Coding the distributions in contract bridge

Georgi Georgiev (Skeleta)   Vladimir Babev

April 28, 2016

Abstract

This paper describes a simple compression scheme for hand distributions in contract bridge. The scheme simplifies the convention rules and decreases the complexity of the bidding systems.

Most ideas in this work are taken from the strong pass system, developed by authors in years 1978-1983.

These ideas include encoding and decoding distributions, merging fictive distributions in groups, and rules for conducting the relays.

Notation:

We use records like 4-4-3-2 to denote distributions with two 4-card colors, one 3-card, and 1 doubleton. The colors are not specified and the numbers are sorted in descending order.

The record 3-4-2-4 denotes a distribution with 3 cards in ♣, 4 in ♢, doubleton ♡ and 4 cards in ♠. Note that the numbers in this case are unsorted and we use natural order of bridge colors ♣-♢-♡-♠.

In case the colors are specified and colors length descends from ♣ to ♠, the upper two notations contradict. More often we get the proper meaning from the context. When this is impossible, we use records like 5=4=2=2 for specified colors and 5-4-2-2 for the common case.

1 Encoding scheme

1.1 Real and fictive distributions

We denote any hand distribution as *real distribution* or simply *distribution.*

The first step in the scheme is to define 4 to 1 encoding to *fictive* distributions.

Note that precisely one of the following holds:

- Here is exactly one color of odd length. We obtain *fictive* distribution in this case by decreasing the odd color.
- Here is exactly one color of even length. In this case we increase the even color.

We obtain the following fictive distributions:

Odd: 5-3-3-3, 5-5-3-1, 7-3-3-1, 7-5-1-1, 9-3-1-1, 11-1-1-1

Even: 4-4-2-2, 4-4-4-0, 6-2-2-2, 6-4-2-0, 6-6-0-0, 8-2-2-0, 8-4-0-0, 10-2-0-0, 12-0-0-0

It is obvious that this coding step is optimal from a mathematical point of view – each fictive distribution approximates exactly 4 real and distance between real and corresponding fictive is exactly 1.

1.2 Groups of fictive distributions

Some fictive distributions are similar in structure and quality. We unite them in *groups*:

Mono color 6-x-x-x: 6-2-2-2, 7-3-3-1

Strong mono 8-x-x-x: 8-2-2-0, 9-3-1-1

Super mono 10-x-x-x: 10-2-0-0, 11-1-1-1, 12-0-0-0

Flat bicolor 4-4-x-x: 4-4-2-2, 5-5-3-1

Skew bicolor 6-4-x-x: 6-4-2-0, 7-5-1-1, 8-4-0-0

Few fictive distributions are unique and remains alone:

Weak mono: 5-3-3-3

Three colors: 4-4-4-0

Strong bicolor: 6-6-0-0

This is the second encoding step. Merging fictive distributions into groups, we partition the set of all real distributions into a relatively small number of subsets, each containing similar elements.

There are 4 groups in each of mono color types, 6 flat and 12 skew bicolor groups. This gives in summary 30 possible groups altogether.

8 mono groups are rarely used in preemptive bidding (8-x-x-x, 10-x-x-x), so the count of often used groups is 22.

Alone fictive distributions are 14 (4 weak, 4 three colors and 6 strong bicolors).

2 Relay bidding, based on the scheme

We can use the set of 22 often used groups and 14 alone fictive distributions to define the constructive openings of the bidding system.

Assuming our system has 6 constructive opening bid on the average, each of these bids contains 3 or 4 groups and 2 or 3 fictive distributions.

In such system, the relay sequence has those simple phases:

(A) Determine the strength of the teller.

(B) Determine the set of possible distribution of the teller Depending on the system, both phases (A) and (B) uses 1 or 2 rounds.

(B_1) Determine the distribution group (or alone fictive).

(B_2) Determine the fictive distribution of the teller (1 round).

(B_3) Determine the real distribution (1 round).

(C) Determine the top honors (as much as possible).

In real system design the phases A, B and B_1 may interfere.

3 Decoding

3.1 Decoding fictive distributions

We decode even fictive distributions in one relay step by adding the missing card from shortest to longest color. In case of equal length we use natural order ♣-♢-♡-♠.

Example: We decode fictive distribution 2-4-4-2 to real one with answers:
level 1 – 3-4-4-2 (short club and spade, club is lower)
level 2 – 2-4-4-3
level 3 – 2-5-4-2 (5 cards in diamond, it is lower color)
level 4 – 2-4-5-2

We decode odd fictive distributions by subtracting the redundant card from longest to shortest color.

Example: We decode fictive 3-7-1-3 (long ♢, short ♡) with answers:
level 1 – 3-6-1-3 (redundancy in longest color)
level 2 – 2-7-1-3 (redundancy in clubs, spade is higher)
level 3 – 3-7-1-2
level 4 – 3-7-0-3 (redundancy in shortest color)

Proposed relay step is simple and effective – at a lower level, we explain the weak and frequent distribution, while higher level answer determines the strongest and most rare case.

3.2 Decoding groups

Let the distribution group of the teller is determined. Then he decodes the group to fictive distribution, using the table:

	level 1	level 2	level 3	level 4	level 5	level 6
4-4-x-x	4-4-2-2	5-5-3-1	5-5-1-3			
6-4-x-x	6-4-2-0	6-4-0-2	7-5-1-1	8-4-0-0		
6-x-x-x	6-2-2-2	7-3-3-1	7-3-1-3	7-1-3-3		
8-x-x-x	8-2-2-0	8-2-0-2	8-0-2-2	9-3-1-1	9-1-3-1	9-1-1-3
10-x-x-x	10-2-0-0	10-0-2-0	10-0-0-2	11-1-1-1	12-0-0-0	

Table 1 Decoding groups: colors noted by 'x' are ordered from ♣ to ♠.

Example: We decode group x-4-6-x (6+ ♡, 4+ ♢) with answers:
level 1 – 2-4-6-0 (2+ ♣)
level 2 – 0-4-6-2 (2+ ♠)
level 3 – 1-5-7-1
level 4 – 0-4-8-0 (8+ ♡)

3.3 Decoding honors

This phase of the relay sequence begins with a step for aces, followed by step for kings, then followed by step for queens etc.

Number of iterations depends on the remaining bidding space.

At each question for top honors (A, K, D ...), the answers are:

level 1: 2 top honors, glued bid is a question for them:

- level 1: minor/major – ♣-♢ or ♡-♠
- level 2: red/black – ♢-♡ or ♣-♠
- level 3: mixed – ♣-♡ or ♢-♠

If the asker is not interested where are the two honors, he continues the relay skipping a level, this way he asks for the next rank honors.

level 2: 0 or 4 top honors

level 3: 1 in longest color, or 3 in others

level 4: 1 in second longest color, or 3 in others

level 5: 1 in third longest color, or 3 in others

level 6: 1 in shortest color, or 3 in others

4 Example

Board 1 North dealer None vul	♠ JT98 ♡ 7 ♢ AJ983 ♣ QJ5	
♠ 542 ♡ 952 ♢ T5 ♣ AT976	N W E S	♠ Q763 ♡ Q64 ♢ 72 ♣ K832
	♠ AK ♡ AKJT83 ♢ KQ64 ♣ 4	

N-S uses the system sNT, details are published at Strong NoTrump for mathematicians. N adds 2 points for the singleton in ♡, E-W passed all the time:

N: 1♢ – 11-20 corrected points, 4+ ♢, possible 0-3 ♡, 4+ ♠ or ♣

S: 1♡ – 10+, forcing

N: 1♠ – 4+ ♠, 11-20 points, distribution groups x-4-x-4, 4-4-0-4

S: 1NT – relay, the teller will answer with levels as follows:

- level 1 – 11-14 points, x-4-x-4
- level 2 – 11-14 points, 4-4-0-4
- level 3 – 15-20 points, x-4-x-4
- level 4 – 15-20 points, 4-4-0-4

N: 2♣ – level 1, 11-14 points, x-4-x-4

S: 2♢ – relay, question for fictive distribution

N: 2♠ – fictive distribution 3-5-1-5, level 2 from table 1.

S: 2NT – relay, question for exact distribution

N: 3♢ – exact distribution 3-5-1-4

S: 3♡ – question for aces
N: 4♣ – A♢
S: 6♢ – final contract

The same board, N-S uses SDI (Strong minors for mathematicians):
N: 1NT – 11-14 corrected points, 4+ ♢, 0-3 ♣, possible 4+ ♠ or 0-4-4-4
S: 2♣ – 13+, forcing
N: 2♠ – 4+ ♠, distribution group x-4-x-4
S: 2NT – relay, question for fictive distribution
N: 3♢ – fictive distribution 3-5-1-5
S: 3♡ – relay, question for exact distribution
N: 3NT – exact distribution 3-5-1-4
S: 4♣ – question for aces
N: 4♠ – A♢
S: 6♢ – final contract

G. Georgiev, Faculty of Mathematics and Informatics, Sofia University, Sofia, Bulgaria
E-mail: skelet@fmi.uni-sofia.bg, skeleta@gmail.com

V. Babev, Faculty of Mathematics and Informatics, Sofia University, Sofia, Bulgaria
E-mail: babev@fmi.uni-sofia.bg, babev58@gmail.com