendable and modifiable.

We now give some details on how the various tables were computed. As a general remark, note that percentage figures are approximate by truncation and/or rounding, so percentages will not add up to exactly 100.

4.1 <u>TABLE 1</u> (p. 24-25)

<u>Number of notes in the songs</u>. This quantity will be denoted nn.

<u>Total time values of the notes in the songs</u>. This quantity is obtained by simply adding all the time values as they appear in the notation. Of course, it is not a measure of actual duration. We call this quantity tt.

Total duration of each note. These durations were obtained by simply adding all the time values of all the notes of the same pitch in the set of songs in consideration. For a note a, we call its total duration ta. The percentage of total duration of note a is obtained by evaluating the formula 100. (ta/tt).

Number of occurrences of each note is the total number of times the note occurs in the set of songs. For a note a, we call na the number of times a appears in the set of songs. Percentage of number of occurrences of ntoe a is then 100. (na/nn)

4.2 TABLE 2 (p. 26-27). This table shows which intervals appear in the set of songs in consideration, in absolute values and in percentages. For example, 7 denotes an ascending interval of seven semitones, i.e. a perfect fifth. -7 denotes the same interval, but descending.

4.3 Matrix M (p. 28-29) This matrix shows the number of times each interval appears in the set of songs. For example; in the matrix M for Eskimo Point one sees that M(D,F)= 17. This means that D is followed by F 17 times in the Eskimo Point sample.
Note that the array contains three special entries: Rest, First, and Last. So M(A, Rest) indicates how many times note A precedes a rest in the set of songs (twice in the Eskimo Point sample). First and Last denote the beginning and end of a song M (First, G) is then the number of times G is an initial note in the set of songs (27 times in the Eskimo Point sample).

The following matrices N, P, and Q were obtained from array M and will be explained in terms of M.

4.4 Matrix N (p. 30-31). This array gives, in percentage values, the number of occurrences of each interval in the set of songs. So element N(i, j) is obtained by dividing M(i, j) by the total number of intervals in the songs, and multiplying the result by 10,000. Note therefore that each number in this array should be mentally divided by 100. The decimal point is not shown for reasons of space and readability.

4.5 Matrix P (p. 32-33). Element P(i, j) of matrix P gives, in percentage values, the number of occurrences of ntoe i being followed by note j in the set of songs. It was calculated by using the following formula:

$$P(i, j) = 100.M(i, j) / \sum_{k=1}^{Max} M(k, j)$$

So for example P(-A#, D)= 50 for Eskimo Point means that -A# is followed by D 50% of the times in this set of songs.

4.6 Matrix Q (p. 34-35). Element Q(i, j) of matrix Q gives, in percentage values, the frequency of note j being preceded by note i in the set of songs. The reason why matrices P and Q are not the same will be explained by a simple example: consider the sequence

FGGGG

Clearly, F is always followed by G in this sequence, so P(F, G) is 100%. However, G is most often preceded by another G, so Q(F, G) = 25% only, while Q(G, G) 75%. Matrix Q was obtained by the following formula:

$$Q(i, j) = 100.M(i, j) / \sum_{K=1}^{Max} M(i, k)$$

4.7 Listing of melodic patterns. This listing was produced in order to obtain some preliminary information on melodic patterns, before proceeding to more complex programming tasks such as the one described in Regener (E. Regener 1975: 5-8). First, the songs were "compressed" by eliminating rhythmic information, repeated notes, ornamentation, etc... These compressed songs were then scanned, in order to obtain all the melodic patterns of length from three to sixteen. Thus, from a compressed melodic pattern such as:

G F G A# G D

we would extract the following subpatterns:

of length 3:

G F G

F G A#

G A# G

A# G D

of length 4:

G F G A#

F G A# G

G A# G D

and so on. The number of times each pattern appeared in the set of songs was then counted. Finally, a listing of all the subpatterns was printed out, sorted by length and, within length, by number of occurrences. The printout also shows in which songs each pattern appears. Thanks to an ingenious program organisation we were able to do most of this "in core", i.e. with little use of temporary external storage devices.

4.8 Rhythm analysis programs. The rhythm analysis proceeded more or less according to the same ideas as melodic analysis. Rhythmic values were classified according to the following scheme:

3(1/64) sixty-fourth note within a triplet (also abbreviated 3*64).

1/64 sixty-fourth note (also abbreviated 64).

3(1/32) thirty-second note within a triplet (also abbreviated 3*32).

1/32 thirty-second note, or thirty second tied to a sixty-fourth within a triplet (abbreviated 32).

etc.

The sign + indicates a tie, so 1/4 + 1/8 + 1/16 (also abbreviated 4 + 8 + 16) denotes the time value of a quarter note tied to an eighth note, tied to a sixteenth note.

4.9 TABLE 3 (p. 36-37). Table of rhythmic figures occuring in the set of songs. This table shows how many times each one of the values above occurs in the set of songs in consideration, as a note and as a rest. For example, in the set of Rankin Inlet songs, the rhythmic value of an eighth note tied to a sixteenth note occurs 52 times as a note, three times as a rest.

4.10 TABLE 4 (p. 38-39). Shows the same information in terms of percentages. In the Rankin Inlet songs, the rhythmic value of an eight rest followed by a sixteenth rest is 0.21% of all rests and 0.02% of all rhythmic figures (rests and played notes). On the other hand, the same rhythmic figure as a sung note is 1.26% of all sung rhythmic figures, and 1.13% of all rhythmic figures (rests and sung notes).

4.11 TABLE 5 (p. 40-41). Rhythmic patterns of length two. This table shows how many times each combination of two consecutive time values occurs in the set of songs in consideration. For example, in the set of Rankin Inlet songs, the rhythmic value of a sixteenth note within a triplet occurs 3 times followed by the rhythmic of a sixteenth note.

4.12 TABLE 6 (p. 42-43). Shows the same information in terms of percentages. All the figures in this table must be mentally divided by 100. So in the Rankin Inlet songs, the rhythmic value of a sixteenth within a triplet is followed 0.05% of the time by a sixteenth note. We make no distinction here between rests and sung notes.

4.13 Rhythmic patterns of length greater than two. We also have programs for the listing of longer rhythmic patterns, which proceed in a fashion similar to the programs discussed under 7. These programs however have only been used to analyze the Rankin Inlet sample, and we are currently working on the modifications that are necessary to run them on the Eskimo Point sample. A serious obstacle in this rhythm analysis has been found to reside in the fact that there was no way of compressing the information by eliminating repetitions as could be done for melodic patterns. So this analysis revealed an enormous number of rhythmic patterns. One of the tables printed, a dictionary of all the rhythmic patterns of length from three to fifteen found in the set of all Rankin Inlet songs, with indication of where each pattern appears, fills two boxes, each one of them 30 centimeters high. Needless to say, we never dared to read beyond the first few pages of this enormous printout.

These programs were developed over a time span of about two years, many of them as undergraduate student projects in the Department of Computer Science of the University of Ottawa. The rhythm analysis programs described in point 4.13 were developed by Hélène Gauthier, an undergraduate student in the Department.

The programming language used is PL/I under the optimizing compiler. The programs run on the IBM 360/65 of the University of Ottawa, under the operating system MVT.

5. In the following, we will present the results of our research. They are obtained through comparative analysis and interpretation of the computational outputs.

To be retained: nn = number of notes in a song
tt = total time value of the notes in the two samples
pd = percentage of total duration
po = percentage of total number of occurrences

R.I. = Rankin Inlet
E.P. = Eskimo Point

5.1 Table 1 R.I. and E.P. : Computation of notes

(s.p. 24 and 25)

Comparative excerpt:

	R.I.	E.P.
nn	5,329	6,593
tt	941 semibreves	1,239 semibreves
pd of note G	46.50%	57.76%
po of note G	44.40%	53.71%
Number of pitches used	17	16

This means:

a) The major nn in the sample of E.P. and the corresponding major tt simply indicate that songs in E.P. are longer than they are in R.I. As the length of a song is usually a function of the verbal text ("tainirk") and of the "ajajai" refrain ("kimmik"), the longer the tainirk and the kimmik are, the longer the song will be.

b) The higher number of different pitches used in R.I. (19 pitches) points out that this sample has more melodic possibilities than the sample of E.P. (16 pitches), which tends towards a certain melodic redundancy.

c) In both samples, the higher of pd and po corresponds to the note G. In fact, G is recitation tone as well as tonal center in both samples.

d) Furthermore, pd and po indicate that there is a different distribution of pitches in both samples (compare Table 1 R.I. with Table 1 E.P.). This difference traces back to a different pitch organization which dominates in the different samples. Indeed, if we build abstract scales according to po, we will obtain for R.I.:
G - A - C - F# - F - E
for E.P.:
G - F - F# - A# - C - G#

These abstract pitch collections are the source material of the melodic patterns, which characterize each one of the samples in a specific way (s.p. 19).

5.2 Table 2 R.I. and E.P.: Computation of Intervals

(s.p. 26 and 27)

Comparative excerpt:

The interval	Frequency percentage R.I.	E.P.
Prime (0 half-tones)	51.0%	53.6%
MD2 (-2 half-tones)	14.1	10.9
MA2 (+2 half-tones)	8.6	7.1
mD3 (-3 half-tones)	6.4	4.3
mA3 (+3 half-tones)	4.3	6.6
Ascending intervals	21.4%	21.9%
Descending intervals	27.6%	24.6%
Prime intervals	51.0%	53.6%

This means:

a) The results of the interval counting confirms the results of the note counting. Thus, the high percentage of prime intervals in both samples indicates that the tune is mostly based on recitation of the text on the same tone. Here, again, E.P. with 53.6% of prime intervals slightly more redundancy than R.I. (51.0%), and consequently a tendency towards less of a "melodic" movement.

b) Furthermore, the order of frequency of the most used interval series (prime, second, third) is common for both samples. This leads us to believe that both samples have a basically analogous tonal organization. Differentiation occurs on a level of lower frequency of the interval series and on the subtle shifting of interval classes (prime, ascending, descending). Divergent organization of interval classes may be relevant to a differentiation in the contour shape.

5.3 Matrices M and N (R.I. and E.P.): Frequency of occurrence of the intervals

(s. p. 28-29 and p. 30-31)

Whereas Tables R.I. and E.P. indicate only serial quality (prime, second, third, etc...) and class direction (prime, ascending, descending) of the intervals, Matrices M and N add new information about:

- the number, percentage of occurrence and relative position of the intervals in the scale, and, moreover,
- the context in which rests may appear, and
- the notes which appear at the beginning and at the end of the songs.

We observe:

a) The maximum intervallic activity occurs in the range of -C to +D in the sample of R.I.; and in the range of D to C in the sample of E.P. The transgression of these limits is exceptional. Thus, the range of melodic activity is smaller in E.P. than in R.I., which means that intervallic, i.e. melodic activity is more diversified in R.I. than in E.P.

Privileged intervals are:

	In R.I.	In E.P.
G-G	27.13%	35.52%
G-F	3.62%	6.40%
A-G	5.67%	2.09%
A-A	4.82%	1.59%
F-F	2.55%	3.50%
F-G	2.36%	3.90%

These quantities indicate that R.I. prefers intervallic activity in the pitch band of G-A, i.e. between the tonal center and the "supertonica". Whereas E.P. prefers an intervallic activity within the region of G-F. These preferences, as we shall see later, are related to the different preferences in the modal organization of each sample.

b) The current assumption that rests in the "ajajait" are a function of performance rather than a function of structure is modified by the counting of the total number of rests. Indeed:

- singers in R.I. tend to breathe twice as often (6.88% rests in the sample) than singers in E.P. (only 3.28% rests in the sample) whose songs are longer;

- by far the greatest number of rests occurs either following or preceding the tonal center. Concerning the rests which occur in a different context than that of the tonal center, we observe that in R.I. rests usually follow notes which are equally distributed between the authentic and the plagal registers, and usually precede notes which belong to the authentic register (A, B). Whereas, in Eskimo Point, rests usually follow and precede notes from the plagal register. These statements, however, do not weaken the fundamental assumption that "ajajait" are breathless songs. As Reverend Armand Tagoona, from Baker Lake, puts it, "the songs of white people include breaks which do not exist in those of the Inuit. If two Inuit sing together, one of them can stop to take a breath, while the other one continues singing". (A. Tagoona 1978: 56)

5.4 Matrices P and Q (R.I. and E.P.): Contexts of intervals

(s. p. 32-33 and 34-35)

Matrices P and Q are a step towards the determination of the intervallic grammar of both samples. They show which intervals are permitted and which are excluded from the sample (value 0). This selection of intervals pertinent to the sample is operated by showing how often a note i is followed by a note j (Matrix P) or how often a note j is preceded by a note i (Matrix Q).

. Comparative chart of the distribution of intervals in R.I. and E.P. (Matrix P)

		D	D#	E	F	F#	G	G#	A	A#	B	C	C#	÷D
D	R.I.	38		3	3	0	28		3					
	E.P.	6		0	9	16	50		0					
D#	R.I.		9				88			0				
	E.P.		22				59			9				
E	R.I.	9		34		0	19		6			3		3
	E.P.	0		19		13	56		3			0		0
F	R.I.	3			34		31	0	13	0				
	E.P.	0			28		34	19	0	3				
F#	R.I.			3		34	38		16					
	E.P.			3		38	34		13					
G	R.I.			3	6	3	59		6	0				
	E.P.			0	9	3	66		0	3				
G#	R.I.				16		66	0				16		
	E.P.				9		34	31				13		
A	R.I.				3		41		34		3	3		
	E.P.					9	41		31		3	3		
A#	R.I.						22	0	0	44		13		9
	E.P.						31	3	3	31		16		0
B	R.I.						22		25		31	9		3
	E.P.						34		22		25	6		0
C	R.I.						9	0	22	3	6	38		13
	E.P.						28	3	0	13	0	38		0
C#	R.I.						0		0		0	0	0	
	E.P.						9		9		9	38	28	
÷D	R.I.								9	0	9	38		28
	E.P.								0	13	25	13		50

Note: the chart presents a frequency distribution only in the ambitus of D to ÷D.

The chart shows that:

a) The tonal center is privileged in the formation of intervals: each tone of the scale has at least one instance in which the tonal center G becomes an element of the respective interval.

b) The higher density of the distribution going from high left to low right of the chart is due to the relatively small intervals predominant in the corpora.

c) Certain distributions particularize the corpus: thus, there are some intervals specific to E.P. and some other, specific to R.I.

5.5 Listing of melodic patterns

In the context of this study, we understand by "melodic pattern" any melodic sequence which is composed of at least two intervals from which the prime is excluded.

We distinguish between dependent and independent melodic patterns. Melodic patterns are independent when they are not part of a longer repeated pattern. Dependent melodic patterns are part of a longer repeated pattern.

We also distinguish between redundant melodic patterns and specific melodic patterns. Redundant melodic patterns are those which do not individualize the song; they exceed neither the third above the tonal center nor the third below the tonal center.

Specific melodic patterns are those which individualize the song: they exceed the major third above and / or below the tonal center. A specific melodic pattern begins and ends on the tonal center G.

For the purpose of this study we will only take into account such patterns which occur in more than one song. The reason for this limitation being that we want to verify the following hypothesis: Inuit songs are composed from a thesaurus of a limited number of independent specific melodic patterns.

Originally, our objective was to establish a dictionary of melodic patterns, which should have allowed to recognize the relationship among them on different levels of pertinence. However, the accomplishement of this objective has been relayed to a later stage.

Some of the preliminary results are expressed in the following table:

	R.I.			E.P.	
Number of occurrences	pattern	appears in	Number of occurrences	pattern	appears in
121	G-A-G	23 songs	221	G-F-G	17 songs
99	G-F-G	15 songs	164	F-G-F	17 songs
79	G-F#-G	10 songs	120	G-F-G#	10 songs
67	A-G-F	13 songs	112	G-F#-G	20 songs
59	C-A-G	15 songs	92	G-A#-G	12 songs
58	A-G-A	13 songs	86	F-G#-G	11 songs
57	A-G-F#	8 songs	82	G#-G-F	10 songs
52	F-G-F	10 songs	80	F#-G-F#	16 songs
etc			etc		

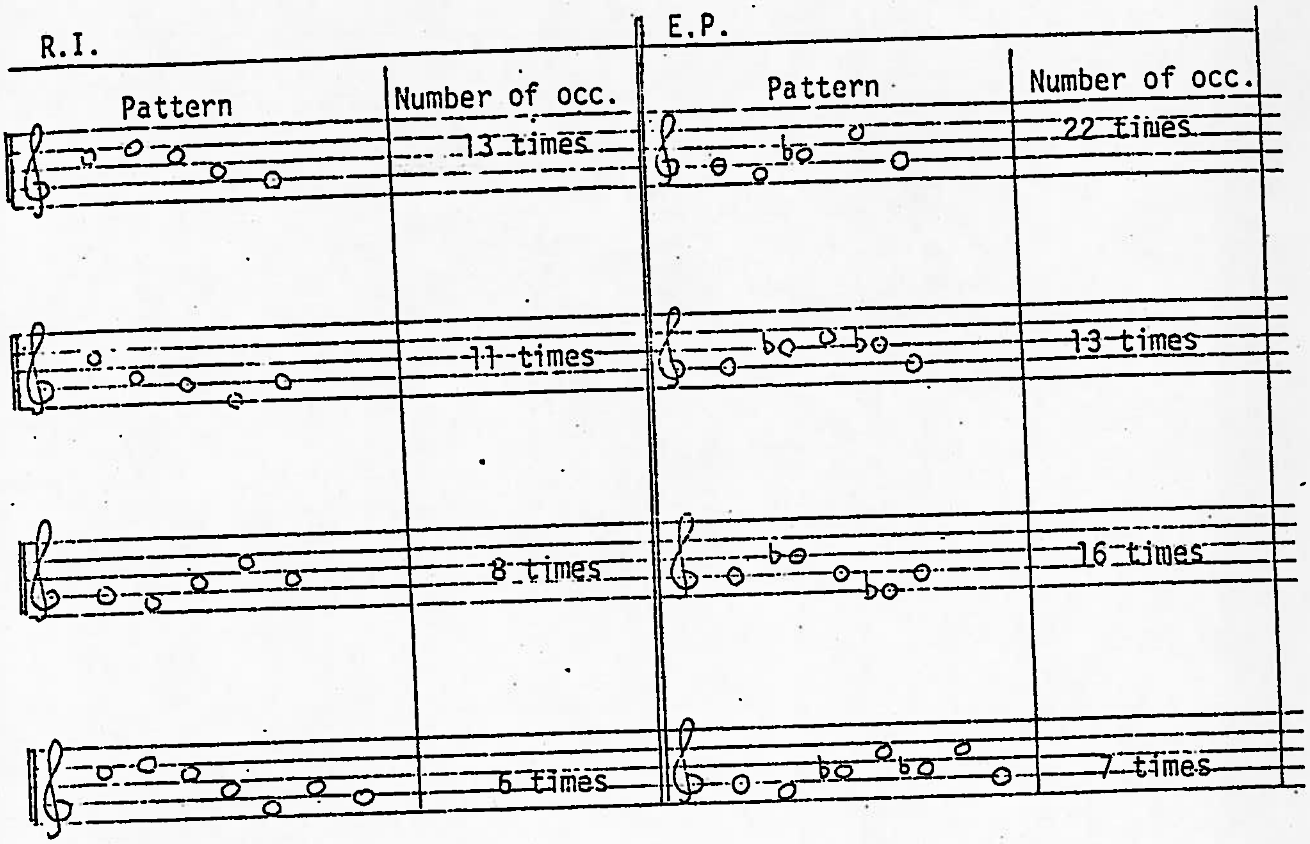
We observe that:

- the number of melodic patterns or intervallic sequences selected from the set of possible intervals confirms the differences existing between the two samples: Among the 8 most used melodic patterns of length three, only three are common to both samples (G-F-G; G-F#-G and F-G-F).

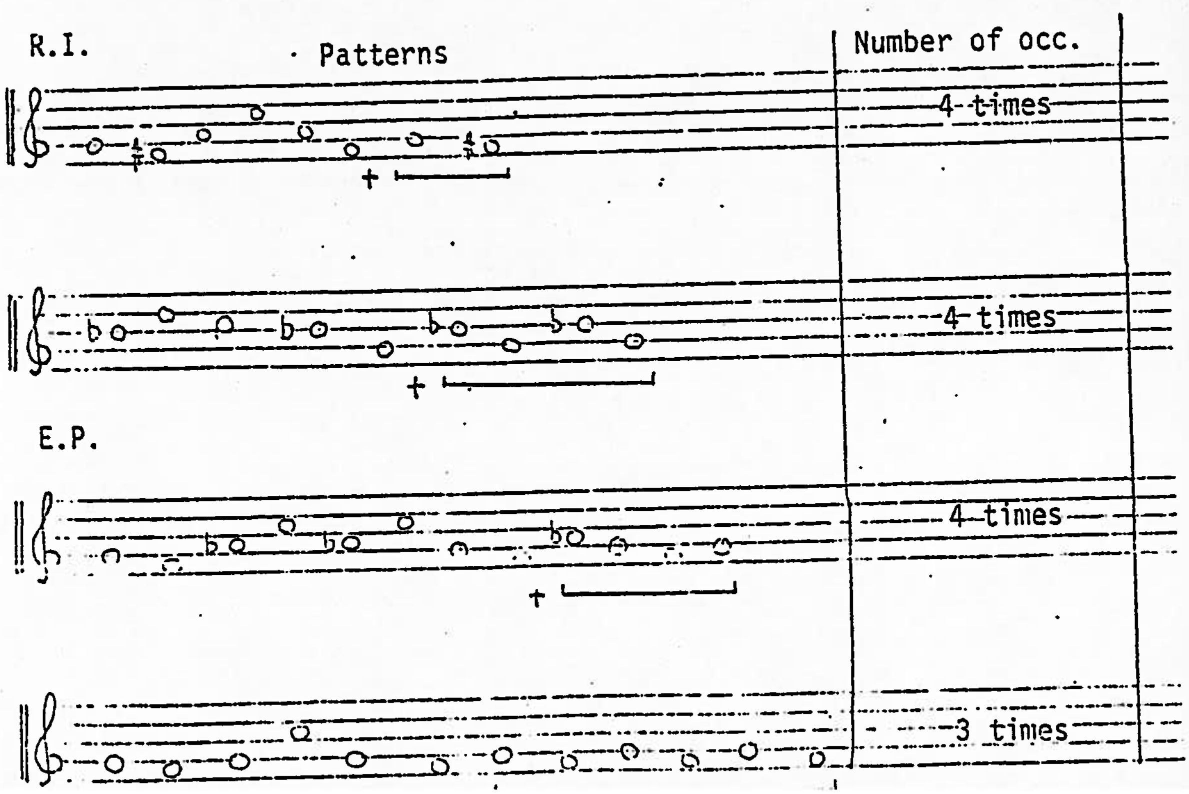
- in both cases, the major concentration of melodic activity occurs in the pitchband surrounding the tonal center. In other words, the highest amount of melodic activity is carried by the redundant melodic patterns.

- it is common to both samples, that specific melodic patterns are most frequent in the length order of 4 or/and 5 intervals. These patterns emerge like islands in the quiet sea of redundant melodic patterns which abound in both samples.

- specific melodic patterns are more diversified, hence, relatively less frequent, in the sample of R.I. This might be due to the higher degree of heterogeneity which characterizes the provenance of the Eskimo population in R.I.



- finally, the wider the interval leaps are, the less frequent the longest repeated melodic patterns are. We notice also that the longest repeated patterns are obtained by coupling a specific melodic pattern with redundant prefixes and/or infixes (M. Hauser 1977).



5.6 Tables 3 and 4 R.I. and E.P.: Rhythmic values

(s.p. 36 to 39)

Tables 3 and 4 R.I. and E.P. show the frequency distribution of rhythmic values for notes and rests: We observe:

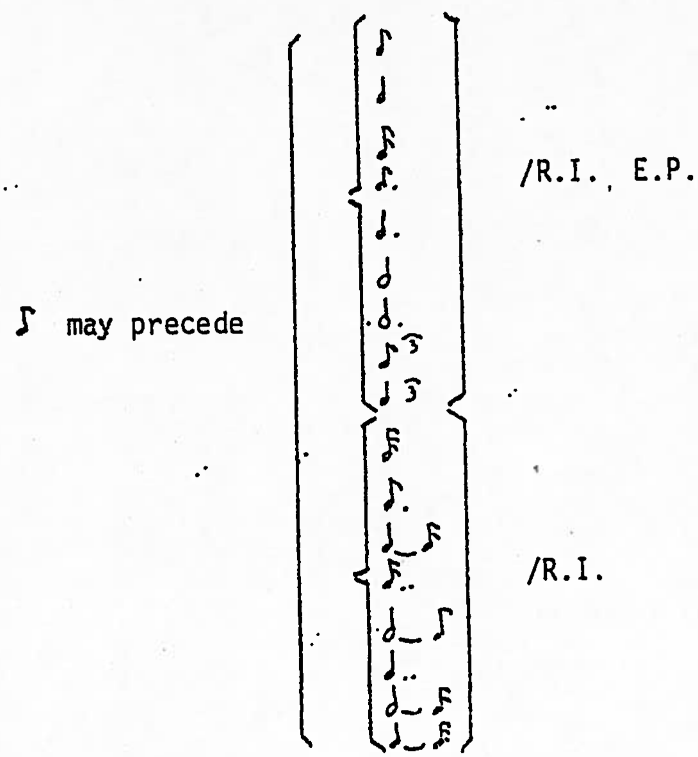
- the unity of declamation is the eight.
- the relative high amount of eight-triplets in E.P. is due to the tendency of the singers to transform ♪♪ into ♩♪ (triplet)
- otherwise the rhythmic organization of both samples is more similar than their melodic organization.

5.7 Tables 5 and 6 R.I. and E.P.: Rhythmic patterns of length two

(s.p. 40 to 43)

We observe:

- the predominant rhythmic movement of both samples is based upon sequences of eighth, which usually enter into combination with quarters.
- Table 4 R.I. and E.P. is the first step towards establishing syntactic rules concerning the division and combination of rhythmic values, which, similarly to the intervalic rules implied in Matrices P and Q, would assume the following form:



Whereby the different values are classified according to their frequency distribution in the sample of R.I.

6. Conclusion

Instead of offering a tautologic conclusion in the form of analytical statements, we prefer to raise some critical questions concerning the research done; this will serve as a forewarning for the continuation of our project.

At this stage of our research, it is not the fault of the computer if some important questions concerning the syntax of our corpora remain unanswered:

- If it is true that the syntactico-analytical perspective is based upon a multiple taxonomy of previously isolated units, we may ask if a classificatory identification of elements constitutes a pertinent description. Does the simple isolation and classification of units yield ipso facto a basis for syntax? Is syntax an immediate product of statistics? As Milton Babbit said: "The problem of analysis, of course, is that of signification, not of identification". (A. Forte 1967: 38)

- Furthermore, at the structural level, our algorithms produce little information about the functional interrelation of elements of different series; i.e. pitches are not related to duration, melodic patterns to formal structure, etc.

- On a higher level of criticism, we may observe that it is dubious that the postulae of analycity could assure the closest and most comprehensive view of musical facts in Inuit culture. As we stated before (s.p. 3), it is probable that the search for a coherent view of an object, based upon the analytical decomposition of this object into its smallest units, predetermines the object which we are actually trying to discover. Indeed, we must admit that an examination of larger and more complex units of musical discourse would yield more significant results concerning the organisation of the songs studied here. If, for example, our perspective were based on the production of musical discourse in the frame of interacting individual texts and social contexts, a more dynamic view on the corpora would be obtained. However, at this stage of our research, we are not sure if the consideration of "Wholes" of musical discourse could be meaningfully operational in terms of a computer processing of data. For, if they are not quantifiable, they cannot be an object of computer-implemented analysis.

Until these, and similar questions, are answered, we recognize that we can not comply with Ulrich's requirements for a General Secretariat for Precision and Soul. For the soul is still missing.

NOTES

1. Seminar given at the University of Montreal, winter session 1977.
2. The songs were collected by R. Pelinski in 1975-76 and 1977, respectively.

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STATISTICS ON THE SONGS FROM RANKIN INLET

THERE ARE 6557 NOTES IN THE SONGS (INCLUDING RESTS).

THE SONGS LAST 1095 UNITS OF TIME (INCLUDING RESTS). A SEMIBREVE IS ONE UNIT.

THERE ARE 19 DIFFERENT NOTES IN THE SONGS. IN ORDER OF FREQUENCY, THEY ARE:

NOTE	TOTAL DURATION (A SEMIBREVE IS ONE UNIT)	PERCENTAGE OF TOTAL DURATION	NUMBER OF OCCURENCES	PERCENTAGE OF TOTAL NUMBER OF OCCURENCES
G	509.24 UNITS OF TIME	46.50%	2740 TIMES	41.79%
A	118.53 UNITS OF TIME	10.82%	843 TIMES	12.86%
C	65.06 UNITS OF TIME	5.94%	408 TIMES	6.22%
F#	44.49 UNITS OF TIME	4.06%	407 TIMES	6.21%
F	62.02 UNITS OF TIME	5.66%	387 TIMES	5.90%
E	56.88 UNITS OF TIME	5.19%	349 TIMES	5.32%
B	32.83 UNITS OF TIME	3.00%	243 TIMES	3.71%
D	36.47 UNITS OF TIME	3.33%	240 TIMES	3.66%
+D	29.25 UNITS OF TIME	2.67%	236 TIMES	3.60%
A#	21.80 UNITS OF TIME	1.96%	141 TIMES	2.15%
-C	6.63 UNITS OF TIME	0.60%	50 TIMES	0.76%
+E	2.69 UNITS OF TIME	0.25%	18 TIMES	0.27%
+F	1.31 UNITS OF TIME	0.12%	10 TIMES	0.15%
G#	0.72 UNITS OF TIME	0.07%	9 TIMES	0.14%
D#	1.06 UNITS OF TIME	0.10%	9 TIMES	0.14%
-B	0.30 UNITS OF TIME	0.03%	6 TIMES	0.09%
-G	1.50 UNITS OF TIME	0.14%	6 TIMES	0.09%
-C#	0.38 UNITS OF TIME	0.03%	3 TIMES	0.05%
-A#	0.31 UNITS OF TIME	0.03%	1 TIMES	0.02%
REST	104.03 UNITS OF TIME	9.50%	451 TIMES	6.88%

THERE ARE 7501 NOTES IN THE SONGS (INCLUDING RESTS).

THE SONGS LAST 1383 UNITS OF TIME (INCLUDING RESTS). A SEMIBREVE IS ONE UNIT.

THERE ARE 16 DIFFERENT NOTES IN THE SONGS. IN ORDER OF FREQUENCY, THEY ARE:

NOTE	TOTAL DURATION (A SEMIBREVE IS ONE UNIT)	PERCENTAGE OF TOTAL DURATION	NUMBER OF OCCURENCES	PERCENTAGE OF TOTAL NUMBER OF OCCURENCES
G	776.69 UNITS OF TIME	56.15%	3919 TIMES	52.25%
F	132.00 UNITS OF TIME	9.54%	821 TIMES	10.95%
F#	78.24 UNITS OF TIME	5.66%	479 TIMES	6.39%
+F#	70.17 UNITS OF TIME	5.07%	423 TIMES	5.64%
C	64.48 UNITS OF TIME	4.66%	411 TIMES	5.48%
C#	72.10 UNITS OF TIME	5.21%	390 TIMES	5.20%
A	59.79 UNITS OF TIME	4.32%	350 TIMES	4.67%
E	19.79 UNITS OF TIME	1.43%	134 TIMES	1.79%
D	19.69 UNITS OF TIME	1.42%	123 TIMES	1.64%
B	13.17 UNITS OF TIME	0.95%	88 TIMES	1.17%
D#	12.33 UNITS OF TIME	0.89%	87 TIMES	1.16%
+C#	1.17 UNITS OF TIME	0.08%	10 TIMES	0.13%
-C	1.29 UNITS OF TIME	0.09%	9 TIMES	0.12%
+D	1.56 UNITS OF TIME	0.11%	8 TIMES	0.11%
-A#	0.25 UNITS OF TIME	0.02%	2 TIMES	0.03%
-B	0.13 UNITS OF TIME	0.01%	1 TIMES	0.01%
REST	60.27 UNITS OF TIME	4.36%	246 TIMES	3.28%

TABLE 1 - E.P.

THERE ARE 22 DIFFERENT INTERVALS. THEY ARE:

THE INTERVAL	# OF OCCURENCES	PERCENTAGE
0 HALF-TONES	2816 TIMES	50.2
-2 HALF-TONES	765 TIMES	13.6
2 HALF-TONES	477 TIMES	8.5
-3 HALF-TONES	348 TIMES	6.2
3 HALF-TONES	253 TIMES	4.5
-1 HALF-TONES	172 TIMES	3.1
1 HALF-TONES	149 TIMES	2.7
5 HALF-TONES	127 TIMES	2.3
4 HALF-TONES	120 TIMES	2.1
-5 HALF-TONES	120 TIMES	2.1
-4 HALF-TONES	113 TIMES	2.0
7 HALF-TONES	46 TIMES	0.8
-7 HALF-TONES	35 TIMES	0.6
8 HALF-TONES	22 TIMES	0.4
10 HALF-TONES	22 TIMES	0.4
9 HALF-TONES	10 TIMES	0.2
-8 HALF-TONES	6 TIMES	0.1
6 HALF-TONES	6 TIMES	0.1
-12 HALF-TONES	3 TIMES	0.1
-10 HALF-TONES	3 TIMES	0.1
-15 HALF-TONES	1 TIMES	0.0
12 HALF-TONES	1 TIMES	0.0

22.0% OF THE INTERVALS ARE ASCENDING.

27.9% OF THE INTERVALS ARE DESCENDING.

50.2% OF THE INTERVALS ARE NEITHER ASCENDING NOR DESCENDING.

TABLE 2 - R.I.

THERE ARE 15 DIFFERENT INTERVALS. THEY ARE:

THE INTERVAL	# OF OCCURENCES	PERCENTAGE
0 HALF-TONES	3769 TIMES	54.1
-2 HALF-TONES	716 TIMES	10.3
2 HALF-TONES	486 TIMES	7.0
3 HALF-TONES	469 TIMES	6.7
-1 HALF-TONES	360 TIMES	5.2
-3 HALF-TONES	339 TIMES	4.9
1 HALF-TONES	237 TIMES	3.4
4 HALF-TONES	183 TIMES	2.6
-4 HALF-TONES	133 TIMES	1.9
-5 HALF-TONES	128 TIMES	1.8
5 HALF-TONES	111 TIMES	1.6
7 HALF-TONES	23 TIMES	0.3
-6 HALF-TONES	8 TIMES	0.1
-7 HALF-TONES	6 TIMES	0.1
6 HALF-TONES	1 TIMES	0.0

21.7% OF THE INTERVALS ARE ASCENDING.

24.3% OF THE INTERVALS ARE DESCENDING.

54.1% OF THE INTERVALS ARE NEITHER ASCENDING NOR DESCENDING.

TABLE 2 - E.P.

RANKIN INLET

MATRIX M: NUMBER OF OCCURENCES OF EACH INTERVAL.

	-G	-G#	-A	-A#	-B	-C	-C#	D	D#	E	F	F#	G	G#	A	A#	B	C	C#	+D	+D#	+E	+F	REST	LAST
-G	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-G#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-A#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
-B	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-C	0	0	0	0	0	15	0	6	0	15	0	0	9	1	0	0	0	0	0	0	0	0	0	4	0
-C#	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
D	0	0	0	0	6	6	3	97	0	13	6	0	52	0	12	1	4	5	0	1	0	0	0	34	0
D#	0	0	0	0	0	0	0	0	1	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	13	0	39	0	124	0	4	80	0	24	0	7	19	0	14	0	0	0	24	1
F	0	0	0	0	0	0	0	14	7	3	136	0	127	0	55	9	3	11	0	0	0	0	0	20	2
F#	0	0	0	0	0	0	0	1	0	8	1	170	117	1	52	0	0	0	0	1	0	0	0	56	0
G	0	0	0	0	0	13	0	42	1	136	193	134	1630	4	185	44	23	27	0	7	0	0	3	265	33
G#	0	0	0	0	0	0	0	0	0	0	1	1	5	0	0	0	0	1	0	0	0	0	0	1	0
A	0	0	0	0	0	0	0	6	0	15	24	41	346	1	284	0	40	44	0	15	0	0	0	25	2
A#	0	0	0	1	0	0	0	0	0	0	0	0	34	0	1	64	0	20	0	14	0	0	0	7	0
B	0	0	0	0	0	0	0	0	0	0	0	0	58	0	63	0	69	28	0	23	0	0	0	2	0
C	0	0	0	0	0	1	0	0	0	0	0	0	42	1	91	17	24	156	0	67	0	4	0	4	1
C#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+D	0	0	0	0	0	0	0	1	0	3	0	6	16	0	18	3	19	76	0	67	0	14	4	9	0
+D#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	6	0	9	0	0	0	0	0
+F	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	6	0	0	3	0	0
REST	0	0	0	0	0	2	0	29	0	26	26	51	179	1	58	3	51	14	0	11	0	0	0	x	x
FRST	0	0	0	0	0	0	0	4	0	0	0	0	34	0	0	0	0	1	0	1	0	0	0	x	x

MATRIX M - R.I.

ESKIMO POINT

MATRIX M: NUMBER OF OCCURENCES OF EACH INTERVAL.

	-G	-G#	-A	-A#	-B	-C	-C#	D	D#	E	F	F#	G	G#	A	A#	B	C	C#	+D	+D#	+E	+F	REST	LAST
-G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-G#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-A#	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-B	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-C	0	0	0	0	0	0	0	5	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	1	0
-C#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D	0	0	0	2	1	0	0	54	0	7	17	6	26	0	1	0	0	0	0	0	0	0	0	8	1
D#	0	0	0	0	0	0	0	0	17	0	1	1	59	0	0	8	0	0	0	0	0	0	0	1	0
E	0	0	0	0	0	5	0	1	0	29	2	16	68	3	6	1	0	0	0	0	0	0	0	3	0
F	0	0	0	0	0	4	0	35	4	3	272	2	263	157	22	28	0	11	0	0	0	0	0	17	3
F#	0	0	0	0	0	0	0	7	0	21	2	191	170	5	68	1	1	0	0	0	0	0	0	10	3
G	0	0	0	0	0	0	0	14	60	64	428	187	2585	45	89	140	36	49	0	0	0	0	0	190	32
G#	0	0	0	0	0	0	0	0	0	0	39	11	141	129	2	7	0	54	0	0	0	0	0	7	0
A	0	0	0	0	0	0	0	0	0	0	8	39	148	6	108	6	16	16	1	0	0	0	0	2	0
A#	0	0	0	0	0	0	0	0	0	0	9	0	147	15	14	165	1	71	1	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0	1	30	1	22	0	20	6	2	0	0	0	0	6	0
C	0	0	0	0	0	0	0	0	0	0	6	.7	100	19	11	64	3	192	3	4	0	0	0	1	1
C#	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	4	3	0	0	0	0	0	0
+D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	0	4	0	0	0	0	0
+D#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	x	x
REST	0	0	0	0	0	0	0	5	5	8	32	14	152	9	5	2	7	7	0	0	0	0	0	x	x
FRST	0	0	0	0	0	0	0	0	1	2	3	4	27	1	1	0	1	0	0	0	0	0	0	x	x

MATRIX M - E.P.

RANKIN INLET.

MATRIX N: PERCENTAGE OF OCCURENCES OF EACH INTERVAL.

	-G	-G#	-A	-A#	-B	-C	-C#	D	D#	E	F	F#	G	G#	A	A#	B	C	C#	+D	+D#	+E	+F	REST	LAST
-G	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-G#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
-A#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-B	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-C	0	0	0	0	0	23	0	9	0	23	0	0	14	2	0	0	0	0	0	0	0	0	0	6	0
-C#	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
D	0	0	0	0	9	9	5	148	0	20	9	0	79	0	18	2	6	8	0	2	0	0	0	52	0
D#	0	0	0	0	0	0	0	0	2	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	20	0	59	0	189	0	6	122	0	37	0	11	29	0	21	0	0	0	37	2
F	0	0	0	0	0	0	0	21	11	5	207	0	194	0	84	14	5	17	0	0	0	0	0	31	3
F#	0	0	0	0	0	0	0	2	0	12	2	259	178	2	79	0	0	0	0	2	0	0	0	85	0
G	0	0	0	0	0	20	0	64	2	207	294	204	2486	6	282	67	35	41	0	11	0	0	5	404	50
G#	0	0	0	0	0	0	0	0	0	0	2	2	8	0	0	0	0	2	0	0	0	0	0	2	0
A	0	0	0	0	0	0	0	9	0	23	37	63	528	2	433	0	61	67	0	23	0	0	0	38	3
A#	0	0	0	2	0	0	0	0	0	0	0	0	52	0	2	98	0	31	0	21	0	0	0	11	0
B	0	0	0	0	0	0	0	0	0	0	0	0	88	0	96	0	105	43	0	35	0	0	0	3	0
C	0	0	0	0	0	2	0	0	0	0	0	0	64	2	139	26	37	238	0	102	0	6	0	6	2
C#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+D	0	0	0	0	0	0	0	2	0	5	0	9	24	0	27	5	29	116	0	102	0	21	6	14	0
+D#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	9	0	14	0	0	0	0	0
+F	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	9	0	0	5	0	0
REST	0	0	0	0	0	3	0	44	0	40	40	78	273	2	88	5	78	21	0	17	0	0	0	x	x
FRST	0	0	0	0	0	0	0	6	0	0	0	0	52	0	0	0	0	2	0	2	0	0	0	x	x

MATRIX N - R.I.

MATRIX N: PERCENTAGE OF OCCURENCES OF EACH INTERVAL.

	-G	-G#	-A	-A#	-B	-C	-C#	D	D#	E	F	F#	G	G#	A	A#	B	C	C#	+D	+D#	+E	+F	REST	LAST
-G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-G#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-A#	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-B	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-C	0	0	0	0	0	0	0	7	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0	1	0
-C#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D	0	0	0	3	1	0	0	72	0	9	23	8	35	0	1	0	0	0	0	0	0	0	0	11	1
D#	0	0	0	0	0	0	0	0	23	0	1	1	79	0	0	11	0	0	0	0	0	0	0	1	0
E	0	0	0	0	0	7	0	1	0	39	3	21	91	4	8	1	0	0	0	0	0	0	0	4	0
F	0	0	0	0	0	5	0	47	5	4	363	3	351	209	29	37	0	15	0	0	0	0	0	23	4
F#	0	0	0	0	0	0	0	9	0	28	3	255	227	7	91	1	1	0	0	0	0	0	0	13	4
G	0	0	0	0	0	0	0	19	80	85	571	249	3446	60	119	187	48	65	0	0	0	0	0	253	43
G#	0	0	0	0	0	0	0	0	0	0	52	15	188	172	3	9	0	72	0	0	0	0	0	9	0
A	0	0	0	0	0	0	0	0	0	0	11	52	197	8	144	8	21	21	1	0	0	0	0	3	0
A#	0	0	0	0	0	0	0	0	0	0	12	0	196	20	19	220	1	95	1	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0	1	40	1	29	0	27	8	3	0	0	0	0	8	0
C	0	0	0	0	0	0	0	0	0	0	8	9	133	25	15	85	4	256	4	5	0	0	0	1	1
C#	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	5	4	0	0	0	0	0	0
+D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	1	0	5	0	0	0	0	0
+D#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REST	0	0	0	0	0	0	0	7	7	11	43	19	203	12	7	3	9	9	0	0	0	0	0	x	x
FRST	0	0	0	0	0	0	0	0	1	3	4	5	36	1	1	0	1	0	0	0	0	0	0	x	x

MATRIX N - E.P.

RANKIN INLET

MATRIX P: P(I,J) IS THE PERCENTAGE OF NOTES I BEING FOLLOWED BY NOTE J.

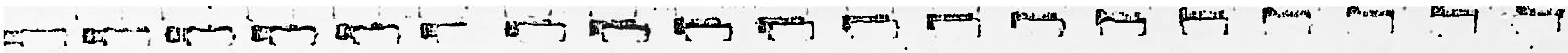
	-G	-G#	-A	-A#	-B	-C	-C#	D	D#	E	F	F#	G	G#	A	A#	B	C	C#	+D	+D#	+E	+F	REST	LAST
-G	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-G#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-A#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
-B	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-C	0	0	0	0	0	28	0	9	0	28	0	0	16	0	0	0	0	0	0	0	0	0	0	6	0
-C#	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0
D	0	0	0	0	0	0	0	38	0	3	0	0	19	0	3	0	0	0	0	0	0	0	0	13	0
D#	0	0	0	0	0	0	0	0	9	0	0	0	88	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	3	0	9	0	34	0	0	22	0	6	0	0	3	0	3	0	0	0	6	0
F	0	0	0	0	0	0	0	3	0	0	34	0	31	0	13	0	0	0	0	0	0	0	0	3	0
F#	0	0	0	0	0	0	0	0	0	0	0	41	28	0	13	0	0	0	0	0	0	0	0	13	0
G	0	0	0	0	0	0	0	0	0	3	6	3	59	0	6	0	0	0	0	0	0	0	0	9	0
G#	0	0	0	0	0	0	0	0	0	0	9	9	53	0	0	0	0	9	0	0	0	0	0	9	0
A	0	0	0	0	0	0	0	0	0	0	0	3	41	0	31	0	3	3	0	0	0	0	0	0	0
A#	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	44	0	13	0	9	0	0	0	3	0
B	0	0	0	0	0	0	0	0	0	0	0	0	22	0	25	0	28	9	0	9	0	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0	0	0	9	0	22	3	3	38	0	16	0	0	0	0	0
C#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+D	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	0	6	31	0	28	0	3	0	3	0
+D#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	31	0	50	0	0	0	0	0
+F	0	0	0	0	0	0	0	9	9	0	0	0	0	0	0	0	0	0	0	59	0	0	28	0	0
REST	0	0	0	0	0	0	0	6	9	3	3	9	38	0	13	0	9	0	0	0	0	0	0	X	X

MATRIX P - R.I.

ATRIX P: P(I,J) IS THE PERCENTAGE OF NOTES I BEING FOLLOWED BY NOTE J.

	-G	-G#	-A	-A#	-B	-C	-C#	D	D#	E	F	F#	G	G#	A	A#	B	C	C#	+D	+D#	+E	+F	REST	LAST
G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A#	0	0	0	0	0	0	0	50	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-C	0	0	0	0	0	0	0	53	0	0	9	0	22	0	0	0	0	0	0	0	0	0	0	9	0
-C#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D	0	0	0	0	0	0	0	44	0	3	13	3	19	0	0	0	0	0	0	0	0	0	0	6	0
D#	0	0	0	0	0	0	0	0	19	0	0	0	66	0	0	6	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	3	0	0	0	19	0	9	50	0	3	0	0	0	0	0	0	0	0	0	0
F	0	0	0	0	0	0	0	3	0	0	31	0	31	19	0	3	0	0	0	0	0	0	0	0	0
F#	0	0	0	0	0	0	0	0	0	3	0	38	34	0	13	0	0	0	0	0	0	0	0	0	0
G	0	0	0	0	0	0	0	0	0	0	9	3	66	0	0	3	0	0	0	0	0	0	0	3	0
G#	0	0	0	0	0	0	0	0	0	0	9	0	34	31	0	0	0	13	0	0	0	0	0	0	0
A	0	0	0	0	0	0	0	0	0	0	0	9	41	0	28	0	3	3	0	0	0	0	0	0	0
A#	0	0	0	0	0	0	0	0	0	0	0	0	34	3	3	38	0	16	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0	0	31	0	25	0	22	6	0	0	0	0	0	6	0
C	0	0	0	0	0	0	0	0	0	0	0	0	22	3	0	13	0	44	0	0	0	0	0	0	0
C#	0	0	0	0	0	0	0	0	0	0	0	0	9	0	9	0	9	38	28	0	0	0	0	0	0
+D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	25	13	0	50	0	0	0	0	0
+D#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REST	0	0	0	0	0	0	0	0	0	3	13	3	59	3	0	0	0	0	0	0	0	0	0	x	x

MATRIX P - E.P.



RANKIN INLET

MATRIX Q: Q(I,J) IS THE PERCENTAGE OF NOTES J BEING PRECEDED BY NOTE I.

	-G	-G#	-A	-A#	-B	-C	-C#	D	D#	E	F	F#	G	G#	A	A#	B	C	C#	+D	+D#	+E	+F	REST
-G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-G#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-A#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-B	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-C	0	0	0	0	0	28	0	0	0	3	0	0	0	9	0	0	0	0	0	0	0	0	0	0
-C#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D	0	0	0	0	100	9	100	38	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	6
D#	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	25	0	16	0	34	0	0	0	0	0	0	0	3	0	3	0	0	0	3
F	0	0	0	0	0	0	0	3	75	0	34	0	3	0	6	6	0	0	0	0	0	0	0	3
F#	0	0	0	0	0	0	0	0	0	0	0	41	3	9	3	0	0	0	0	0	0	0	0	9
G	0	0	0	0	0	25	0	16	9	38	47	31	59	44	22	28	9	6	0	0	0	0	28	56
G#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A	0	0	0	0	0	0	0	0	0	3	3	9	13	9	31	0	16	9	0	6	0	0	0	3
A#	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	44	0	3	0	3	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	28	6	0	9	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0	0	0	0	9	9	9	9	38	0	28	0	22	0	0
C#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	16	0	28	0	75	38	0
+D#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
+F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0
REST	0	0	0	0	0	3	0	9	0	6	6	13	6	9	6	0	19	3	0	3	0	0	0	X
FRST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X

MATRIX Q - R.I.

ESKIMC POINT .

MATRIX Q: Q(I.J) IS THE PERCENTAGE OF NOTES J BEING PRECEDED BY NOTE I.

	-G	-C#	-A	-A#	-B	-C	-C#	D	D#	E	F	F#	G	G#	A	A#	B	C	C#	+D	+D#	+E	+F	REST
-G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-G#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-A#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-C	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-C#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
D	0	0	0	100	100	0	0	44	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D#	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	53	0	0	0	19	0	3	0	0	0	0	0	0	0	0	0	0	0	6
F	0	0	0	0	0	44	0	28	3	0	31	0	6	38	6	6	0	0	0	0	0	0	0	3
F#	0	0	0	0	0	0	0	3	0	16	0	38	3	0	19	0	0	0	0	0	0	0	0	75
G	0	0	0	0	0	0	0	9	69	47	50	38	66	9	25	31	41	9	0	0	0	0	0	0
G#	0	0	0	0	0	0	0	0	0	0	3	0	3	31	0	0	0	13	0	0	0	0	0	0
A	0	0	0	0	0	0	0	0	0	0	0	6	3	0	28	0	16	3	9	0	0	0	0	0
A#	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	38	0	16	9	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	22	0	19	0	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	13	3	44	28	50	0	0	0	0
C#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0	0	0
+D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0
+D#	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+F	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	X
REST	0	0	0	0	0	0	0	3	3	3	3	0	3	0	0	0	6	0	0	0	0	0	0	X
FRST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

MATRIX Q - E.P.

NUMBER OF OCCURENCES FOR RESTS	NUMBER OF OCCURENCES FOR NOTES	VALUE
0	0	3(1/64)
0	3	1/64
0	0	3(1/32)
16	230	1/32 OR 3(1/32 + 1/64)
0	52	3(1/16)
109	456	1/16 OR 3(1/16 + 1/32)
3	37	3(1/8)
22	66	1/16 + 1/32
0	3	1/16 + 1/32 + 1/64
274	3405	1/8 OR 3(1/8 + 1/16)
0	5	1/8 + 1/32
0	28	3(1/4)
3	72	1/8 +1/16
0	22	1/8 + 1/16 + 1/32
197	936	1/4 OR 3(1/4 + 1/8)
0	1	1/4 + 1/32
0	12	1/4 + 1/16
0	2	3(1/2)
3	141	1/4 +1/8
0	8	1/4 + 1/8 + 1/16
5	124	1/2 OR 3(1/2 + 1/4)
0	1	1/2 + 1/32
0	2	1/2 + 1/16
0	50	1/2 + 1/8
0	22	1/2 + 1/4
0	3	1/2 + 1/4 + 1/16
0	12	1/2 + 1/4 + 1/8
17	1	1

TABLE 3 - R.I.

NUMBER OF OCCURRENCES FOR RESTS	NUMBER OF OCCURRENCES FOR NOTES	VALUE
0	0	3(1/64)
0	0	1/64
0	0	3(1/32)
0	0	1/32 OR 3(1/32 + 1/64)
0	2	3(1/16)
18	80	1/16 OR 3(1/16 + 1/32)
9	322	3(1/8)
0	5	1/16 + 1/32
0	0	1/16 + 1/32 + 1/64
143	4440	1/8 OR 3(1/8 + 1/16)
0	0	1/8 + 1/32
1	191	3(1/4)
0	64	1/8 +1/16
0	0	1/8 + 1/16 + 1/32
168	1779	1/4 OR 3(1/4 + 1/8)
0	0	1/4 + 1/32
0	9	1/4 + 1/16
0	24	3(1/2)
0	189	1/4 +1/8
0	3	1/4 + 1/8 + 1/16
2	116	1/2 OR 3(1/2 + 1/4)
0	0	1/2 + 1/32
0	3	1/2 + 1/16
0	27	1/2 + 1/8
0	39	1/2 + 1/4
0	0	1/2 + 1/4 + 1/16
0	3	1/2 + 1/4 + 1/8
24	0	1

TABLE 3 - E.P.

PERCENTAGE OF OCCURENCES FOR RESTS OUT OF RESTS	TOTAL PERCENTAGE	PERCENTAGE OF OCCURENCES FOR NOTES OUT OF NOTES	TOTAL PERCENTAGE	VALUE
0.00	0.00	0.00	0.00	3(1/64)
0.00	0.00	0.05	0.05	1/64
0.00	0.00	0.00	0.00	3(1/32)
2.44	0.25	4.03	3.61	1/32 OR 3(1/32 + 1/64)
0.00	0.00	0.91	0.82	3(1/16)
16.59	1.71	7.99	7.16	1/16 OR 3(1/16 + 1/32)
0.46	0.05	0.65	0.58	3(1/8)
3.35	0.35	1.16	1.04	1/16 + 1/32
0.00	0.00	0.05	0.05	1/16 + 1/32 + 1/64
41.70	4.30	59.63	53.48	1/8 OR 3(1/8 + 1/16)
0.00	0.00	0.09	0.08	1/8 + 1/32
0.00	0.00	0.49	0.44	3(1/4)
0.46	0.05	1.26	1.13	1/8 +1/16
0.00	0.00	0.39	0.35	1/8 + 1/16 + 1/32
29.98	3.09	16.39	14.70	1/4 OR 3(1/4 + 1/8)
0.00	0.00	0.02	0.02	1/4 + 1/32
0.00	0.00	0.21	0.19	1/4 + 1/16
0.00	0.00	0.04	0.03	3(1/2)
0.46	0.05	2.47	2.21	1/4 +1/8
0.00	0.00	0.14	0.13	1/4 + 1/8 + 1/16
0.76	0.08	2.17	1.95	1/2 OR 3(1/2 + 1/4)
0.00	0.00	0.02	0.02	1/2 + 1/32
0.00	0.00	0.04	0.03	1/2 + 1/16
0.00	0.00	0.88	0.79	1/2 + 1/8
0.00	0.00	0.39	0.35	1/2 + 1/4
0.00	0.00	0.05	0.05	1/2 + 1/4 + 1/16
0.00	0.00	0.21	0.19	1/2 + 1/4 + 1/8
2.59	0.27	0.02	0.02	1

TABLE 4 - R.I.

0.00	0.00	0.00	0.00	3(1/64)
0.00	0.00	0.00	0.00	1/64
0.00	0.00	0.00	0.00	3(1/32)
0.00	0.00	0.00	0.00	1/32 OR 3(1/32 + 1/64)
0.00	0.00	0.03	0.03	3(1/16)
4.69	0.23	1.09	1.04	1/16 OR 3(1/16 + 1/32)
2.34	0.12	4.39	4.17	3(1/8)
0.00	0.00	0.07	0.06	1/16 + 1/32
0.00	0.00	0.00	0.00	1/16 + 1/32 + 1/64
37.24	1.85	60.56	57.54	1/8 OR 3(1/8 + 1/16)
0.00	0.00	0.00	0.00	1/8 + 1/32
0.26	0.01	2.61	2.48	3(1/4)
0.00	0.00	0.87	0.83	1/8 +1/16
0.00	0.00	0.00	0.00	1/8 + 1/16 + 1/32
43.75	2.18	24.26	23.06	1/4 OR 3(1/4 + 1/8)
0.00	0.00	0.00	0.00	1/4 + 1/32
0.00	0.00	0.12	0.12	1/4 + 1/16
0.00	0.00	0.33	0.31	3(1/2)
0.00	0.00	2.58	2.45	1/4 +1/8
0.00	0.00	0.04	0.04	1/4 + 1/8 + 1/16
0.52	0.03	1.58	1.50	1/2 OR 3(1/2 + 1/4)
0.00	0.00	0.00	0.00	1/2 + 1/32
0.00	0.00	0.04	0.04	1/2 + 1/16
0.00	0.00	0.37	0.35	1/2 + 1/8
0.00	0.00	0.53	0.51	1/2 + 1/4
0.00	0.00	0.00	0.00	1/2 + 1/4 + 1/16
0.00	0.00	0.04	0.04	1/2 + 1/4 + 1/8
6.25	0.31	0.00	0.00	1

TABLE 4 - E.P.

	3+64	64	3+32	32	3+16	16	3+8	16+32	32+64	8	8+32	3+4	8+16	16+32	4	4+32	4+16	3+2	4+8	8+16	2	2+32	2+16	2+8	2+4	4+16	4+8	1
3+64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	2	0	2	0	7	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3+32	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	1	0	62	0	79	5	59	2	61	2	0	4	4	11	0	2	0	5	0	2	1	0	1	2	0	1	1
3+16	0	0	0	12	34	3	2	1	0	6	0	1	0	0	2	0	1	0	0	0	0	0	0	0	0	0	1	0
16	0	0	0	74	1	315	1	3	1	311	2	1	42	1	141	1	3	1	19	4	19	0	1	5	3	0	0	0
3+8	0	0	2	0	10	2	5	0	0	9	0	13	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
16+32	0	0	0	85	6	2	0	5	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16+32+64	0	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	38	3	369	6	28	0	2670	3	5	27	16	550	0	2	1	74	0	62	0	1	29	8	2	0	0
8+32	0	0	0	0	0	1	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3+4	0	0	0	0	1	0	19	0	0	3	0	3	0	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0
8+16	0	0	0	1	0	39	0	0	0	30	0	1	1	0	11	0	3	0	0	0	0	0	0	0	0	0	0	0
8+16+32	0	0	0	18	0	1	0	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	6	8	88	3	1	0	614	0	3	4	0	336	0	1	0	62	3	53	0	0	10	10	0	1	0
4+32	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4+16	0	0	0	0	0	7	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3+2	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4+8	0	0	0	0	0	12	0	3	0	96	0	0	1	0	49	0	0	0	5	0	1	0	0	0	1	0	0	0
4+8+16	0	0	0	0	0	4	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	11	0	0	1	65	0	0	0	0	52	0	0	0	3	0	12	0	0	0	0	0	0	1
2+32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2+16	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2+8	0	0	0	0	0	1	0	0	0	28	0	0	0	0	12	0	0	0	1	0	1	0	0	0	0	0	0	0
2+4	0	0	0	0	0	5	0	0	0	7	0	0	0	0	11	0	0	0	0	0	1	0	0	0	0	0	0	0
2+4+16	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2+8+8	0	0	0	0	0	2	0	0	0	6	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

TABLE 5 R.I.

	3+64	64	3+32	32	3+16	16	3+8	16+32	16+32+64	8	8+32	3+4	8+16	8+16+32	4	4+32	4+16	3+2	4+8	4+8+16	2	2+32	2+16	2+8	2+4	2+4+16	2+4+8	1
3+64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3+32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3+16	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	21	1	0	0	67	0	3	32	0	114	0	3	1	6	1	10	0	1	2	0	0	0	0
3+8	0	0	0	0	0	7	88	0	0	19	0	128	3	0	62	0	0	2	9	0	6	0	0	0	5	0	2	0
16+32	0	0	0	0	0	0	0	3	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
16+32+64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	121	26	0	0	3340	0	14	9	0	893	0	0	8	76	2	49	0	0	17	14	0	2	0
8+32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3+4	0	0	0	0	0	5	144	0	0	22	0	0	0	0	17	0	0	3	0	0	2	0	0	0	4	0	0	0
8+16	0	0	0	0	0	13	0	0	0	33	0	2	2	0	12	0	0	0	0	0	3	0	2	0	0	0	0	0
8+16+32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	1	82	40	0	0	880	0	46	14	0	681	0	8	9	111	0	68	0	0	10	17	0	0	0
4+32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4+16	0	0	0	0	0	7	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
3+2	0	0	0	0	0	0	21	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
4+8	0	0	0	0	0	7	4	0	0	113	0	1	1	0	67	0	0	0	2	0	3	0	0	0	1	0	0	0
4+8+16	0	0	0	0	0	2	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	1	0	2	3	0	0	55	0	0	3	0	62	0	0	0	3	1	6	0	0	2	0	0	0	0
2+32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2+16	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2+8	0	0	0	0	0	0	0	0	0	25	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0
2+4	0	0	0	0	0	0	1	0	0	19	0	0	0	0	7	0	0	1	1	0	0	0	0	0	0	0	0	0
2+4+16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2+4+8	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	3*64	64	3*32	32	3*16	16	3*8	16+32	16+32+64	8	8+32	3*4	8+16	16+32	4	4+32	4+16	3*2	4+8	8+16	2	2+32	2+16	2+8	2+4	4+16	4+8	1
3+64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	2	0	2	0	9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3+32	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	1	0	86	0	110	6	82	2	85	2	0	5	5	15	0	2	0	6	0	2	1	0	1	2	0	1	1
3+16	0	0	0	16	47	4	2	1	0	8	0	1	0	0	2	0	1	0	0	0	0	0	0	0	0	0	1	0
16	0	0	0	103	1	440	1	4	1	434	2	1	58	1	196	1	4	1	26	5	26	0	1	6	4	0	0	0
3+8	0	0	2	0	13	2	6	0	0	12	0	18	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
16+32	0	0	0	118	8	2	0	6	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16+32+64	0	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	53	4	515	8	39	0	3729	4	6	37	22	768	0	2	1	103	0	86	0	1	40	11	2	8	0
8+32	0	0	0	0	0	1	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3+4	0	0	0	0	1	0	26	0	0	4	0	4	0	0	4	0	0	1	0	0	0	0	0	0	0	0	0	0
8+16	0	0	0	1	0	54	0	0	0	41	0	1	1	0	15	0	4	0	0	0	0	0	0	0	0	0	0	0
8+16+32	0	0	0	25	0	1	0	0	0	4	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	8	11	122	4	1	0	857	0	4	5	0	469	0	1	0	86	4	74	0	0	13	13	0	1	0
4+32	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4+16	0	0	0	0	0	9	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3+2	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4+8	0	0	0	0	0	16	0	4	0	134	0	0	1	0	68	0	0	0	6	0	1	0	0	0	1	0	0	0
4+8+16	0	0	0	0	0	5	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	15	0	0	1	90	0	0	0	0	72	0	0	0	4	0	16	0	0	0	0	0	0	1
2+32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2+16	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2+8	0	0	0	0	0	1	0	0	0	39	0	0	0	0	16	0	0	0	1	0	1	0	0	0	0	0	0	0
2+4	0	0	0	0	0	6	0	0	0	9	0	0	0	0	15	0	0	0	0	0	1	0	0	0	0	0	0	0
2+4+16	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2+8+8	0	0	0	0	0	2	0	0	0	8	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	[illegible]	[illegible]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

	3*64	64	3*32	32	3*16	16	3*8	16+32	16+32+64	8	8+32	3*4	8+16	8+16+32	4	4+32	4+16	3*2	4+8	4+8+16	2	2+32	2+16	2+8	2+4	2+4+16	2+8+8	1
3*64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3*32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3*16	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	26	1	0	0	85	0	3	40	0	144	0	3	1	7	1	12	0	1	2	0	0	0	0
3*8	0	0	0	0	0	8	111	0	0	24	0	162	3	0	78	0	0	2	11	0	7	0	0	0	6	0	2	0
16+32	0	0	0	0	0	0	0	3	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
16+32+64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	153	33	0	0	4245	0	17	11	0	1135	0	0	10	96	2	62	0	0	21	17	0	2	0
8+32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3*4	0	0	0	0	0	6	183	0	0	27	0	0	0	0	21	0	0	3	0	0	2	0	0	0	5	0	0	0
8+16	0	0	0	0	0	16	0	0	0	38	0	2	2	0	15	0	0	0	0	0	3	0	2	0	0	0	0	0
8+16+32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	1	104	50	0	0	1118	0	58	17	0	865	0	10	11	141	0	86	0	0	12	21	0	0	0
4+32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4+16	0	0	0	0	0	8	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
3*2	0	0	0	0	0	0	26	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
4+8	0	0	0	0	0	8	5	0	0	143	0	1	1	0	85	0	0	0	2	0	3	0	0	0	1	0	0	0
4+8+16	0	0	0	0	0	2	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	1	0	2	3	0	0	69	0	0	3	0	78	0	0	0	3	1	7	0	0	2	0	0	0	0
2+32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2+16	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2+8	0	0	0	0	0	0	0	0	0	31	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0
2+4	0	0	0	0	0	0	1	0	0	24	0	0	0	0	8	0	0	1	1	0	0	0	0	0	0	0	0	0
2+4+16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2+8+8	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0