

RL Bridge bidding Inventor (on-going work)

An attempt to learn and use bidding systems.

As an example we used the continuation after 1 Spade (5+,12-21 h.c.p) - 1 NoTrump (0-2 spades, 8-11).

The idea is to have a policy to recommend an action (bid) given a situation (hand and the previous bidding).

By using DDS as recommended bids for a number of relevant hands we can train a policy-network with Reinforcement Learning. Here we used table-based Q-learning incl Eligibility traces, $Q(\lambda)$, for respective hand (spades, hearts, diamonds and h.c.p) and bidding history as state. As actions we allow pass and the nearest 11 bids for each rond, maximum 4 bids + pass.

It seems to be a delicate balance between exploration (try new bids with probability epsilon) and exploatation (select bids known to be good) via parameter epsilon - usually one start with a larger value like 0.5 (select randomly 50%) down to 0.02 (select randomly only 2%; 98% best).

Moved from programming language Python to Julia for a speed improvement of ca 100x. Currently not using any GPU but trivial parallel processing on multiple-cores; run with different parameters and select best results. Memory requirements with 10 processes is about 27 GB RAM and this run took about 3 hours on a 6-core machine (5 years old Intel on Linux).

Some experimental bidding results (Intro is 1 ♠ - 1 NT. Only 1N = North passes). The topscore value is used with the difference presented and parScore in brackets. Rewards is average lost par-bid topscore count. (Imp is slower to learn because of coarser reward numbers). (Some earlier runs lost -180). The always-pass policy here results in a loss of about -258 points/deal. 2 "best" runs are shown.

a)

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2♣2♠3♣3N n AKQ985.K.AJ4.Q64 6133(19) s J3.QT8.KQ832.975 2353(8) 300 [100]
2♦2♠3♣4♠ n AJT632.K.Q.Q9762 6115(12) s Q7.A63.98543.KT4 2353(9) 50 [-100]
2♦2♠4♥6♥ n AKJT2.A.AJ9643.Q 5161(19) s Q.KQ987643.8.KJ6 1813(11) 0 [980]
2♦2♠3♦ n KT983.K.KQJ8.A95 5143(16) s J.QT862.7642.KQJ 1543(9) 0 [130]
1N n AKQ95.T.K3.AJ875 5125(17) s J4.AJ852.985.K94 2533(9) -710 [920]
1N n KJ873.J8.AKQ54.2 5251(14) s 62.KQT95.J73.QT7 2533(8) -50 [140]
2♦2♠2N4♠ n Q9865.A53.AQ62.Q 5341(14) s K7.QJ8.754.K9832 2335(9) -210 [110]
1N n QJ9542.QJ4.QJ.A5 6322(13) s T7.972.AK75.J986 2344(8) 20 [100]
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1N n AJ972.AQT6.QT8.9 5431(13) s K5.K92.K43.QT854 2335(11) -250 [430]
2♦2♠2N4♥ n AKQ53.AJ4.KT.J64 5323(18) s 64.Q9832.AQ4.952 2533(8) 0 [420]
1N n AJT984.K5.Q87.AJ 6232(15) s .A6.AJ63.T986543 0247(9) -250 [400]
1N n AJ954.QJT.T95.A2 5332(12) s 87.K864.2.KQT854 2416(8) -10 [100]
2♣2♠4♥4♠ n KT8763..AKJT3.J2 6052(12) s A2.AT8.Q8762.T85 2353(10) -150 [100]
2♦2♠3♥3N n AQ532.965.AKJ83. 5350(14) s K.QJ73.Q9762.732 1453(8) -430 [130]
1N n AKQJ6.74.Q76.T73 5233(12) s 97.KJ63.K4.A8654 2425(11) -20 [140]
2♥2♠3♥4♥ n K8642.AT654.AJ7. 5530(12) s AT.J32.K532.JT84 2344(9) 0 [420]
2♦2♠3♣4♠ n AKQ975.A4.A865.4 6241(17) s JT.Q965.K732.Q52 2443(8) 0 [420]
1N n KJ9632.AQ.QJ9.95 6232(13) s A8.964.864.AJ843 2335(9) -280 [430]
1N n AKT82.Q8.K76.983 5233(12) s J9.K632.AJT9.652 2443(9) -150 [100]
2♦2♠3♦ n AQ632.2.AK963.K2 5152(16) s K.J9543.QJT8.Q65 1543(9) -250 [400]
1N n AK632.KQ9.K43.A9 5332(19) s Q5.AJ632.J5.K652 2524(11) -770 [980]
1N n AKQ874.A64.5.T87 6313(13) s 2.Q53.K9862.KQ94 1354(10) -20 [140]
1N n Q9843.K4.A83.AK7 5233(16) s A5.QJ982.Q75.J32 2533(10) 0 [120]
Lr0.001 reward=-209.04
b)
1N n AQJ652.K.985.Q32 6133(12) s 83.AT8643.KQ.865 2623(9) -50 [-100]
1N n AKQ87.J65.K4.JT6 5323(14) s 2.9.AQJ832.K7542 1165(10) -150 [100]
1N n Q9762.KQ.A6.J984 5224(12) s J4.9764.J972.AK3 2443(9) -150 [100]
1N n KJ743.AQT4.8.K73 5413(13) s T6.K653.AQJT75.4 2461(10) -470 [420]
1N n QJ984.K.AJ42.A98 5143(15) s 3.Q62.K98763.KT3 1363(8) -180 [130]
2♣3N4♥6♥ n KJ532..AJ3.K9875 5035(12) s 7.AT9764.75.AQ42 1624(10) -600 [400]
2N4♥ n AKJT986.KJ97.2.3 7411(12) s .QT652.KJ3.QT942 0535(8) 320 [100]
1N n AJT54.K62.J84.K3 5332(12) s 8.QT8.A92.QT7652 1336(8) 0 [90]
1N n KQJ62.KJ3.543.Q6 5332(12) s T9.T92.Q82.AK942 2335(9) -250 [400]
1N n AKQ32.J7.QJ94.32 5242(13) s 75.AT.T653.KQT54 2245(9) 90 [-140]
2♣2♠3♦4N n AQJ986.KQ72..762 6403(12) s K2.J.QT87642.KJ5 2173(10) -290 [140]
1N n AT743.T542.A.AJ9 5413(13) s K9.76.K72.KT6432 2236(9) -280 [400]
2♣2♠4♥4♠ n AKQ83.KT.Q8.AK54 5224(21) s JT.J96.AKT75.T62 2353(9) -510 [990]
1N n AQT84.K75.QJ63.T 5341(12) s J.AT9632.KT98.83 1642(8) -190 [140]
2♣3N4♥ n AKQJ62.KQ9.KJ54. 6340(19) s .AJ875.Q82.KJ532 0535(11) -500 [980]
2♥2♠3♥3N n KQJ62.J9.AQ832.8 5251(13) s A3.62.K975.A7532 2245(11) -570 [420]
1N n AQ983.T54.KT9.AJ 5332(14) s 7.A732.AQJ.T9762 1435(11) 0 [120]
1N n AKJT63.82.K6.JT2 6223(12) s 42.K97.AJT87.Q75 2353(10) -160 [110]
2♣2♥4♦6♣ n AQT32.AK92.AQT.J 5431(20) s 6.T5.K984.KQT654 1246(8) 0 [920]
2♣2N3♠3N n AQ932.Q54.AJ986. 5350(13) s 7.AK97.3.KJ98763 1417(11) 0 [400]
2♥2♠4♣4♠ n AKJ632.5.T7.AJ74 6124(13) s 74.J62.AKQ543.T9 2362(10) -500 [980]
1N n AKQJ6.Q84.AT8.K6 5332(19) s 8.AK732.K762.T85 1543(10) -750 [990]
1N n AQ763.KJ4.Q862.T 5341(12) s 52.A953.AJ3.Q532 2434(11) 0 [120]

Lr0.001 reward=-212.19

Some preliminar bidding systems (only first two bids are shown, two more is done but not shown here)
a)

*** Try 6 Lr=0.001 R=-209.041lambda=0.7eps=0.5 - 0.02 --- North 1st rebid ---

	12	14	16	18	20
5035	2♦	2♦	2♣	2♣	
5044	2♦	2♦	2♦	2♣	2♦
5053	2♦	2♣	2♦	2♦	2♣
5062	2♦	2♣	2♦	2♣	
5125	P	P	P	2♣	2♣
5134	P	P	2♦	2♦	2♦
5143	P	P	2♦	2♦	2♣
5152	P	P	2♦	2♣	2♦
5161	2♦	2♦	2♦	2♦	2♣
5215	P	P	P	2♣	2♦
5224	P	P	P	P	2♣
5233	P	P	P	P	2♦
5242	P	P	2♦	P	2♦
5251	P	P	2♦	2♦	2♣
5260	2♦	2♦	2♦	2♦	3♣
5305	2♦	2♣	2♣	2♦	
5314	P	P	P	2♣	2♣
5323	P	P	P	2♦	P
5332	P	P	P	P	P
5341	P	2♦	2♦	2♦	2♦
5350	2♦	2♦	2♦	2♣	2♣
5404	2♦	2♦	2♣	2♣	2♠
5413	P	P	2♦	2♦	2♣
5422	P	P	P	2♦	2♣
5431	P	2♦	P	2♦	2♣
5440	2♦	2♦	2♦	2♦	2♦
5503	2♦	2♣	2♣	2♣	2♦
5512	2♦	2♦	P	2♦	2♣
5521	2♦	2♦	2♦	2♦	2♣
5530	2♥	2♦	2♦	2♦	2♦
6016	2♣	2♦	2♣		
6025	2♣	2♣	2♦	2♦	2♦
6034	2♣	2♣	2♦	2♣	2♣
6043	2♦	2♦	2♣	2♣	2♦

6052	2♣	2♦	2♦	2♣	
6061	2♦	2♣	2♦		
6106	2♦	2♥	2♦		
6115	2♦	2♣	2♣	2♣	2♣
6124	P	P	2♣	2♣	2♦
6133	2♦	P	P	2♣	2♦
6142	2♦	P	2♣	2♦	2♣
6151	2♦	2♦	2♦	2♦	2♥
6160	2♦	2♦	2♦	2♣	
6205	2♣	2♦	2♣	2♣	
6214	2♦	P	2♦	2♦	2♣
6223	P	P	P	P	2♣
6232	P	P	P	2♣	2♦
6241	P	P	2♦	2♦	2♦
6250	2♦	2♦	2♦	2♣	
6304	2♦	2♣	2♦	2♦	2♦
6313	P	P	P	2♣	2♣
6322	P	2♦	2♦	2♦	2♣
6331	P	P	P	2♦	2♣
6340	2♦	2♦	2♣	2♦	
6403	2♦	2♦	2♦	2♣	
6412	P	2♦	2♦	2♣	2♣
6421	2♦	2♦	2♣	2♣	2♣
6430	2♣	2♦	2♦	2♣	
6502	2♦	2♣	2♦	2♦	2♣
6511	P	2♦	2♦	2♦	2♥
6520	2♦	2♣	2♦	2♦	2♦
6601	2♥	2♣	2NT		
6610	2♣	2♦	2♣	2♣	
7006	2♣				
7015	2♦	2♦	2♣		
7024	2♣	2♣	2♣		
7033	2♣	2♦	2♣	2NT	
7042	2♣	2♦	2♣	2♦	
7051	2♦	2♣	2♦		
7060	2♦				
7105	2♦	2♣	2♣		
7114	2♦	2♣	2♦	2♣	2♦
7123	P	2♦	2♣	2♦	2♣
7132	2♦	2♣	2♦	2♦	2♦

7141 2♦ 2♦ 2♦ 2♦
 7150 2♣ 2♦
 7204 2♣ 2♣ 2♦ 2NT
 7213 P 2♦ 2♣ 2♦ 2♣
 7222 2♦ 2♦ 2♦ 2♣ 2♣
 7231 2♦ 2♦ 2♦ 2♦ 2♣
 7240 2♦ 2♣ 2♦ 2♦
 7303 2♣ 2♣ 2♦ 2♣
 7312 2♦ 2♦ 2♦ 2♦ 2♣
 7321 2♦ 2♦ 2♦ 2♣ 2♣
 7330 2♣ 2♦ 2♦ 2♦
 7402 2♦ 2♣ 2♣ 2♣
 7411 2♦ 2♣ 2♣ 2♣ 2♣
 7420 2♣ 2♦ 2♦ 2♥ 2♦
 7501 2♦ 2♦ 2♥
 7510 2♦ 2♦
 7600 2NT 2♥

--- South's Responses --- (up to 2 more bids are done in the bid sequence, not shown)

- to: 2♣ 2♦ 2♥ 2♠ 2NT 3♣ 3♦ 3♥ 3♠ 3NT
 h.c.p:8-9 10+ 8-9 10+ 8-9 10+
 0166 3♦ 2♦ 2♠ 3♣ 4♣ 3♣ 2NT 3♣ 4♠ 4♣ 3♥ 3NT 3NT 5♣ 3♠ 3NT 4♣ 4♣ 4♦ P
 0256 4♣ 2♠ 2♠ 2♠ 2♠ 2NT 3♠ 3♠ 4♦ 3♠ 4NT 3♦ 4NT 4♦ 4NT 3NT 3NT 5♥ 5♥ 4♣
 0265 2♠ 2♠ 2♠ 2♠ 2♠ 3NT 3NT 2NT 3♥ 4♥ P 4NT 3♠ 3♥ 3♠ 4♣ 5♣ 5♣ 4♣ P
 0346 2♠ 2♠ 2♠ 2♠ 2♠ 3♦ 3NT 3♣ 3♦ 4♦ P 3NT 4♦ 4♠ 3♠ P 4♦ 5♣ P 4♥
 0355 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ P 3♣ 3♦ 4♣ 3♦ 4♦ 3♥ 5♦ 3♠ 3NT 4♣ 4♠ 5♠ 4♥
 0364 2♠ 2♠ 2♠ 2♠ 3NT 3♣ 2NT 2NT 3♦ 3♦ 4♣ 3♦ 3♠ 4♦ 4NT 3NT 4♠ 3NT 4♣ 4♥
 0436 2♠ 2♠ 2♠ 2♠ 2♠ 3♠ 3NT 3♣ 3♦ 4♠ 3♥ 3NT 3NT 3♥ 4♦ 4NT 5♥ 4♦ P P
 0445 2♠ 2♠ 2♠ 2♠ 2NT 3♠ 3NT 2NT 3♣ P 4♦ 3♠ 3♥ 3♠ 3NT 3NT P 4♠ 5NT 4NT
 0454 2♠ 2♠ 2♠ 2♠ 3♣ 2♠ 3♥ 3♠ 3♦ 4♠ 3♥ P 4♣ 4♥ 4♣ 5♣ 4♥ P 4NT 5♦
 0463 2♠ 2♠ 2♠ 2♠ 2♠ 4♣ 3♦ 3NT 3♦ 4♥ 3♥ 3♦ 4♣ P 4♦ 4NT 4♠ 4♦ P 5♥
 0526 2♠ 2♠ 2♠ 2♠ 4♣ 4♣ 3♦ 3♣ P 4♥ 3NT 4♣ 3♠ 3♠ 3♠ 3♠ 4NT 5♥ 4♠ P
 0535 2♠ 2♠ 2♠ 2♠ 3NT 3NT 3♠ 4♦ 4♦ 3♦ 3♦ 3♦ 3NT 4♣ 3♠ 4NT 4♣ 5♣ P P
 0544 2♠ 2♠ 2♠ 2♠ 3NT 3NT 3♥ 4♣ 3♦ 4♠ 3NT 5♣ 3♠ 4♠ P 3♠ 3NT 4NT 4♦ 4NT
 0553 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 2NT 3♥ 3♥ 3♣ 4♠ 4♠ 4♣ 3♥ 3♠ 4♣ 4NT P 4NT 4♠
 0562 2♠ 2♠ 2♠ 4♦ 4♥ 3♥ 2NT 3♦ 4♥ 3♦ 4♦ 3NT 3NT 4♥ 3♠ 3NT 3NT 4NT 4NT 4♦
 0616 3♦ 2NT 3NT 2♠ 4♦ 4♣ 2NT 4♦ 4♦ 4♣ 4♣ 4♥ 3♠ 3NT 3NT P 5♦ P 4♦ 5♥
 0625 2♠ 2♠ 2♠ 2♠ 3♥ 2♠ 3♦ 3♦ 3NT 3NT 4♠ 4♣ 4♠ 4♠ 5♥ 4♥ 4♥ 5♣ 5♠ 5♣
 0634 2♠ 2♠ 2♠ 2♠ 2NT 4♦ P 3♠ 3♦ 3NT 3♥ 3♦ 4♥ 3♥ P P 4♦ 4♣ P 4♦
 0643 2♠ 2♠ 2♠ 2♠ 3NT 2♠ 3♣ 4♣ P 3♥ 4♣ 3NT 3NT 4♠ 4♦ 5♣ 4NT 4♥ P 4♦

0652 2♠ 2♠ 2♠ 2♠ 4♣ 3♥ 4♠ 3♥ 3NT 3♥ 4♦ 3♠ 3♠ 3♠ 4♣ 3♠ 4NT 3NT 4♥ 4NT
 0661 3NT 3♠ 3NT 3♣ 2♠ 2♠ 3♣ 3♦ 3♠ 3NT 4♠ 4♥ 3NT 4NT 4♥ 4♠ 4NT 4♥ 5♣ P
 1066 3♥ 2NT 4♣ 4♣ 2NT 2NT 3NT 3♣ 4♣ 3♠ 4♥ 3NT 4♥ 4♣ 4♥ 4♥ 3NT 4♠ 4♣ 4♣
 1156 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♦ 2NT 4♣ 3♥ 3♥ 4♠ 3NT 3♥ 4♠ 3NT 3NT 4♣ 4♠ 4♣
 1165 4♣ 3♣ 2♠ 2♠ 4♣ 2NT 4♥ 3NT 3♥ 3♥ P 3♠ 3NT 4♦ 3NT 3♠ P 3NT 5♣ 4♣
 1246 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 4♦ 3NT 3♦ 4♦ 3♦ 3♠ 4♣ 3♥ 4NT 4♦ 3NT 5♥ 4♦ 4♣
 1255 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ P P 3♥ 4♠ P 3♥ 3NT 3♥ 4♥ 3♠ 3NT 4♠ 4♦ 4♣
 1264 2♠ 2♠ 2♠ 2♠ 2♠ 3♠ 3♥ 3♣ 3♥ P 3♥ 3♦ 3♥ 3NT 3NT 4NT 4♥ 4♣ 4♣ 4♦
 1336 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♣ 3♦ 3♥ 3♦ 3♦ 3♥ 4♠ P 3♠ 4♠ 3NT P 4♦ P
 1345 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♦ 4♣ 3♥ 3NT P 3NT 4♣ 3♠ 4♦ 4♦ 3NT 4NT 4♦ 5♥
 1354 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 2NT 2NT 3NT 3♠ 3♥ P P P 5♣ 3NT 3NT 4♣ P 5♥
 1363 2♠ 2♠ 2♠ 2♠ 2♠ P 3♣ 3♠ 3♦ 4♦ P 3NT 4♦ 4♣ 3♠ 4♣ 3NT P 4♠ 5♥
 1426 2♠ 2♠ 2♠ 2♠ 2♠ 3NT 3♦ 2NT 4♣ 3♦ 3♥ 3♦ 4♣ P 4♥ 4♦ 5♦ 3NT P 4♣
 1435 2♠ 2♠ 2♠ 2♠ 2♠ 2NT P 2NT 3♣ 3NT 3♦ 3♠ P P P 5♥ 3NT 4♠ 4NT 4♦
 1444 2♠ 2♠ 2♠ 2♠ 2♠ 3♣ 4♠ 3♦ 3♠ 3♠ 3♥ 3♦ 4♠ P P 4♦ 3NT 5♣ 4♣ 4♥
 1453 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 4♣ 2NT P 3♠ 3♠ 5♣ 4♣ 4♦ P 3♠ 4♦ 4♦ 5♦ 4♣
 1462 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♠ 2NT 3♠ 3♦ 4♠ P P 3♥ 4♦ P 3NT 4♥ 4NT 4♠
 1516 2♠ 2♠ 2♠ 2♠ 3♣ 3♦ 2NT 3♥ 4♣ 3♠ 3♦ 3NT 3♠ 3NT 3♠ 3NT 5♣ 5♣ 4♣ 5♦
 1525 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 2NT 2NT 4♥ 3♦ 3♥ 3♦ 3♥ 4♠ 4♥ 3♠ 5♦ 3NT 4♦ 5♣
 1534 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♦ 3♥ 3♣ 3NT 3NT 4♥ 3♥ 4♣ 4♥ 4♦ 5♣ 3NT 5♣ 4♥
 1543 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♣ P 3NT 3NT 4♥ 3♠ 4♥ 3♥ 4♣ 3♠ 3NT 4♦ 4♣ 5♥
 1552 2♠ 2♠ 2♠ 2♠ 3NT 3♥ 3♦ 2NT 3NT 3♦ 3NT 3NT 3♠ 3♥ 4♣ P P 5♥ 4♦ P
 1561 2♠ 2♠ 2♠ 2♠ 4♦ 3NT 4♥ 2NT 3♣ 3NT 3♠ 3♥ 3♥ 4♦ 3NT 3♠ 4♣ 4♥ 4♦ 4♣
 1606 2♠ 2♥ 2♥ 4♣ P 4♥ 3♣ 3♥ 4♦ 4NT P 4♠ 3♥ 4♥ 3♠ 5♦ 5♣ 5♥ 5♣ 4♦
 1615 2♠ 2♠ 2♠ 2♠ 3♥ 3♠ 2NT 3♥ 4♣ 3NT 3NT 3♦ 4NT 4♦ 4♦ 4♠ 4♠ P P 4♣
 1624 2♠ 2♠ 2♠ 2♠ 3♠ 2♠ 3♦ 4♥ 3NT 3♣ 3♦ 4♠ 3NT 4♣ 3♠ 4♦ 4♦ 4♥ P 4♦
 1633 2♠ 2♠ 2♠ 2♠ 3♣ 3NT 4♠ 4♥ 4NT 3♠ 3♦ 3♦ 3♥ 4♦ 3NT 4♠ 4♦ 4♣ 5♣ 4♠
 1642 2♠ 2♠ 2♠ 2♠ 3♣ 2♠ P 3♠ P P 3♥ 3NT 4♣ 3♠ 3♠ P 3NT 4♠ 4♠ 5♣
 1651 2♠ 2♠ 2♠ 2♠ 3♥ 3♣ 4♠ 2NT 4♦ 3♣ 4♠ 4♣ 3♥ 5♣ 4♦ 4♦ 4♣ 3NT 4♣ 4♦
 1660 2♠ 2♠ 2♥ 2♠ 3♠ 3♣ 4♦ 4♣ 3♥ 3♥ 4NT 4♥ 3♥ 4♥ 3♠ 4♥ 4♦ 4NT 4♣ 4♥
 2056 2♠ 4♣ 2♠ 4♦ 2♠ 2♠ 2NT 3♥ 3♣ 3NT 4♥ 3NT 4♣ 4♦ 3♠ P 4♠ 4♥ 4♦ 5♦
 2065 2♠ 3♥ 2♠ 2♠ 2NT 4♣ 2NT 3♦ 3♦ 3♠ 4♣ 3♦ 3♥ 3♥ 3♠ 5♥ P 4♣ 4♣ P
 2146 2♠ 2♠ 2♠ 2♠ 2♠ 2NT 3♠ 4♥ 4♥ 3♣ 3♦ 5♣ 3♠ 3♥ 3♠ 4♣ 5♦ P 4NT 4♠
 2155 2♠ 2♠ 2♠ 2♠ 2♠ 2NT 3♦ 4♣ 3♦ P 3♦ 3♥ 3♠ 4♣ 4♦ 3♠ P 5♦ 4♥ 4♣
 2164 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ P 3♥ 3♦ 3♦ 4NT 3♥ 3♥ 3♠ 3♠ 3♠ P 5♦ 4NT 4♦
 2236 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ P 3♦ 3♦ P 3♠ 3♥ P 4♥ 3♠ 3NT 4♠ P 4♣ 4NT
 2245 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ P P P 3♥ 4♦ 3♦ 3♥ 3♠ 3NT 3♠ 3NT 4♦ 4♣ 5♦
 2254 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♣ 3♦ 3♦ 3♦ 3♦ 4NT 3♥ 3♥ 4♣ 3NT 4♣ 4♦ P P
 2263 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ P 2NT 3♣ 3♠ 3♥ 3♠ 3♥ 3NT 4♦ 4♦ 3NT 4♦ P 4♥
 2326 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 4♥ P 3♥ 3♦ P 4♣ 4♣ 4♥ 4NT P 3NT P 4NT 4♣

2335 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 2NT 2NT 4♥ 3♦ 3♦ 3♠ 3♠ 3♠ P P 3NT 3NT P 4NT
 2344 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♣ 2NT 3♣ 3♣ 3♦ 4♦ P 3♥ 3NT 3♠ 3NT 5♥ 4♦ 4♣
 2353 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♣ P 3♠ 3♠ 3♦ P 3♥ 3♥ 4♠ 4♠ 3NT P P 4♥
 2362 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♦ P 3♣ 3♠ 3♥ 3♦ 3♥ 3NT 4NT 3♠ 4♣ 4♠ 4♠ 4♦
 2416 2♠ 2♠ 2♠ 2♠ 4♥ 3NT 2NT 3♦ 3♥ 4♣ 4♦ 3♠ 5♦ 4♦ 4♣ 4♥ 4♥ 4♥ 5NT P
 2425 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♦ 3♦ 3♣ 4NT 5♣ 3♥ 3♥ 3♥ 4♦ 4♣ 5♥ 4♣ 5♦ P
 2434 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 2NT 2NT 3♦ 3♠ 3♠ 3♠ 3♥ 3NT 4♥ 3♠ 3NT 4NT 4♥ 4♣
 2443 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 2NT 4♠ 3♣ 3♦ 3♦ 3♦ P P 4♦ 3NT P 3NT P 4♣
 2452 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♣ P 3♠ 4♦ 3♦ 3♠ 4♣ 4♦ 3♠ 3♠ 3NT 4♥ 4♣ 4♣
 2461 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3NT 3♦ P 3♣ 4♣ 3♦ 4♥ P 4♥ P 4♦ 4♣ P 4♦
 2506 2♠ 2♠ 2♠ 2♠ 4♥ 3♥ 3♥ 3♥ 3♣ 4♣ 4♦ 3♠ 3♠ 4♥ 3NT 4♠ 4♦ 4♦ 4♥ 4♦
 2515 2♠ 2♠ 2♠ 2♠ 3♦ 2♠ 2NT 3♣ 4♥ 3♣ 4NT 3♦ 3♥ 4♠ 4♦ 4♥ P 4♠ 4♠ 5♣
 2524 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ P 4♥ P 4♠ P 4♣ 3♥ 4♥ 3♠ P P P 4♦ 4♣
 2533 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♠ P 3♦ 3♥ 3♥ 3♠ 3♠ 5♦ 4♣ P 4NT 4♠ 4♦ P
 2542 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♠ P 3♣ 3♠ 3♥ 3♠ 3♠ 3♠ 3NT 5♥ 4♣ 3NT 5♠ 5♠
 2551 2♠ 2♠ 2♠ 2♠ 2♠ 3NT 3♦ 3♦ 3NT 4♥ 4♠ 3♠ 4♥ 3NT 4♣ P 3NT P 4NT 4NT
 2560 4♣ 2♠ 2♠ 2♠ 3♠ 3♠ 3♠ 4♠ 4♦ 3♥ 3♥ 5♣ 4♦ 3♥ 4NT 3NT 4♠ 4♣ 4♣ 4♣
 2605 2♥ 2♠ 2♠ 2♠ 3♠ 3NT 3♠ 3♥ 4♣ 4♥ 3♥ 5♣ 4♥ 4♣ 4♦ 4♣ 3NT 4♦ P 5♦
 2614 2♠ 2♠ 2♠ 2♠ 2♠ 3♦ 3NT 3♠ 3♦ 4♥ 4♠ 4♣ 4♦ 3NT 3NT P 4♣ 4♥ 5♥ 4♠
 2623 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 2NT 3♦ 3♥ 3♦ 3♦ 4♦ 3♥ 4♠ 4♠ 4♦ 4♥ P P 4♥
 2632 2♠ 2♠ 2♠ 2♠ 2♠ 3♦ 4♦ 2NT P P 4♥ 3♦ 3NT 4NT 3NT 4♠ 4♥ 5♣ P 4♠
 2641 2♠ 2♠ 2♠ 2♠ 2♠ 3♦ 2NT 3NT 3♦ P 4NT 3♦ P 3♠ 3NT 4♣ 3NT 3NT 4♣ 4♣
 2650 3♥ 2♠ 2NT 2♠ 4♣ 4♦ 3♥ 2NT 3NT 3♠ 3♥ 3NT 3♠ 3NT 3♠ P 4NT 4♣ P 5♥

b)

*** Try 1 Lr=0.001 R=-212.191lambda=0.5eps=0.5 - 0.02 --- North 1st rebid ---

	12	14	16	18	20
5035	2♣	2♣	2♣	2♣	
5044	2♣	2♣	2♣	3♣	2♦
5053	2♣	2♦	2♣	2♣	2♣
5062	2♣	2♣	2♣	2♦	
5125	2♥	2♣	2♣	2♦	2♣
5134	P	P	P	2♣	2♣
5143	P	P	P	2♣	2♣
5152	P	2♣	2♣	2♥	2♣
5161	2♦	2♦	2♦	3♣	2♣
5215	P	P	2♣	2♣	3♣
5224	P	P	P	P	2♣
5233	P	P	P	P	2♣
5242	P	P	P	2♣	2♣
5251	2♥	3♣	2♣	3♣	2♣

5260	2♦	2♦	2♦	2♣	3♥
5305	2♣	3♣	2♣	2♣	
5314	P	P	P	2♣	2♣
5323	P	P	P	2♥	2♣
5332	P	P	P	P	2♣
5341	P	P	P	2♣	2♦
5350	2♣	2♣	2♦	2♣	3♣
5404	2♥	2♣	2♣	2♣	3♥
5413	P	P	P	2♥	3♣
5422	P	P	P	2♥	2♣
5431	P	P	P	2♣	2♣
5440	2♣	2♥	3♣	2♣	2♣
5503	2♣	2♣	2♣	2♣	2♣
5512	P	2♣	2♣	2♣	2♣
5521	P	P	2♥	3♣	2♥
5530	2♥	2♣	2♣	2♣	2♣
6016	2♣	2♣	3♣		
6025	2♦	2♣	2♣	2♣	2♥
6034	2♣	2♣	2♣	2♣	2♣
6043	2♣	2♣	2♣	2♦	2♥
6052	2♣	2♦	2♣	3♦	
6061	3♣	2♣	2♣		
6106	3♦	2♣	2♣		
6115	2♣	2♥	3♣	3♣	2♣
6124	2♥	P	3♣	2♣	2♣
6133	P	P	2♣	2♣	2♣
6142	P	2♣	2♣	2♥	2♣
6151	2♦	2♦	2♣	2♣	2♦
6160	2♣	2♣	2♣	2♣	
6205	3♣	2♥	2♣	2♣	
6214	2♦	P	2♥	2♣	2♣
6223	P	P	P	2♣	3♣
6232	P	P	P	2♦	2♣
6241	P	2♥	2♥	2♣	2♦
6250	2♣	2♣	2♣	2♣	
6304	3♣	2♣	2♣	3♥	2♣
6313	P	P	2♣	2♣	2♣
6322	P	P	P	3♣	2♣
6331	P	3♣	2♣	2♥	3♦
6340	2♣	2♣	2♣	2♣	

6403 2♣ 2♦ 3♣ 2♣
 6412 2♥ 2♣ 2♣ 2♣ 2♣
 6421 P 2♣ 2♣ 2♣ 2♣
 6430 3♣ 2♥ 2♥ 2♣
 6502 2♣ 2♣ 2♣ 3♦ 2♣
 6511 2♥ 2♥ 2♣ 2♣ 3NT
 6520 2♣ 2♣ 2♣ 2NT 3♥
 6601 2NT 2♣ 3♥
 6610 2♣ 3♣ 2♥ 2♣
 7006 3♣
 7015 3♦ 2♣ 3♣
 7024 2♦ 2NT 2♣
 7033 2♣ 3♣ 2♣ 2NT
 7042 2NT 2♦ 2♣ 2♣
 7051 2♣ 2♣ 2♣
 7060 2♦
 7105 3♣ 2♣ 3♣
 7114 2♥ 3♣ 2♣ 2♣ 2♣
 7123 3♣ 2♦ 2♣ 2♦ 2♣
 7132 3♥ 3♣ 2♣ 2♣ 3♣
 7141 2♣ 2♦ 2♣ 3♥
 7150 2NT 2♣
 7204 2♣ 2♥ 2♣ 3♥
 7213 2♣ 2♣ 2♣ 2♣ 2♣
 7222 2♦ 2♣ 2♦ 3♣ 2♣
 7231 2♦ 2♣ 2♦ 2♣ 2♦
 7240 2♣ 2♣ 2♥ 2♦
 7303 3♣ 2♣ 3♥ 2♣
 7312 2♣ 2♣ 2♦ 2♣ 2♣
 7321 3♣ 2♣ 2♣ 2♣ 2♣
 7330 2NT 2♦ 2♣ 3♣
 7402 3♣ 3♣ 2♣ 3♣
 7411 2NT 3♣ 2♣ 2♣ 2♣
 7420 2♣ 3♥ 2♣ 2♣ 2♣
 7501 2♦ 2♣ 2♣
 7510 3♣ 2♣
 7600 2♠ 2♥

--- South's Responses ---

- to: 2♣ 2♦ 2♥ 2♠ 2NT 3♣ 3♦ 3♥ 3♠ 3NT

h.c.p:8-9 10+ 8-9 10+ 8-9 10+

0166 2♠ 3NT 3♠ 2NT 3♦ 2NT 3♠ 3♥ 4♥ 3♠ 3♦ 4♦ 4♠ 3♠ 3♠ 4♣ 4♣ 4♥ 4♣ P
0256 2♠ 2♠ 3♦ 3♦ 2♠ 2♠ 3♦ 3♠ 4♦ 4♣ 3NT 3♦ 4♦ 4♣ 3NT 4♦ 4♦ 4♦ 4♦ 5♦
0265 3NT 3NT 2NT 3♠ 2♠ 4♥ 3♥ 3♠ 4♥ 4♣ 3♥ 4♥ 3♥ 3♥ 3NT 4♥ 4♦ 3NT 4♣ 4♣
0346 3NT 3NT 2♠ 2♠ 2NT 4♦ 2NT 2NT 3♣ 4♥ 4♠ 4♠ 4♦ 3♠ 4♦ 5♣ 3NT P 4♣ 4♥
0355 2♥ 2♥ 3♦ 3NT 2NT 2♠ 3NT 3♦ P 3♠ 3♦ 3♦ P 4♣ 3♠ 4♣ 4NT 4♣ 4♥ 4♣
0364 3NT 3NT 3♥ 2♠ 2NT 3♦ 2NT 3♦ P 3NT 3♠ 3♠ 4♠ 3♠ 3♠ 4♣ 4♣ 3NT 4NT 4♣
0436 3NT 3NT 2♥ 2♠ 2♠ 3♥ 3♣ 4♣ 4♠ 4♦ 3♦ 3♠ 4♦ 4♦ 4♥ 3♠ 3NT 4♦ 4♥ 4♣
0445 2♥ 3NT 2♥ 2♥ 2♠ 2♠ 3♣ 4♦ 4♣ 3♦ 3♠ 3NT 3♠ 4♣ P 4♣ 5♦ 3NT 4♣ 4♦
0454 2♥ 3NT 2♥ 2♠ 3NT 2NT 3♥ 3♠ 3NT 4♣ 3♦ 3♦ 3NT 3NT 3♠ 3♠ 4♣ 4♣ 4♦ 4♥
0463 3NT 3NT 3♦ 2♥ 2NT 3NT 3NT 3NT 4♥ 4NT 3♠ 3♠ 3♥ 4♠ P 3♠ 4NT 5♣ 4♥ 4♥
0526 3NT 3NT 2♥ 3♠ 2NT 3♦ 3♥ 3NT 3♦ 3♦ 4♦ 3♦ 4♦ 3♠ 5♦ 4NT P 4♠ 4♠ 4♣
0535 3NT 3NT 2♥ 2♥ P 2NT 2NT 3♦ 4♥ 3♣ 3♠ 3♦ 3♥ 3♠ 4♠ 3NT 5♠ 4♦ 4♦ 4♥
0544 3NT 3NT 2NT 2♠ 2♠ 2NT 3♣ 3♣ P P 3♠ 4♠ 3♠ 3♥ 3♠ 3♠ 4♥ 3NT 4♣ 4♥
0553 3NT 3NT 2♥ 2♠ 3NT 2♠ 3♠ 2NT 3♥ 4♥ 3♠ 4♣ 4♣ 4♣ 3♠ 4♣ 3NT 4♥ 4♣ 4♠
0562 3NT 3NT 4♣ 3♦ 2♠ 2♠ 3♥ 3NT 3♠ 3NT 4♠ 5♣ 4♣ 4NT 3NT 3♠ 4♣ 5♥ 4♥ 4♣
0616 3NT 3NT 3♥ 4♦ 4♣ 3♣ 3♦ 2NT 4NT 4NT 4♥ 3♥ 3NT 4♣ P P 4♦ 4♥ 4♣ 4NT
0625 2♠ 3NT 2♠ 4♦ 2♠ 2NT 4♣ 4♣ 3♠ 4♥ 3♦ 3♦ 4♠ 4NT 4♦ 3NT 4♣ 4♣ P 4♥
0634 3NT 3NT 2♥ 2♥ 2♠ 2♠ 3♥ 4♣ 3♠ 3♦ 3NT 3♠ 4♦ 3NT 4NT 3NT 4♥ 4NT P 5♣
0643 3NT 3NT 2♠ 2♠ 2NT 2♠ 3♥ 3♥ 4♥ 3♦ 3♦ 3♠ 4♦ 3NT 3♠ 3NT 4♠ P 4♣ P
0652 3NT 3NT 2♠ 2♠ 2NT 2♠ 3♠ 2NT 3♥ 3♠ 3♦ 3♦ 4♣ 4♣ 4♣ 4♣ 4NT 5♥ 5♥ 4NT
0661 3NT 3NT 2♥ 3♠ 3♥ 4♥ 4♣ 3♦ 3♠ 3♣ 3NT 5♣ 4♣ 3♠ 3♠ 4NT 4♦ 4NT 4♥ 4♥
1066 4♣ 3NT 4♣ 3♠ 4♦ 3♥ 3♦ 3♥ 3♦ 4♠ 3♦ 4♠ 4♠ 3NT 3♠ 3NT 4♥ 4♦ 4♥ 4♦
1156 2♦ 3NT 2♥ 3♥ 2♠ 3♦ P 3♦ 3♠ 3♥ 4♥ 4♠ 3♠ 4♠ 5♣ 5♣ 4♣ 3NT 4♦ 4♠
1165 3NT 3NT 3♠ 3♠ 2♠ 2NT 3♠ 3♠ 3♠ 3NT 3♠ 3♦ 4♠ 4♠ 4♠ 3♠ 4♥ 3NT P 5NT
1246 2♥ 2♥ 2NT 4♣ 2♠ 3NT P 3NT 4♥ 3♥ 3♦ 3♠ 3♥ 4♠ 3NT 4♠ 4NT 3NT P 4♣
1255 2♥ 2♥ 2♠ 2♥ 2♠ 3NT 3♠ 3♠ 4♠ 3♦ 4♠ 3♠ 3NT 3♥ 4♠ 4♦ 4♦ 4♦ 4♥ 4NT
1264 2♥ 2♥ 2♠ 3♠ 2♠ 4♣ 3♥ 2NT 4♠ 3♠ 3♦ 3♦ 4♦ 3♠ 4NT 3NT 4♦ 4♣ 4♦ 4♠
1336 2♥ 2♥ 2♠ 2♠ 2♠ 2♠ 3♦ 4♥ 3♦ 4♠ 4♠ 3♦ 4♠ 3♠ 4♦ 4♥ 3NT 4♥ 4♣ 4♠
1345 2♥ 2♠ 2♠ 3♠ 2♠ 2♠ 3♠ 2NT 3♠ 4♥ 3♠ 4♠ 4♠ 3NT 4♠ 4♠ 4NT 3NT 4♦ 4♠
1354 2♠ 2♠ 2♠ 2♠ 2♠ 3NT 2NT 2NT 4♥ 3♦ 4♠ 4♠ 3♥ 3♠ 4♠ 4♦ 4♦ 3NT 5♣ 4♥
1363 3NT 2♠ 2♥ 2♠ 2♠ 2NT 4♦ 2NT 3♠ 4♥ 4♠ 3♦ 3♥ 4♦ 4♠ 4♥ 5♦ 4♦ 4♣ 4NT
1426 3NT 2♠ 2♠ 2NT 2NT 2NT 2NT 3NT 3♥ 4♦ 4♠ 3♦ 3♠ 4♦ 4♠ 4♥ 5♣ 3NT 4♠ 5♣
1435 2♠ 2♠ 3♠ 3♠ 2♠ 2♠ 3♠ 3♠ 3♦ 4♠ 4♠ 3♦ 4♠ 3♥ 4♠ 4♠ 3NT 3NT 4♦ 5♥
1444 2♠ 2♠ 3♠ 3NT 2♠ 2♠ 2NT 4♥ 3♠ 4♣ 4♠ 4♠ 3NT 4♦ 4♠ 4♠ 4♣ 4♣ 4♠ 4♦
1453 2♠ 2♠ 2♥ 2♥ 2♠ 2♠ 2NT 3♠ 3♠ 3♠ 4♠ 4♠ 4♦ 3♥ 3♠ 4♠ 4♣ 4♣ 4♠ 5NT
1462 3NT 3NT 2♥ 2♠ 2♠ 2♠ 2NT 3♠ 4♥ 3♦ 3♦ 3♦ 3♠ 3♥ 3NT 4♥ 4♣ 4♥ 4♠ 4♦
1516 3NT 2♥ 2NT 3♦ 2NT 3NT 3♠ 3♥ 3♠ 3♦ 3♠ 3♦ 5♦ 3♥ 4♣ 4♠ 4♣ 4♠ 4NT 4♠
1525 3NT 2♥ 2♠ 2♠ 2NT 3NT 4♠ 3♠ 4♣ 4♦ 4♠ 4♠ 4♠ 3♠ 4♠ 3♠ 5♣ 4♠ 4♦ 4♦
1534 2♠ 2♠ 3NT 2♠ 2♠ 2♠ 4♣ 2NT 4♠ 3♥ 4♥ 4♠ 3NT 4♠ 4♠ 4♠ 3NT 3NT 4♦ P

1543 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♣ 4♦ 3♣ 4♠ 4♠ 3♥ 4♣ 3♥ 3♠ 5♦ 4♦ 5♦ 4♣ 4♦
1552 2♠ 3NT 2NT 3♠ 2♠ 2♠ 3♣ 2NT 3♦ 3♠ 3♠ 4♣ 3♥ 4♣ 4♣ 4♠ 4♣ 4♦ 4♥ 4♣
1561 3NT 2♥ 2♥ 2♠ 2♠ 2NT 4♦ 3♣ 3♠ 4♦ 3♦ 3♦ 3♠ 3♥ 3NT 4♣ 4♦ 5♣ 5♣ 4♠
1606 2♥ 3♣ 3♥ 4♣ 4♦ 4♥ 3NT 4♠ 3♣ 4NT 4♥ 4♠ 3♥ 5♣ 4♥ 4NT 4NT 5♣ 5♣ 5♣
1615 3NT 3NT 2♥ 3♠ P 2♠ 3NT 4♥ 3♦ 3♦ 3♦ 3♥ 3NT 3♥ 4♠ 4♠ 4♠ P 4♦ 4♥
1624 2♥ 3NT 3♦ 2♠ 2♠ 2♠ 3♦ 3NT 4♦ 4♠ 3♥ 3♦ 3♥ 4♠ 3♠ 4♠ 4♣ 4♥ 4♦ 5♣
1633 2♥ 2♥ 2♠ 2♠ 2♠ 2NT 2NT 4♦ 4♠ 3♣ 3♠ 4♠ 3♥ 3NT P 4♦ 4♠ 4♣ 4♣ 4♦
1642 2♥ 3NT 2NT 2♠ 2♠ 2♠ 3♣ 3♣ 3♣ 3♣ 3♠ 4♥ 3♠ 3NT P 3NT 4♣ 3NT 4♥ 4♠
1651 3NT 3NT 3♣ 2♥ 2♠ 2♠ 2NT 3NT 4NT 3♥ 3♠ 4♠ 4♣ 3♠ 3♠ 3♠ 4♠ 4♣ 4♣ 4NT
1660 3NT 2♥ 4♣ 3♣ 3♣ 3♥ 3♦ 3♣ 3♥ 3NT 3♦ 4♥ 5♦ 4NT 3NT 4NT 5♦ 3NT 4NT 4NT
2056 3NT 3NT 4♦ 2♥ 2♠ 2♠ 3♥ 3♠ 3♣ 3♣ 4♣ 3♠ 3♥ 3♥ 3NT 3♠ 4♠ 4♣ 5♣ P
2065 3NT 3NT 2NT 3♥ 2NT 2NT 4♥ 3♥ 3♦ 3♠ 3♥ 3♠ 4♠ 3♠ 3NT 3♠ 5♦ 4♠ 4♠ 5NT
2146 2♥ 3NT 2♠ 3♠ 2♠ 3♠ 3♣ 3♣ 3♥ 3♥ 3♦ 4♣ 3NT 3♠ 3♠ 4NT 3NT 4♣ 4♣ 4NT
2155 2♥ 3NT 3♣ 4♣ 2♠ 2NT 3♣ 3♣ 3♣ 3♠ 3♠ 3♦ 3♥ 4♥ 3♠ 3NT 4♠ 4♦ 5♣ 4♣
2164 2♥ 3NT 3♣ 2♥ 2♠ 4♣ 3♥ 3NT 4♠ 3♥ 4♠ 3♦ 3♠ 4♦ 4♣ 3♠ 4♦ 4♥ 4♣ 4♣
2236 2♥ 2♥ 2NT 3♠ 2♠ 2♠ 3♣ 3NT 3♥ 3♣ 4♠ 3♦ 4♠ 4♠ 4♦ 4♠ 4♥ 5♦ 4♣ 4♣
2245 2♠ 3NT 2♠ 4♣ 2♠ 2♠ 3♦ 2NT 4♥ 4NT 4♠ 3♦ 3♥ 3♠ 3♠ 3♠ 4♣ 4♦ 4♣ 4♠
2254 2♠ 2♠ 2NT 3NT 2♠ 2♠ 3♥ 3♥ 4♥ 4NT 3♦ 4♠ 4♠ 3NT 4♠ 3NT 4♣ 3NT P 4♣
2263 2♠ 2♠ 2♠ 3♠ 2♠ 2♠ 3♣ 3♠ 4♥ 3♣ 4♠ 4♠ 4♣ 3♥ 3NT 5♦ 4♥ 3NT 4♠ 4♦
2326 2♥ 3NT 2♥ 3♠ 2♠ 2♠ 3♣ 3♣ 4♠ 4♠ 3♠ 4♠ 4♣ 4♥ 3NT 3♠ 5♣ 3NT 4♥ 4♠
2335 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♠ 2NT 4♥ 3♣ 4♠ 4♠ 4♦ 5♣ 4♠ 4♠ P 3NT 4♣ 4♣
2344 2♠ 2♠ 2♠ 3♠ 2♠ 2♠ 3♣ 3♠ 4♠ 3♦ 4♠ 4♠ 4♥ 3NT 4♠ 3♠ 3NT 3NT 4♣ 4♠
2353 2♠ 2♠ 2♥ 2♠ 2♠ 2♠ 4♠ 3♥ 4♠ 3♣ 3♠ 4♠ 3♥ 3♠ 3♠ 3♠ 4♦ 3NT 4NT 4♣
2362 2♠ 2♠ 2♠ 2♠ 2♠ 2♠ 3♥ 2NT 3♠ 3♦ 4♠ 4♠ 3♥ 3♠ 4♠ 4♣ 4♣ 4♦ 4♠ 4NT
2416 2♠ 2♠ 3NT 3NT 2♠ 2NT 2NT 2NT 4♦ 3♠ 3♦ 4♦ 4♠ 4♣ 3NT 4♠ 4♣ 3NT 4♦ 4♥
2425 2♠ 2♠ 3♠ 2♥ 2♠ 2♠ 4♣ 2NT 4♥ 3♦ 4♠ 4♠ 5♦ 3♥ 3♠ 4♣ 4♣ 4♦ 4♣ 4♠
2434 2♥ 2♠ 2♠ 2♠ 2♠ 2♠ 4♣ 3♠ 4♥ 3♣ 4♠ 4♠ 4♠ 4♠ 4♠ 4♠ 4♣ 3NT 4NT 4♣
2443 2♠ 3NT 2♠ 2♠ 2♠ 2♠ 2NT 2NT 4♥ 3♣ 4♠ 4♠ 3NT 3NT 4♠ 3♠ 5♣ 4NT P 4♣
2452 2♠ 2♠ 2♠ 4♦ 2♠ 2♠ 2NT 2NT 3♣ 4♦ 3♦ 4♠ 4♠ 4♠ 4♠ 5♦ 4♥ 4♥ 4♠ 5♣
2461 2♥ 3NT 2♥ 2♠ 2♠ 2♠ 2NT 3♥ 3♠ 3♠ 4♠ 3♦ 4♦ 3♥ 3♠ 3NT 4♦ 4♠ 4♠ 4♥
2506 2♠ 3NT 2NT 3♠ 4♦ 2♠ 2NT 3NT 3♠ 3♠ 3♦ 3♠ 3NT 5♣ P 3NT 4♥ 4♠ 4♦ 4♣
2515 3NT 3NT 2NT 2♠ 2♠ 2NT 2NT 4♦ 4♥ 4♠ 4♠ 3♦ 5♣ 3♠ 4♦ 4♠ 3NT P 5♦ 5♥
2524 2♠ 2♠ 2♠ 2NT 2♠ 2♠ 3♣ 4♠ 4♣ 3♦ 4♠ 3♦ 3♥ 3NT 3♠ 4♠ 4♠ 3NT 4♠ 4♠
2533 2♠ 2♠ 3♠ 2♠ 2♠ 2♠ 3♦ 2NT 4♠ 3♣ 4♠ 4♠ 4♦ 3♥ 4♠ 3♠ 5♣ 3NT 4♠ 4♣
2542 2♠ 2♠ 3♠ 2♠ 2♠ 2♠ 3♣ 4♠ 4♠ 3♥ 4♠ 4♠ 4♠ 3♠ 4♠ 3NT 4♣ 4♣ 4NT 4♣
2551 2♥ 2♠ 2♥ 3♣ 2♠ 2♠ 3♣ 2NT 4♥ 3♥ 3♠ 4♣ 3NT 4♠ 3NT 5♦ 4♣ 3NT 4♠ 4♣
2560 2♠ 3NT 3♠ 4♣ 2NT 4♦ 3♦ 4♦ 4♠ 4♠ 4♥ 3NT 4♠ 3♠ 4NT 4♣ 5♣ 4♦ 4♣ 4♠
2605 3NT 3NT 2NT 3♠ 3♦ 4♥ 2NT 3♠ 4♣ 3♠ 3♥ 4♣ 3♠ 4NT 4♣ 4♥ 3NT 4♣ 4♣ 4NT
2614 2♥ 2♥ 2♥ 2♥ 2♠ 2♠ 3NT 3♦ 4♠ 4NT 4♠ 4♥ 4♥ 4♣ 3NT 4♠ 3NT 3NT 4♠ 4♦
2623 2♠ 2♠ 2♥ 2♥ 2♠ 2♠ 4♣ 3♠ 3♠ 3♥ 3♠ 3♠ 3♥ 4♠ 3♠ 3♠ 4♥ 3NT 4♠ P

2632 2♠ 2♠ 2♥ 2♠ 2♠ 2♠ 3♦ 3♥ 3♥ 4♥ 3♠ 3♦ 4♠ 4♦ 4♥ 4♦ 4♦ 4♥ 4♥ 5♣
2641 2♥ 3NT 2♥ 3♠ 3NT 2♠ 3♦ 3♠ 4♣ 3♥ 3♦ 3♦ 3♠ 4♣ 4NT 4♣ 3NT 5♣ 5♣ 4♣
2650 3NT 3NT 2NT 2♠ 3♦ P 2NT 3♦ 4♦ 4♥ 4NT 4♠ 5♦ 3NT 3♠ 4♣ 4NT 5♣ 4♣ 4♣